Dec. 28, 1948. G. F. RACKETT 2,457,319

CINEMATOGRAPHIC DYE PRINTING

Filed Aug. 31, 1945

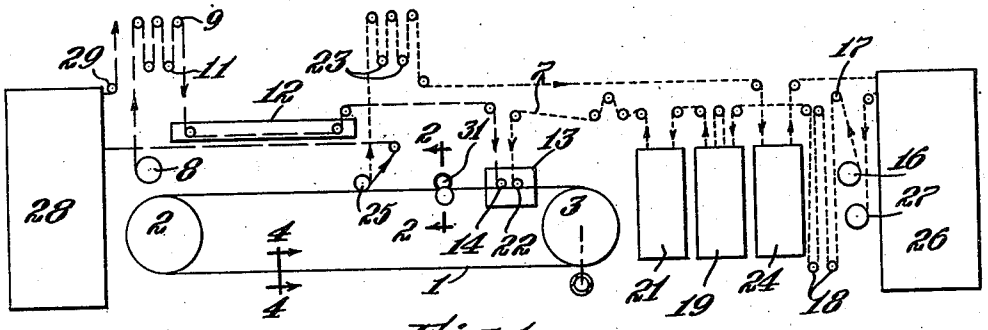


Fig. 1

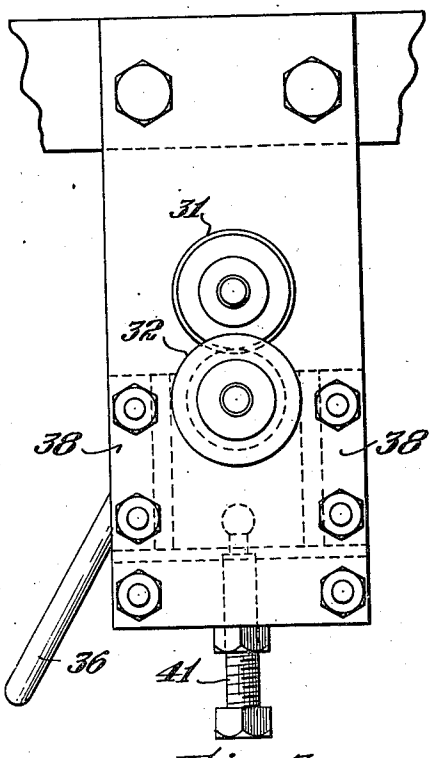


Fig. 3

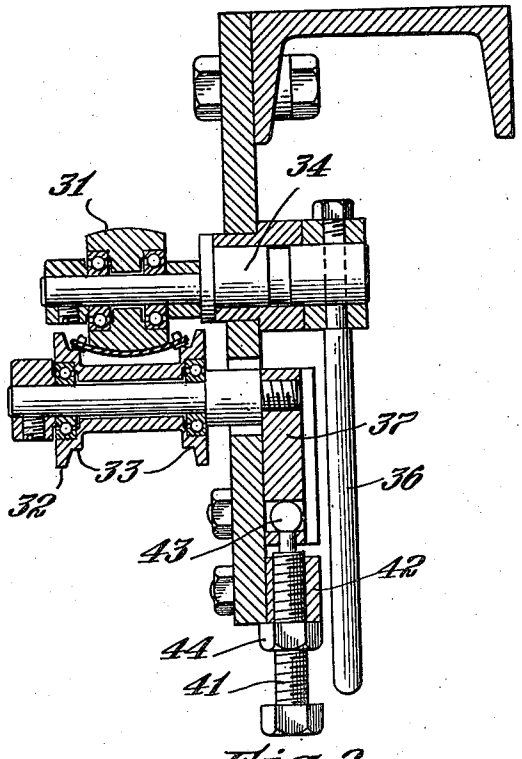


Fig. 2

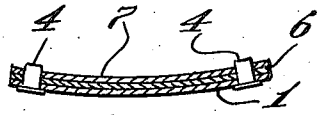


Fig. 4

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CINEMATOGRAPHIC DYE PRINTING

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8 Claims. (Cl. 271—2.1)

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In printing motion pictures by imbibition, from a dye impregnated matrix to a dye-absorptive blank, it is customary to employ a relief matrix in which the gelatin coating is thicker in the shadows than in the highlights and a blank comprising a layer of gelatin or other dye-absorptive material. In order to obtain good definition in the picture printed on the blank it is necessary to employ relatively hard gelatin and in order to maintain intimate contact between the matrix and blank while the dye is being imbibed by the blank from the matrix, it is desirable to soften the gelatin on the blank temporarily. This is usually accomplished by passing the blank through a water bath in transit to the matrix in order to cause the gelatin on the blank to swell somewhat before it comes into contact with the matrix. If the gelatin be softened too much it mitigates against good definition in the transfer operation, and if the gelatin be softened too little it results in edge trouble. The degree of softening for optimum definition is somewhat above the point where edge trouble begins. Heretofore it has been necessary to tolerate imperfect definition or encounter some edge trouble, and as a practical matter it has been customary to compromise between the two evils.

The aforesaid edge trouble results from the fact that the valleys of the relief matrix do not make good contact with the blank along the edges of the pictures during the transfer process, as they would if the blank were swollen with water to a greater degree. This lack of intimate contact interferes with the transfer of dye, resulting in imperfect printing along the margin of the picture. Ordinarily this edge trouble is confined to a narrow zone just inside the sprocket holes. In the case of film having a sound-track inside one row of sprocket holes the edge trouble is usually confined to the edges of the pictures along the other row of sprocket holes; on the sound-track side the edges of the pictures are too remote from the sprocket holes to be subject to the trouble.

Objects of the present invention are to avoid the aforesaid edge trouble and to afford intimate contact between the two films throughout their entire width, to counteract the tendency for the films to separate at the edges, to permit the dye-absorptive layer of the blank film to be hardened to the optimum degree, to avoid the necessity of softening this layer excessively in order to maintain intimate contact, and generally to improve the art of printing pictures by dye transfer, whether with dyes which soak into the blank or

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dyes which are deposited on the surface of the blank.

According to the present invention the apparatus comprises an endless belt adapted to travel in an orbital path, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, and the belt being curved transversely so that it is concave on the film side, whereby the margins of the films, when pressed tightly against the belt, remain in intimate contact while on the belt. The belt is trained over sheaves with relatively straight portions extending from sheave to sheave and the films are fed to the belt where the belt is relatively straight, preferably in the same one of the aforesaid straight portions. The films travel with the belt throughout a portion of its orbit and are then conducted away from the belt, preferably in the same straight portion in which they are fed to the belt at a location in advance of the location where they are applied to the belt. In the preferred embodiment the belt is rendered concave on the film side by opposed rollers on opposite sides of the belts at a location intermediate the aforesaid locations, where there is no film on the belt.

For the purpose of illustration a typical embodiment of the invention is shown in the accompanying drawing in which

Fig. 1 is a diagram of imbibition apparatus for printing a blank film from a matrix film;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a side view of the mechanism shown in Fig. 2; and

Fig. 4 is a section on line 4—4 of Fig. 1.

The particular embodiment chosen for the purpose of illustration comprises a pin belt 1 trained over sheaves 2 and 3, the belt having marginal rows of teeth or pins 4 adapted to fit into the sprocket holes of the blank and matrix films 6 and 7 while the two films travel in superposition on the belt. The blank 6 feeds from a supply reel 8 through an elevator comprising upper rolls 9 rotating about fixed axes and lower rolls 11 which are supported by the film loops and which move up and down to accommodate variations in the degree of film shrinkage and differences in the rate of drive of the belt 1 and the driven sprocket wheels. From the elevator the blank passes through a pre-wet tank 12 and thence to a roll tank 13 where the blank is seated on the belt by means of a roller 14.

The matrix 7 feeds from a supply reel 16 over a driven sprocket wheel 17, thence through an

elevator comprising lower floating rollers 18, thence through a dye tank 19, thence through a wash tank 21 where the superficial dye is washed off, thence over a series of rollers to provide a safety loop, and thence under roll 22 where the matrix is seated on the belt in face-to-face contact with the blank 6. From the roll tank 13 the two films travel together until they reach the roll 25, during which time the pictures are printed on the blank by imbibition of dye by the blank from the matrix. After leaving the pin belt at roller 25 the matrix 7 travels over a series of rolls including floating elevator rolls 23, thence to matrix rinse tank 24, thence to the dry box 26 and thence to the take-up reel 27.

After leaving the pin belt at roller 25 the blank 6 passes to the dry box 28 and thence over roll 29 to a take-up reel or to another similar set of apparatus where another color aspect is printed on the blank in superposition to the first, as described for example in copending application of Frank W. Taylor, Serial No. 599,593, filed June 15, 1945 which has become Patent Number 2,448,691. Certain of the film rollers may be sprocket wheels and these wheels and the pin belt may be driven in various ways, as for example the way disclosed in the aforesaid copending application.

According to the present invention the apparatus has a pair of rollers 31 and 32 located on opposite sides of the belt 1 intermediate the roll tank 13 where the films are applied to the belt and the roll 25 where the films are fed from the belt. As shown in Figs. 2 and 3 the roll 31 is crowned and is narrower than the belt, the roll 32 is recessed around its central portion and has shoulders 33 to support the margins of the belt, and the convex roller 31 extends into the recess between the shoulders 33 so as to bend the belt transversely as shown in Fig. 2. The roll 31 is mounted on an eccentric support 34 which is provided with a handle 36 to move the roller 31 toward and from the roll 32. The roll 32 is mounted on a support 37 sliding in gibs 38. The support 37 is adjustable vertically by a screw 41 threaded in a fixed support 42 with a head 43 anchored in the support 37, a lock-nut 44 being provided to lock the support into juxtaposition. Thus the screw 41 affords an approximate adjustment of the spacing between the rolls 31 and 32, whereas the eccentric 34 affords a fine adjustment.

While the degree of curvature imparted to the belt by means of the rolls 31 and 32 varies slightly depending upon the characteristics of the belt and films, it should always be somewhat beyond the elastic limit. Thus while the belt may spring back toward flat condition as it leaves the rolls 31 and 32, it retains enough transverse curvature to avoid the aforesaid edge trouble. As the belt travels through an arc of 180 degrees at each of the sheaves 2 and 3 it tends to flatten but the films do not tend to separate at the edges because the projecting ends of the belt teeth move apart circumferentially of the sheaves fanwise, thereby drawing the films tightly together against the belt. After leaving each sheave the belt resumes its transverse curvature owing to the fact that it has been curved by the rollers 31 and 32 beyond its elastic limit.

From the foregoing it will be evident that the films are held in intimate contact with each other throughout their entire width during all the time they are traveling with the belt 1. Owing to the transverse curvature of the belt the films do not separate at the edges even when the blank has been hardened to the optimum degree. Consequently the pictures may be sharply printed throughout the entire picture areas.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising an endless belt adapted to travel in an orbital path, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, and the belt being curved transversely so that it is concave on the film side, whereby the margins of the films, when pressed together against the belt, remain in intimate contact while on the belt.

2. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means for feeding films to the belt where the belt is relatively straight, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, and the belt being curved transversely so that it is concave on the film side.

3. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means for feeding films to the belt where the belt is relatively straight, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, and means in one of said straight portions for bending the belt transversely so that it is concave on the film side.

4. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means in one of said straight portions for feeding a plurality of films into superposition on the belt, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, and means in advance of said means, in the same straight portion, for bending the belt transversely so that it is concave on the film side.

5. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means for feeding films to the belt where the belt is relatively straight, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt and, in one of said straight portions, opposed rollers on

opposite sides of the belt for bending the belt transversely so that it is concave on the film side, whereby the margins of the films are held in intimate contact while on the belt.

6. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means in one of said straight portions for feeding a plurality of films into superposition on the belt, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt and, in advance of said means in the same straight portion, opposed rollers on opposite sides of the belt for bending the belt transversely so that it is concave on the film side, whereby the margins of the films are held in intimate contact while on the belt.

7. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means in one of said straight portions for feeding a plurality of films into superposition on the belt, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, means in advance of said means in the same straight portion for feeding the films

from the belt and, intermediate said means in the same straight portion, means for bending the belt transversely so that it is concave on the film side, whereby the margins of the films are held in intimate contact while on the belt.

8. In the art of printing by imbibition from a dyed matrix to a blank having a dye absorptive layer, apparatus comprising a plurality of sheaves, an endless belt trained over the sheaves to travel in an orbital path with relatively straight portions extending from sheave to sheave, means in one of said straight portions for feeding a plurality of films into superposition on the belt, the belt having marginal rows of teeth shaped to fit into the sprocket holes of superposed films to hold the films in registry while the films are traveling with the belt, means in advance of said means in the same straight portion for feeding the films from the belt and, intermediate said means in the same straight portion, opposed rollers on opposite sides of the belt for bending the belt transversely so that it is concave on the film side, whereby the margins of the films are held in intimate contact while on the belt.

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