June 16, 1942. M. HARPER 2,286,733

APPARATUS FOR PRINTING SUBSTANDARD FILM

Original Filed June 4, 1938 2 Sheets-Sheet 1

Fig. 1.

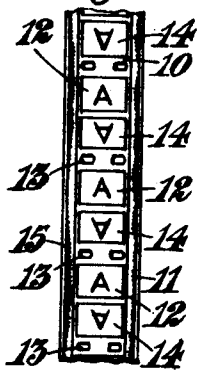


Fig. 2.

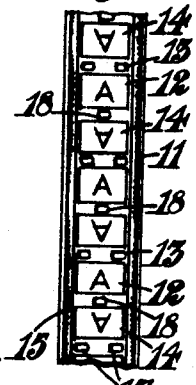


Fig. 5.

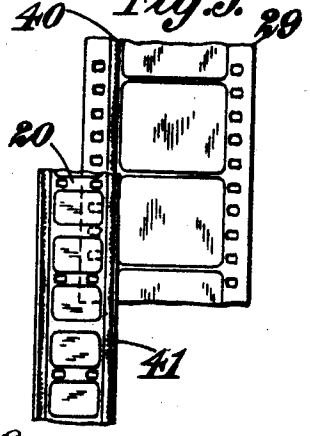


Fig. 6.

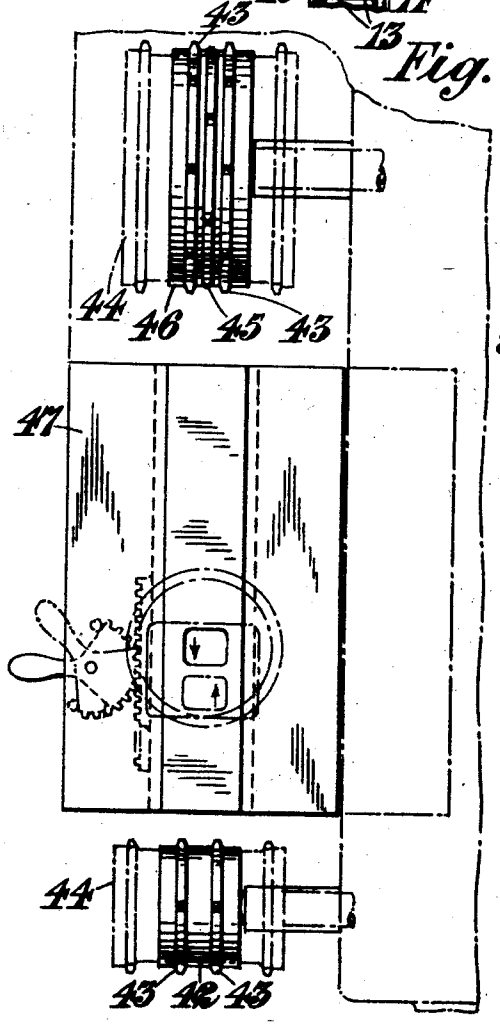
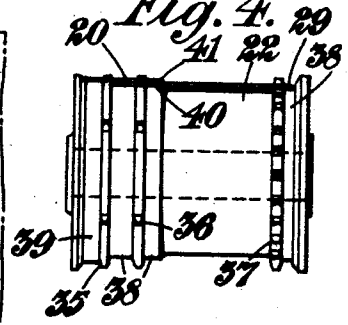


Fig. 4.



Martin Harper
by his attys.
Stebbins and Blanke

June 16, 1942. M. HARPER 2,286,733

APPARATUS FOR PRINTING SUBSTANDARD FILM

Original Filed June 4, 1938 2 Sheets-Sheet 2

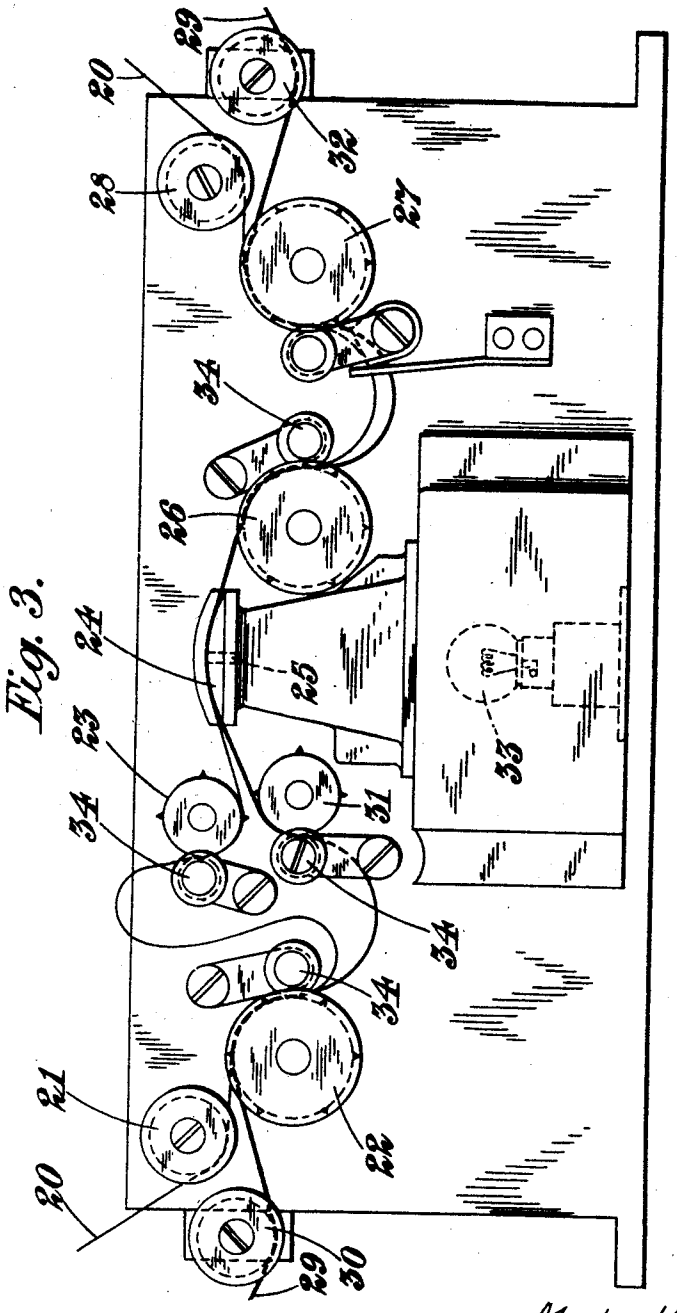


Fig. 3.

Martin Harper
by his attys.
Stebbins and Blenko

Patented June 16, 1942 2,286,733

UNITED STATES PATENT OFFICE

2,286,733

APPARATUS FOR PRINTING SUBSTANDARD FILM

Martin Harper, Hoddesdon, England, assignor to Varley Sound Film System Limited, London, England, a British company

Original application June 4, 1938, Serial No. 211,866. Divided and this application June 12, 1940, Serial No. 340,114. In Great Britain January 4, 1938

2 Claims. (Cl. 74—243)

This application is a divisional from my co-pending United States application Serial No. 211,866 filed June 4, 1938, now Patent No. 2,215,-502, wherein is described a 16 mm. combined sound and picture film comprising in combination a series of related pictures set with their shorter dimension parallel with the sides of the film the pitch of which from picture to picture is equal to the usual pitch of standard 35 mm. film a photographic sound track at one side of the pictures which is of the same longitudinal scale as the sound track of standard 35 mm. film, and a series of feed perforations in spaces between the pictures, the perforations having the same pitch as the said series of related pictures. In one form of film described there is a second series of pictures intercalated between the pictures of the first series and a corresponding sound track is provided therefor, the pictures of the one series being upright or inverted in relation to the pictures of the other series and the same feed perforations being used for feeding when presenting either series of pictures. The feed perforations are preferably formed as a pair of rows of holes running parallel with the edge of the film and spaced across the width of the film by an amount slightly less than the width of the picture, and if desired a third row of perforations may be provided along the centre line of the film.

Prior to the use of sound films, silent pictures of standard size were projected at a speed of 1 foot per second, or sixteen picture frames per second, and this speed provided perfect animation and was satisfactory from a purely visual standpoint, but with the introduction of combined sound and picture films it was found that a speed of eighteen inches or twenty-four frames per second was necessary to obtain satisfactory sound reproduction from the standard sound track. It will be understood, therefore, that the linear velocity of the sound track is an important factor in obtaining efficient reproduction. Substandard films being projected at sixteen or even twenty-four frames per second would naturally have a linear velocity considerably lower than eighteen inches per second, and this tends still further to reduce the quality of the reproduction obtainable.

It is an object of the invention to enable a substandard film to be projected at standard speed so that it is capable of sound reproduction equal to that of a standard sound film.

It is another object of the invention to enable a substandard film to be printed without the possibility of "overprinting" occurring.

The invention envisages a method of printing a substandard film consisting in running the substandard film in contact with the standard film over a sprocket which is common to the two films so that certain teeth of the sprocket pass through feed slots in both films and thereby maintain them positively in register with one another during printing of the sound track, the pictures being printed on a reduced scale in a separate operation. It will be understood that in this way a perfectly sharp and standard sound track which gives as good a reproduction as can be obtained on standard size film is produced on the substandard film. In order to effect this both the film itself and the printing apparatus need to be appropriately designed as hereinafter described and the apparatus is particularly adapted and intended for printing substandard film of the kind herein described, and claimed in my co-pending application No. 211,866 hereinabove referred to.

According to the invention, a sprocket for carrying 16 mm. combined sound and picture films comprises two circumferential rows of teeth for engaging feed perforations in the film, the teeth of the rows being in line with each other parallel to the axis of the sprocket and being of a pitch equal to the picture pitch of normal 35 mm. film and the rows being spaced axially along the sprocket by an amount such as to bring the teeth wholly within a width of 10 mm.

If desired, the sprocket above described may be provided with a third row of circumferential teeth centrally between the other two rows, the teeth of the third row having a pitch equal to that of the other rows and being staggered with relation to the teeth of the other rows.

The present invention further comprises a sprocket as described above having an axial extension carrying a row of teeth adapted for engagement with feed perforations of normal 35 mm. film, the axial distance between the row of teeth on the extension and the next adjacent row of teeth of the sprocket being equal to the spacing between the two sets of feed perforations in the edges of normal 35 mm. picture and sound film. Such a sprocket is particularly advantageous for use in printing the sound track on a film as above described since the 16 mm. film and 35 mm. film may be maintained in accurate overlapping relation during passage through a printer.

Some embodiments of the present invention will now be described by way of example, the de-

scription having reference to the accompanying drawings, in which—

Figure 1 is one form of 16 mm. combined sound and picture film;

Figure 2 is a further form of 16 mm. combined sound and picture film;

Figure 3 is a side elevation of a sound track continuous contact printer embodying the present invention and showing the path of the 16 mm. and 35 mm. film through the printer.

Figure 4 is a side elevation of a sprocket according to the invention for use in a continuous contact, sound track printer;

Figure 5 is a plan view of 16 mm. and 35 mm. film passing over the sprocket shown in Figure 4, and

Figure 6 is a front elevation of the aperture in a projector for projecting certain 16 mm. combined sound and picture films and showing two forms of sprocket according to the invention.

Referring to the drawings, the film in Figure 1 consists of a length of 16 mm. stock 10 carrying along one edge a sound track 11 and along its middle a series of picture frames 12, and perforations 13 are provided for driving the film. The stock 10 is substandard in that it carries picture frames of 16 mm. dimensions but the sound track 11 is of standard size both as regards its width and its length, and the stock is intended to be run at a speed such as is normally used in the projection of standard 35 mm. films. From this it will be seen that so far as the sound track 11 is concerned, it is in all respects exactly similar to a sound track of standard size. There is also provided a further series of pictures 14 uniformly spaced to form a continuous series capable of producing animation on projection, and occupying the spaces between the first series of pictures 12 and the perforations 13. In addition, a second sound track 15 complementary to the second series of pictures 14 is disposed along the other edge of the stock.

Since the sound tracks are in all respects exactly similar to a sound track of standard size, it is necessary for the stock 10 to move through a camera or projector at the speed normally used with standard films (e. g. eighteen inches per second), hereinafter referred to as "standard speed" and also for a corresponding number of frames, in this instance twenty-four, to pass through the picture gate of the camera or projector. Accordingly, the pitch of the 16 mm. pictures 12, and also of pictures 14, is the same as would be the pitch of a series of standard pictures, and the pitch of the perforations 13 is arranged to be a suitable multiple of standard perforation pitch (in the present instances, four times as great).

If, therefore, a 16 mm. film as shown in Figure 1 is passed at standard speed through a projector the picture gate of which is provided with an aperture of 16 mm. dimensions, ordinary 16 mm. picture projection will be obtained while at the same time the reproduction of the sound from the sound track on the 16 mm. film will be of a quality only associated hitherto with standard films.

In Figure 2, the film is the same as that described with reference to Figure 1 except that there is provided a series of perforations 18 in addition to the series of perforations 13. The perforations 18 have a pitch four times that of standard 35 mm. films, but they are spaced along the centre of the stock so that the film may be fed through the machine by sprockets each having an extra set of teeth for the purpose of relieving the strain on the film.

The step of exposing substandard film prior to developing for printing purposes can be carried out in a variety of well-known ways to produce a film according to the invention. Dealing first with optical printing, a standard positive may be optically reduced on to substandard stock to produce a negative, from which a substandard positive can subsequently be produced, or a substandard positive may be optically projected on to substandard stock without reduction.

Substandard films according to the invention can also be produced from identical substandard positives or negatives by contact printing with or without chemical reversal of the image. For these methods the only modification necessary to standard machines is the provision of feeding means such as substandard sprockets having a pitch corresponding to that of the perforations on the film, for example, four times standard pitch.

It is, however, often desirable to be able to reproduce a sound track from one film and a series of pictures from another film, and the apparatus described below illustrates one way of achieving this result.

Figure 3 shows a contact printer embodying the invention in which it is desired to print only a standard sound track from a standard negative on to substandard stock according to the invention, the printing of the picture frames comprising a different operation. Substandard unexposed stock 20 is fed off a delivery reel (not shown) around a guide roller 21, over a feeding sprocket 22, a friction sprocket 23, across a printing mask 24, provided with an aperture shown in broken lines at 25, and is led away by further sprockets 26, 27 around a guide roller 28, to a take-up reel (not shown). A standard negative 29 is led around a guide roller 30, the sprocket 22, a friction sprocket 31, passes across the printing mask 24 and over the aperture 25, around the sprockets 26 and 27 and out of the machine around a guide roller 32 to a standard take-up reel (not shown). A source of light, shown diagrammatically at 33, is provided for exposing the film.

During their passage through the printer, the substandard and standard films overlap to a certain extent and are held in intimate contact against the sprockets by jockey rollers 34. The manner in which they overlap is shown in Figures 4 and 5. The sprockets 22, 26 and 27 have the features illustrated in Figure 4 in that each sprocket is provided with three sets of teeth 35, 36 and 37. The teeth 35 and 36 serve to carry the substandard film 20, have a pitch equal to four times standard pitch and are spaced parallel to the axis of the sprocket by an amount slightly less than the width of the 16 mm. picture. The teeth 37 carried on an axial extension are set at standard pitch and, together with the teeth 36, serve to carry the standard negative 29. The diameter of the sprocket at 38 is less than its diameter at 39 by twice the thickness of the standard film, and it will therefore be seen that while the film 29 is supported at 38, the film 20 is supported at 39 and at that part of the film 29 which it overlaps. The films are thus so disposed relatively to one another that the sound track 40 of the film 29 is immediately beneath that portion 41 of the film 20 which is to receive the sound track, and the sprockets are so disposed

in the machine that only this narrow strip of film passes over the aperture **25**.

Referring now to Figure 6, a projector is illustrated having two forms **42**, **46** of sprocket according to the invention. The sprocket **42** has two rows of circumferential teeth **43** spaced apart by an amount slightly less than the picture width of standard 16 mm. film, the teeth **43** having a pitch equal to the picture pitch of standard 35 mm. film, and being in line across the sprocket **42** parallel to the axis of the sprocket. The sprocket **46** has a similar pair of rows of circumferential teeth **43** and a third row **45** arranged centrally between the other rows **43**, the teeth of the row **45** having the same pitch as those of the rows **43** and being staggered with respect to the teeth of the rows **43**. The sprocket **42** is suitable for feeding 16 mm. film as illustrated in Figure 1 and the sprocket **46** for feeding 16 mm. film as illustrated in Figure 2. The position of a standard 35 mm. sprocket is shown in chain-lines at **44**.

I claim:

1. A sprocket wheel for use in the contact printing of the sound track of 16 mm. film from 35 mm. film comprising three rows of sprocket teeth, two rows of which are spaced apart by a distance appropriate for engaging standard 35 mm. film and one of said rows having teeth spaced at four times the normal pitch of the other row, the third row of sprocket teeth being spaced from the last said row by an amount substantially less than the distance between the first two rows so that these two rows may engage and feed 16 mm. film overlapping a 35 mm. film carried by the first and second said rows, said sprocket being adapted to draw a 35 mm. and a 16 mm. film in overlapping relationship.

2. A sprocket wheel as defined in claim 1 and provided with supporting surfaces for the first two rows of teeth and outside the third row thereof, adjacent to the teeth, on which the edges of the films may run, the supporting surfaces for the first two rows being of smaller diameter than the supporting surface outside the third row of sprocket teeth, on which the 16 mm. film may rest, by an amount sufficient to allow for the thickness of the 35 mm. film.

MARTIN HARPER.