May 3, 1938. W. J. MORRISSEY 2,115,738

FILM FEEDING MECHANISM

Original Filed June 3, 1933

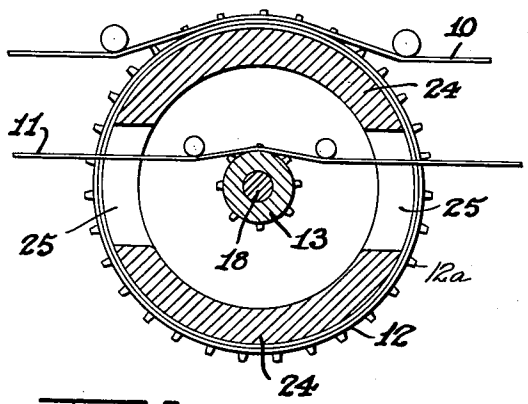


Fig. 3.

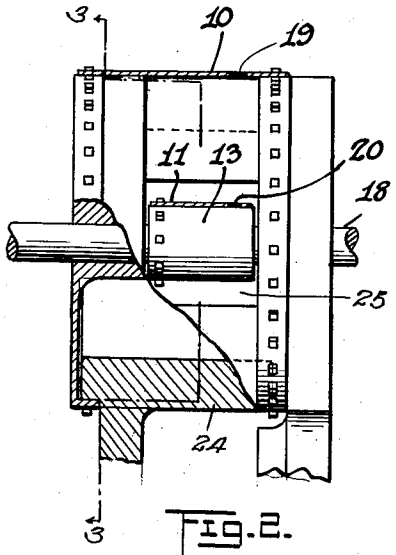


Fig. 2.

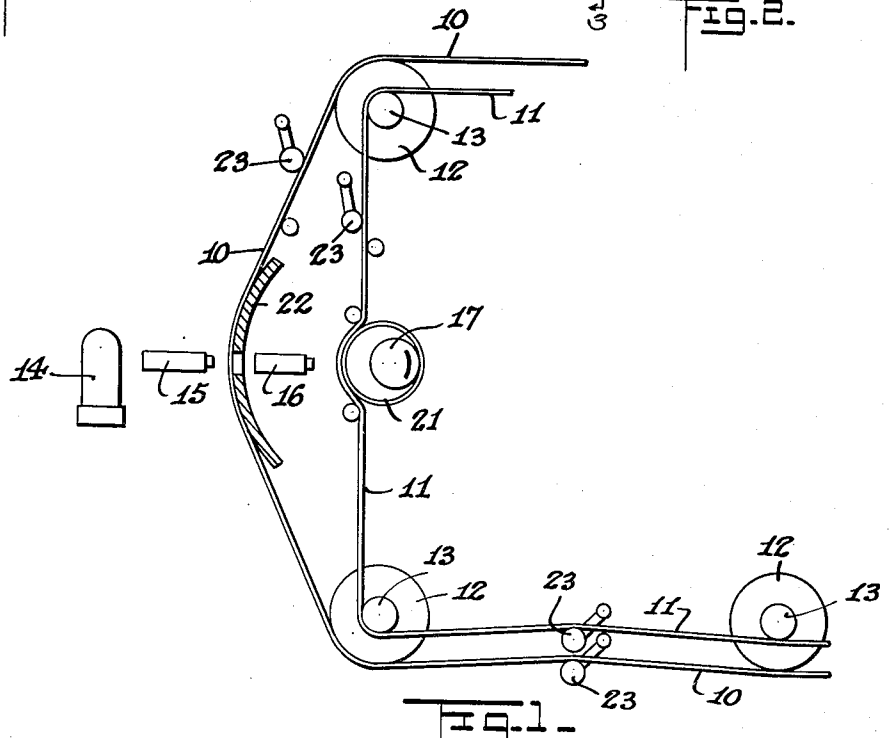


Fig. 1.

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FILM FEEDING MECHANISM

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Original application June 3, 1933, Serial No. 674,127. Divided and this application March 28, 1934, Serial No. 717,785

6 Claims. (Cl. 271—2.3)

This invention relates to methods and means for recording and reproducing sound, and is a division of applicant's case S. N. 674,127, filed June 3, 1933.

An object of the invention is to provide a new and improved method and means for recording sound on film, in which a real recorder is used as distinguished from a mere optical printer or photographer.

Another object is to provide a method and means for reducing the sound on a talking movie film of size 35 mm. to the 16 mm. amateur film size.

A further object is to provide a means for monitoring of recordings, in which the actual recording on the undeveloped prints is caused to do the monitoring.

Yet another object of the invention is to provide the method of recording in which one frequency track may be superimposed upon another frequency track to produce background effects.

A further object is to provide a sprocket construction by means of which the two films are superimposed upon each other with a definite ratio of the peripheral speed between each.

Still another object is to provide a method and means of reproducing sound in which film sound track frequencies are translated into sound, the reproducer being so arranged as to utilize films of different sizes of width and/or speed in the same reproducer without the changing of major parts. This applies as well for use with the motion picture projector.

All these and other objects as set out here below are attained by the method and means now to be described and illustrated in the accompanying drawing, in which—

Figure 1 is a side elevational view, somewhat diagrammatic, of the lens and sprocket arrangement and other essential parts used in this improved reduction process for the reduction of film footage and the changing of the physical dimensions of the frequency track upon the print.

Fig. 2 is a side elevational view of the concentric sprocket used in this invention and showing the large film superimposed upon the small film, where the sound tracks are superimposed upon each other and the small film falls entirely within the large film; and

Fig. 3 is a cross sectional view of Fig. 2 taken through the lines 3—3 thereof.

Like numerals refer to like parts throughout the several views.

Before describing this invention in detail it is desirable to review briefly the present methods of recording and re-recording audible frequencies photographically upon light sensitive materials. Recording of such frequencies is usually divided into three general classifications, viz, variable area, glow tube and light-valve types of variable density. Although there are many combinations and modifications of these three methods it is usually considered that these methods are basic with respect to the type of frequency track obtained. The translation of such frequencies for purposes of changing the physical dimensions of their recordings without altering the effects of their frequencies is brought about by the following methods:

Electrical translation is usually accomplished by modulating a light-sensitive cell and converting into electrical impulses which are amplified by amplifiers and then caused to operate an electrical recorder of the types previously described, whereby the electrical impulses are caused to record themselves upon a light sensitive photographic material. This method, in addition to the expense, has one great disadvantage in that all frequency errors are usually accumulative and much compensation is necessary to preserve the higher frequencies of the original frequency track.

The second method, optical reduction, is only a form of optical printing and should not be considered a re-recording method. The resultant frequency track is entirely dependent optically for its physical dimensions, and deviation from these dimensions can only be brought about by the use of cylindrical lenses in conjunction with spherical lenses. The difficulty of obtaining the correct optical translation together with the difficulty of focusing the objective, which can only be brought about by a microscope, together with the mechanical defects of the printer, make this method of printing unsatisfactory.

The optical printers have long caused considerable trouble and the introduction of frequency tracks in conjunction with motion pictures further amplifies their defects. The inaccuracies of ratios, back-lash of gears utilized for driving the positive and negative materials which must be operated at different peripheral speeds, together with film shrinkage makes it very difficult to obtain a frequency translation free from "wows" or the attenuation of higher frequencies, caused by positive print blurring, which is brought about by the above defects.

In the present invention frequencies are readily translated from one physical dimension to another. This translation may be further modified by superimposing another frequency upon the

original frequency at the time of the translation. This superimposition is exceedingly valuable for scientific purposes and may be utilized for translating inaudible into audible frequencies or for producing beats, audible or inaudible, or for producing background frequencies for scientific purposes, timing frequency, etc., or for purposes such as orchestration for musical solos or any other desired background effects.

This invention is both a sound frequency recorder and reproducer. As a recorder, it is not in the nature of an optical printer or photographer, but is in effect a recorder in all senses of the meaning of the term "recorder". In describing the invention it should be remembered that the illustrations utilized represent mere mechanical illustrations of the invention, which is considered basic in principle, and not confined to any particular mechanical assembly. However, advantages of certain mechanical assemblies are noted and claims made for their superiority over other possible assemblies.

In Figure 1, two films, one the master frequency film 10 and the other the print 11 are caused to be fed into the recorder with a definite relation between their peripheral speeds, which is maintained constantly through the recorder. This relation determines the footage of the recorded film with respect to that of the frequency track. The two films are fed over the special concentric sprockets 12, 13 which feed the film over reading aperture and across the recorder.

The recording is done by a light source 14 which is caused to shine through an optical assembly 15 which causes a very narrow aperture slit, as, for purposes of illustration, assume (0.0007" by 0.100") upon the master frequency track, which is longitudinally recorded on a transparent photographic material. The frequency variation, which is usually embodied as one of the previously described types of sound frequency tracks, consists of alternate transparent and opaque portions. If these opaque portions, which are really frequency variations, are allowed to interrupt the very narrow slit of light which due to its narrow width and the speed of the recording of the original frequency on the master film, will be much narrower than any of the opaque portions of the highest frequency recorded upon the master longitudinal sound track, the opaque material will act as a mechanical shutter, shutting off all the light which would normally extend through the transparent medium of the photographic material.

The flashes of light, which are in reality intermittent flashes of light whose frequency of interruption or flashing is that of the master frequency track, will be illuminated by the first optical assembly and collected by the second optical assembly 16 which by means of its position and optical assembly intercepts the light beam of the first assembly at a point in space which, due to the light beam being out of focus, will be a uniform spot of light, which will exhibit no slit, filament or master frequency track outline, but represents a point where due to mechanical shutter action there will be obtained intermittent flashes of light. The focal plane of the second optical assembly 16 does not lie in the same plane as that of the master film but at an intermediate point beyond: therefore no definite image of the master track is projected by the second optic 16. The elimination of the master frequency track outline is accomplished by keeping the slit of the first optical assembly narrower than the highest frequency recorded on the frequency record. Successful experiments have been performed with slit aperture thicknesses of less than 0.0002". The spot of light intercepted by the second optical assembly will be projected through its aperture, the dimensions of which are a matter of convenience to fit the footage and space limitations of the print film.

The narrow aperture slit of the second optical assembly must be properly focused upon the print film. If the optical assemblies have been properly assembled and adjusted the second optical aperture may be rotated through an arc of 360° and the aperture slit as outlined on the print film will also rotate through the same arc while the aperture slit of the first assembly remains stationary; thus proving conclusively that there is no photographic recording of the first aperture slit upon the print film and that the recorded frequency is not an optical reduction of the master frequency track.

A further proof may be obtained by placing the print film 11 out of focus with the second optical assembly while same has been rotated through an arc of 90°. (It is of course understood that the print film 11 is the new print being created or recorded.) There will be obtained on the print film, if the proper auxiliary focus be obtained, a faint outline of the aperture image of the first optical system, which is probably caused by "pin hole camera action" due to the interception of a minute portion of the physical outlines of one slit by the other. This small pin hole camera action is entirely eliminated by the proper focusing of the second optical assembly with respect to the first assembly and also the proper focusing of the print film 11 with respect to the second assembly. Thus variations of frequencies of the sound negative will mechanically intercept the light and by mechanical shutter action will cause the same to be translated and to be recorded upon the print a variable density type of sound track whose frequencies are similar but whose track dimensions do not have to be physically related. This method of recording eliminates all errors of optical reduction previously described and also eliminates the photographic grain of the master frequency film material.

At the present time there is considerable reduction from the 35 millimeter to 16 millimeter motion picture film, thus utilizing professionally-made film in amateur projections. The above method of recording allows this type of reduction to be made very conveniently, and results in a very good quality of print at a minimum of price. The aperture of the second optical assembly may be set for example at 0.0003" by 0.100" and by means of a mechanical layout later described the sound track may be transferred from inside of the sprockets on the 35 millimeter and reduced in footage by the ratio of 1000 to 400 (2.5 to 1) and reduced physically and recorded in a different location on the 16 millimeter print.

In recording, it is essential that the ratio of the peripheral speeds be constantly maintained. To accomplish this a special combination sprocket has been invented in which the two films are superimposed upon each other with a definite ratio of the peripheral speeds between each. The sprockets are so constructed that one film 11 and its sprocket 13 fall within the sprocket 12 of the larger film 10 and both have the same axis 18. Such a combination sprocket maintains a definite fixed peripheral speed ratio with no back-lash or creepage error, which is common in printers of

the "contact" or "optical-reduction" type. The sprockets are so constructed that the sound tracks 19 and 20 bear the same lateral relation that they occupy at the recorder for the sound track alignment and thus the two films are always in alignment as well as operating at the correct speeds.

Utilizing the special combination sprocket in which the two films are superimposed upon each other with a definite ratio of the peripheral speeds between each and which is constructed so that one film and its sprocket teeth falls within the sprocket of the larger film and both have the same axis, a combination projector may be constructed in which for example, both 35 millimeter and 16 millimeter or any combination of sizes may be operated upon the same machine with a minimum of changes. The only major change is the changing of the picture aperture mat so as to frame the particular size of picture being utilized in the machine. The location of the sound track frequency records with respect to the sound recorder will be automatically maintained in correct position by the construction of the special sprockets, as outlined above.

The tandem or end to end arrangement of the optical assemblies previously described may be utilized for the reproduction of the frequency or sound tracks of the various sizes of film. For example, the first optical assembly 15 will translate the frequency or sound track of a 35 millimeter film 10 and its light variations will successfully pass through the second optical system 16 to the photo-electric cell 17 thus causing the amplifier to translate and amplify the frequency variations. On the other hand if it is desired to utilize a 16 millimeter film 11 it will be passed over the second optical assembly 16 in place of the print film 11, previously described, in the recorder. The light will then pass through the first optical assembly 15 into the second assembly 16 and then be intercepted by the film and the light variations transmitted to the photo-electric cell and amplifier. Thus, a combination sound projector may be readily constructed for films of various dimensions or different location of sound tracks on the film.

In Fig. 1, 21 represents the enclosure or housing for the photo-electric cell 17. The reading aperture plate is shown at 22, and idler pulleys 23 serve to keep the film taut.

It should be further noted that the sprocket teeth 12 rotate around a stationary housing 24 having either one or diametrically opposed openings 25 through which the film 11 is strung.

It should be noted that all the sprocket teeth may be either single or double. In the illustration, the larger film is shown with double sprocket teeth openings, and the smaller film with single openings.

It is to be understood that the present disclosure is for the purpose of illustration only, and that the invention is not limited thereto. To those skilled in the art, many modifications of the invention will be readily apparent, and it will also be obvious to such skilled persons that parts of the device may be used without other parts thereof, and steps in the method, without other steps, many such combinations readily suggesting themselves. Therefore, it should be and is to be distinctly understood that for a definition of the limitations of the invention, reference must be had to the appended claims.

It should be noted that the drum 24 or body of the sprocket does not rotate but is fixed to the frame of the mechanism; that the sprocket teeth 12a are carried on a rim 12, which as it rotates, actuates the film; that the film does not contact the rotating teeth except at the very thin formed edges of the holes, but bears on and is in frictional contact with the fixed drum or body of the sprocket. This frictional action being utilized for its braking or dampening action also eliminates errors due to possible eccentricity of the drum when same is rotated with the teeth, also possible collection of lumps of dirt on the rotating drum, and also loose or worn bearings.

While the description is confined to the master frequency track being a transparent medium, it is of course understood that this may be translucent or opaque, and the light reflected therefrom to the second optical assembly 16.

Having now described the invention, what is claimed as new and for which Letters Patent of the United States is desired, is:

1. In a film feeding device for films having perforated sprocket holes formed therein, a drum like stationary member adapted to support the film passing thereover, a circular rotatable member having sprocket teeth extending radially therefrom to engage said holes, said rotatable member being concentric with said stationary member and of such diameter relative to the stationary member that the roots of said sprocket teeth remain out of contact with the film and means for rotating said second member thereby moving the film over said first or supporting member, whereby the frictional engagement of the film with said supporting member dampens out statically uneven motion such as tooth ripple.

2. In a duplex film feeding device for films having perforated sprocket holes formed therein and adapted to carry visual effects and sound tracks, a drum like stationary member adapted to support one film passing thereover, a circular rotatable member having sprocket teeth extending therefrom to engage the holes in said film and to move the same smoothly over the surface of said first member, said rotatable member being concentric with said stationary member and of such diameter relative to the stationary member that the roots of said sprocket teeth remain out of contact with the film, whereby the film may be frictionally drawn over the surface of said stationary member to dampen out statically uneven motion and other mechanical vibrations, a second circular rotatable member positioned within said stationary member and provided with sprocket teeth engaging holes in a second film, means forming openings in said stationary member through which said second film may pass in a definite relation to the movement of said first film, and a driving shaft common to both said rotatable members.

3. A device according to claim 1 in which the circular rotatable member is comprised of a sprocket near each end of said stationary drum like member, and a single sprocket member is positioned within said drum like member, and a shaft is provided common to the said sprockets, said stationary members being provided with openings through which a film may pass to said single sprocket.

4. In a film feeding device for films having perforated sprocket holes formed therein, a drum-like stationary member adapted to support the film passing thereover, a shaft and means to rotate the same, and a sprocket wheel mounted on said shaft in concentric relation to said stationary member and of such diameter relative to the stationary member that the roots of said

sprocket teeth remain out of contact with the film, whereby the faces of the sprocket teeth engage the perforated sprocket holes in the film and the friction of the film passing over said member dampens out tooth ripple and other statically uneven motions from the film.

5. In a device of the character described for feeding films having imperforate sprocket holes formed therein, a drum-like member with which the film contacts and over which the film is moved frictionally, and a sprocket wheel concentric with said drum-like member and having a root diameter of such dimension relative to the diameter of the drum-like member that only the edges of the holes in the film are contacted by the sprocket teeth, whereby foreign matter accumulated on the surface of the body of said sprocket will not cause irregular movement of said film, and the tooth ripple of said sprocket is ironed out due to the friction of the surface of said film over the surface of said member.

6. A device according to claim 2, in which the said first circular rotatable member and said second circular rotatable member are so positioned relative to each other that the center lines of spaces in said films allocated for sound tracks are in line with each other.

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