Jan. 27, 1942. W. DÄLLENBACH 2,270,996

ARRANGEMENT AND PROCESS FOR THE PRODUCTION OF ENDLESS SOUND FILMS

Filed June 22, 1937 2 Sheets-Sheet 1

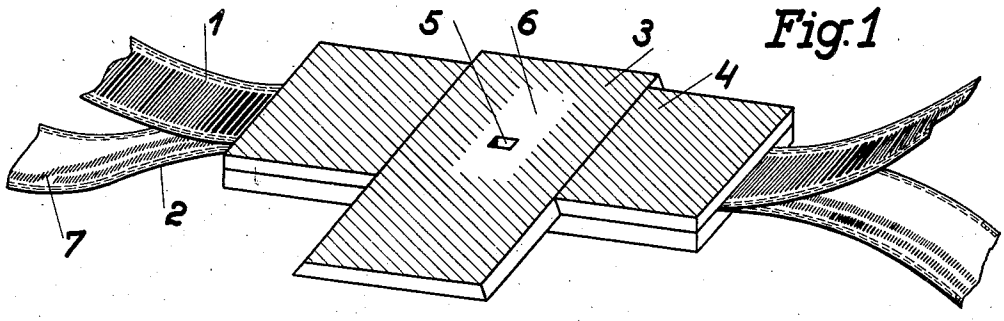


Fig.1

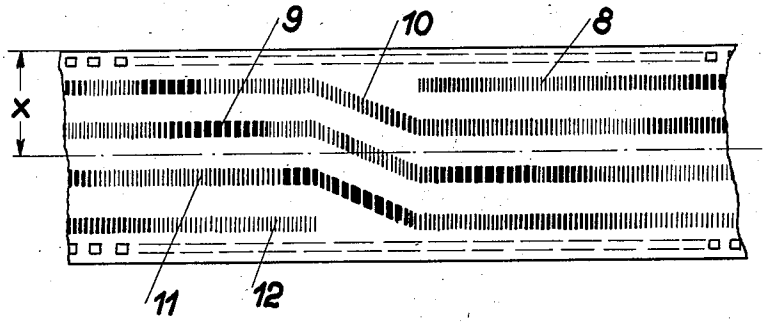


Fig.2

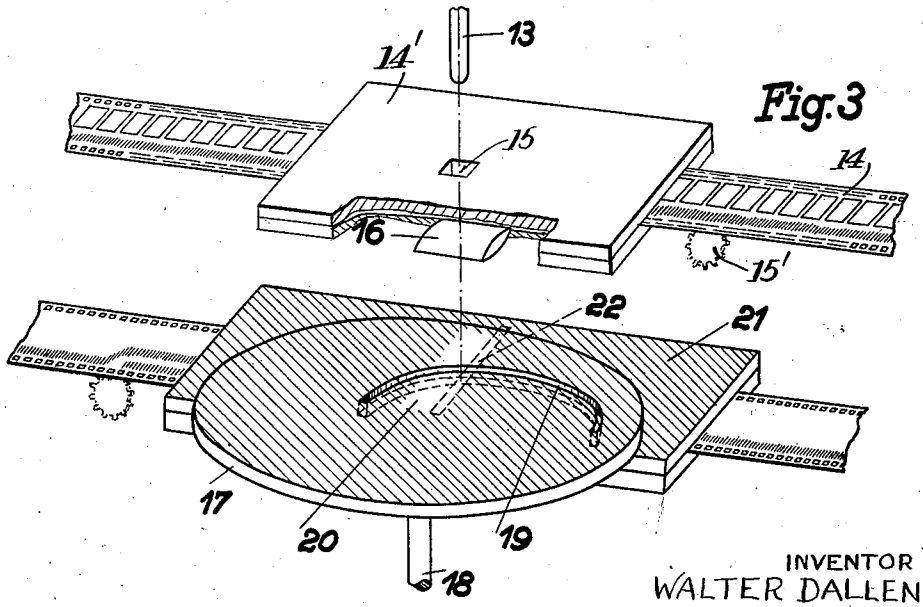


Fig.3

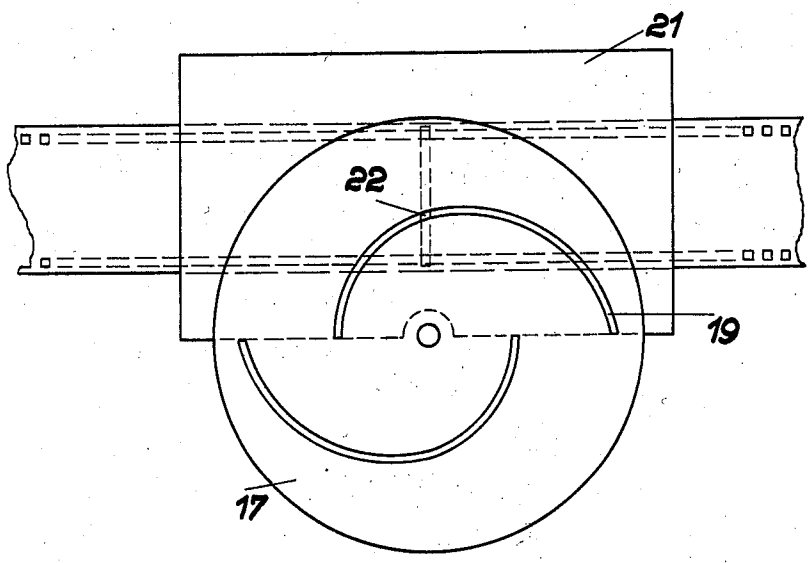
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Fig. 4



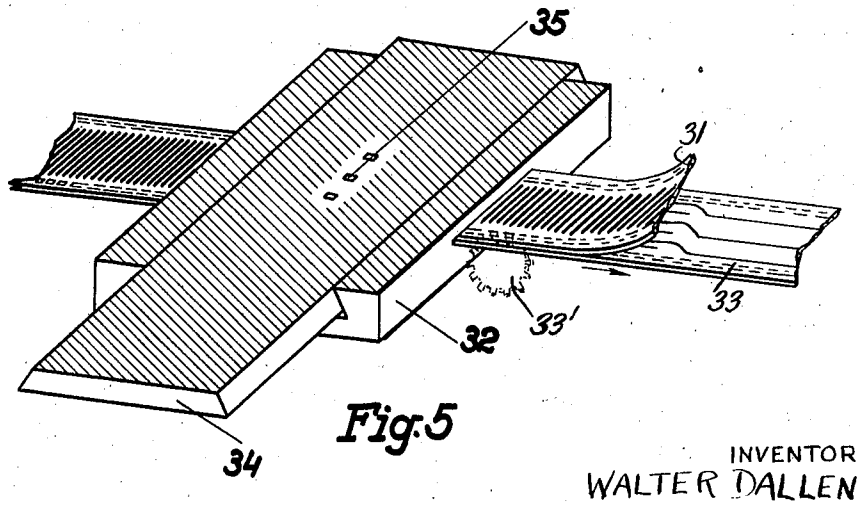


Fig. 5

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ARRANGEMENT AND PROCESS FOR THE PRODUCTION OF ENDLESS SOUND FILMS

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5 Claims. (Cl. 274—46)

The present invention relates to the production of sound films and more particularly to a process and apparatus for transposing onto an endless film with a plurality of juxtaposed sound tracks, a sound record taken from a strip film. Ordinarily the several sound tracks on the endless film are parallel to each other.

The sound record may be arranged on the continuous film in one spiral course, all of which is at a predetermined slight angle to the edge of the film, or it may be so arranged that successive sections of the film are parallel to each other and to the edge of the film and are connected by an oblique section.

The present invention provides means for the purpose of rendering possible the re-recording of sound exposures, which have been made on strip films, on endless films and, furthermore, to subsequently manifold such endless films in a simple manner.

According to the present invention the production by manifolding of endless sound films, preferably with parallel sound records, by copying is effected in such a manner, that by means of a series of sound records of prescribed width and a stop adapted to be displaced transversely to the series of sound records one or a plurality of recording strips of lesser width are produced.

The process described can also be used to advantage in printing ordinary strip films of finite length. A variable density sound record of narrow width can be widened by optical means in projection and printed on a strip film in such condition as to extend substantially the full width of the effective printing area of the film. As will be hereinafter described, this is accomplished by the use of optical means, whereby an original narrow pencil of rays which is modulated according to the sound is widened to the desired width for printing a wide sound track.

By means of a suitable light stop having a small printing aperture a narrow sound track can be printed on a sensitized film even though the record from which it is printed has a wide sound track. The stop in the arrangement shown is movable laterally of the sensitized film to permit successive sections, that is to say sections which are of substantially the length of the endless film to be offset laterally from each other on a sensitized film. The printed and developed record will then have parallel record sections which are connected each to the next by a diagonal record section. The movement of the light stop laterally of the film can advantageously be released automatically, e. g. by means of a trip positioned to engage a notch in the edge of the film. The mechanism for moving the light stop is preferably arranged to move the stop at a speed having a constant predetermined ratio to the speed of the film. The light stop can be a simple slidable element movable transversely of the film or it may be a rotary element with a spiral slit, whereby upon rotation the effective portion of the opening in effect moves across the film.

From one of the films produced in this manner, which may be called in this instance a second original, a copy is made in accordance with the present invention, on which is recorded about 4 to 10 times in juxtaposition the second original. This last copy serves then as master film for the actual production in quantity of the endless films, inasmuch as it will be possible to produce contact copies therefrom which are then cut into separate films of the desired length.

The original record used for printing continuous films according to the present invention may be a record made in accordance with prior practice on any of the ordinary commercial films.

A record to be used for printing and having a sound track extending substantially the full effective width of the film may be made from such original record. When printing from this film onto an endless film, in accordance with the invention, a stop is used which has one or a plurality of printing apertures for the copying light. The printing apertures are so spaced that the printed film has equally spaced record sections thereon. The width of the apertures corresponds to the width of the sound record upon the endless film as finally printed.

If, for instance, the light stop is provided with three printing apertures suitably spaced, three sound records will be produced simultaneously upon the endless film when printing. After each revolution of the endless film the light stop can be moved laterally a distance substantially equal to or slightly more than the width of the printed sound record on the endless film. This is repeated until the entire printing space of the endless film is utilized. The endless film will then contain in triplicate the sound record of the original film. It is self-evident that it is possible to move the light stop at a slow but uniform speed across the film and thereby produce a so-called spiral record on the film such as heretofore produced by Lee de Forrest. An endless film obtained in this way can now either be cut directly, by way of example into three separate films, in connection with which the parts, con-

taining the sprocket holes, are omitted, if standard films are used. It will, however, also be possible, to use this endless film, in the first instance, as master film, from which contact copies can be produced, which are subsequently cut longitudinally in the same way as has just been described.

The most simple operation of the method consists therein, that the original record is recorded across the entire width of a film. This can be effected, e. g. by using a thermionic valve controlled by sound currents and provided with a linear cathode extending perpendicular to the film, whereby a uniform illumination of the total film width is ensured. A record of this nature has, in contradistinction to the exposure in the first instance of an endless multi-record film, the advantage that the original film can be subjected to cuts and combinations, which are impossible in connection with a multi-record film.

In the drawings which illustrate selected embodiments of the invention—

Figure 1 is a perspective view of a film guide with a transversely slidable light stop embodying the invention,

Fig. 2 represents the preferred arrangement of the sound records on the film in accordance with the present invention,

Fig. 3 illustrates an arrangement according to the present invention, in which the original sound record is projected with the aid of a cylindrical lens,

Fig. 4 shows a rotatable stop with a spiral aperture, as it is to be used in accordance with the present invention, and

Fig. 5 represents an arrangement rendering it possible to produce simultaneously a plurality of sound records upon a film.

Fig. 1 illustrates a simple apparatus by means of which the printing can be effected according to the present invention. 1 represents in this instance the original film, carrying the variable density sound record across the entire width of the film. 2 is a piece of the endless film band on which the original record is to be copied in a plurality of sound records in juxtaposition. The stop 3 is slidably disposed in the guide 4, which can also be made to simultaneously serve as film guide. The stop 3 is provided with a printing aperture 5, the width of which corresponds to the width of a sound record, as it is to be printed on the endless film 2. The shape of this aperture 5 can vary; it is, however, of advantage to cause it to be made of rectangular shape as shown in Fig. 1. The source of light used for printing can, for instance, be so constructed that it throws a beam of light of a width equal to the entire width of the film upon the stop 3. This has been indicated by the rectangular space 6 left white. If now both films are made to pass through the film guide with equal speed, merely a narrow sound record will be printed on the endless film band. After one revolution of this film band the stop 3 can now be laterally displaced by a certain amount. This ensures that the light used for copying describes a corresponding relative movement on the endless film 2, and the exposure record takes an oblique course, as indicated at 7 in consequence of the constant movement of both films. The diagonal section of the sound record shows in exactly the same manner as the straight section on the endless film band the variations of density as the corresponding section of the original film.

It is sometimes desirable to print from standard sound films having a single sound track an endless film with a continuous sound track including parallel sections. In accordance with the present invention, an image of the sound record of the original film is produced optically, which image is enlarged laterally for example to such an extent that the enlarged image extends across the entire width of the endless film onto which the sound record is to be reproduced. In one embodiment of the invention, the enlarged image is formed optically in the plane of the sensitized film but the film is shielded by a light stop to control the area to be printed. Fig. 3 illustrates diagrammatically an apparatus for such operation. 13 represents the source of copying light which may be so designed that it illuminates the original film 14 at the point 15 impinging on the film at a right angle thereto. The copying light now passes through an optical printer conventionally indicated as including a cylindrical lens 16, the light subsequently impinging upon a suitable stop arrangement. The optical printer is stationary and projects toward the film to be printed an image, which image is suitably formed in the plane of the sensitized film as is usual in optical printers but due to the effect of the cylindrical lens this image extends over an area of a width in the direction transverse to the film substantially equal to the width of the film. The light stop controls the position of actual printing of the sound record on the film. We have, therefore, in this arrangement a stationary optical printer and a light stop which is movable or adjustable to control the position of actual printing as contrasted with apparatus wherein the optical printer is moved when it is desired to print at a different position laterally of the film. The stop arrangement shown in Fig. 3 is of the rotary slot type although the invention is not limited to this kind of stop construction. 17 represents the stop disk adapted to be rotated about the spindle 18. It is provided with a spiral shape slot 19 which cooperates with the slot 22 in the film guide to form the light stop. As indicated in Fig. 3, by means of the non-hatched rectangular space 20, the enlarged image of the original sound record extends over the whole width of the endless sensitized film. By means of the light stop, however, only a small part of the entire width of the sensitized film is exposed to the copying light. During printing the master film 14 is fed in one direction through the film guide 14' by the sprocket wheel 15' and the sensitized film is fed in the opposite direction through its film guide 21 by the sprocket wheel 21' as is usual in apparatus of this character. After one revolution of the endless sensitized film during which time the sound track is printed on a line parallel to one side of the film, the stop disk 17 is rotated through a small angle sufficient to readjust the position of the aperture to print on a second line parallel to the edge of the film. The adjustment is made during movement of the film, so that a diagonal section of the sound track is provided to connect the two parallel sections. By means of the slot 22 in the film guide 21 forming a part of the light stop, the quantity of copying light impinging on the film and, therefore, the density of the film as printed can be regulated.

Instead of operating the disk 17 as above indicated, it may be rotated continuously but at a very slow rate during the whole course of the printing operation whereby all sections of the

sound track will lie at a constant angle to the length of the film.

Another embodiment of the invention is illustrated diagrammatically in Fig. 5. 31 represents a standard 35 mm. film on which the sound record has been printed to extend across substantially the whole effective width of the film. This master film is passed through a film guide 32 together with a sensitized endless film 33 to be printed. A sprocket feed wheel 33' is indicated conventionally as feeding the films in the direction of the arrow. In the film guide 32 a stop 34 is arranged to slide in a direction transverse to the length of the film. This stop has three printing apertures 35 which may, for example, have a clearance between each two apertures of 8 mm. As indicated in Fig. 5, three sound tracks will be printed simultaneously as the films are fed through the film guide and stop. A lateral displacement of the light stop 34 may be effected after one revolution of the endless film or, if preferred, the stop may be moved continuously to provide a continuous helical sound track as previously explained.

Instead of effecting the printing directly by contact, it is possible to optically magnify the original disclosure in the direction of its width as in the arrangement indicated in Fig. 3, and to print through the stop 34 directly. It is also possible to arrange the light stop at a distance from the film to be printed and to print optically.

If all sound records are to receive the same quantity of light, the apertures in the stop will all be made of equal size in view of the fact that one and the same source of light is used. In accordance with the present invention, it will also be possible to produce sound records of different intensity.

For the purpose of regulating the passage of light through all the apertures of the stops simultaneously, the apertures in the stop can, particularly if the arrangement is such that all sound records are to be produced with the same light intensity, be regulated by means of a single adjusting device common to all stop apertures.

The process in accordance with the present invention may be applied advantageously for the production of sound films by the printing method. In many cases it might, however, be advisable, to use it directly in connection with the original exposure in which the original sound record is made. In this case, as also in those cases where an extremely narrow master sound record is used and where the production of the endless film is to be effected by means of the printing method, the beams of light, either before or after it has been modulated, is given the width, required for the production of the endless film, with the aid of optical means.

In order to still further elucidate the present invention, an example is to be described according to which a symphony is recorded upon an endless film in connection with which the printing method according to the present invention is employed. The original record may in this case have been made upon a finite or limited standard film, in which the entire surface between the sprocket holes is filled up with the sound record. The length of the finite or limited film, on which the entire symphony is to be recorded amounts to say, 1000 m., which corresponds to a duration of run of 40 minutes. The length of the endlessly connected secondary film amounts to 100 m. It can also consist of standard film with a useful width of 24 mm. between the sprocket holes; if now, as shown in Fig. 5, the stop is provided with three apertures, the useful width of 24 mm. of the secondary film is split up in three divisions of 8 mm. each. The finite or limited sound film of 1000 m. length now yields 10 sound records upon the endless film of 100 length. These ten sound records are situated in juxtaposition upon a space of 8 mm. width and can, in connection herewith have a width of 0.6 to 0.8 mm., for example. In view of the fact that the secondary film was split up in three divisions it contains three records in juxta-position. The copy can be cut longitudinally to provide three records or it will be possible to use the endless film thus produced as master film for printing further copies.

Instead, however, of making a record of such an extensive musical composition, it will also be possible to record in succession different musical composition, for example, short orchestral compositions, interrupted by spoken texts by programme announcers, radio reporters and the like, upon the endless film in one and the same division, in connection with which then on the endless film several sections with identical sound records are placed in juxta-position.

It should be expressly pointed out that the statements relating to the dimensions with regard to shape and length of film, as well as the statements relating to the dimensions of the sound records have merely been made by way of example and may be modified as desired.

What I claim, is:

1. Apparatus for use in printing from a master strip film having a variable density sound record thereon a continuous variable density sound record onto a sensitized continuous endless film in sections parallel to each other, comprising means including a lamp, a gate and a lens for directing light through the master film toward the sensitized film over an area of a width substantially equal to the effective width of the sensitized film, a stop in the path of light between the master film and the sensitized film adjacent the latter having a limited exposure aperture and adjustable to limit the exposure of the sensitized film to selected positions transversely of the film.

2. An apparatus for use in printing from a master strip film having a relatively wide variable density sound record thereon, a sound record of relatively narrow width onto a sensitized endless film, comprising a guide to receive the master strip film and the sensitized film in superposed relation, a source of light arranged to direct light toward said guide over an area of a width substantially equal to the width of the sound record on the master film, a stop in the path of the light adjacent the guide having a relatively small printing aperture, said stop being movable in said guide transversely of the films to control the printing of the record on different parallel lines on the endless film, substantially as and for the purpose described.

3. Printing apparatus for sound films comprising a film guide for a master sound film having a variable density sound record of a width substantially equal to the effective width of the film and a continuous endless sensitized film in superposed contacting relation, a light stop adjacent said film guide having a plurality of exposure apertures spaced transversely with respect to the length of the film guide, said light stop being movable transversely of the film guide for printing simultaneously on said endless sensitized

film at a plurality of positions spaced transversely of the film and a fixed light source for directing light onto said light stop at all operative positions of the printing apertures.

4. The method of printing a variable density sound record on a continuous endless film in parallel sections which comprises passing a strip film having a variable density sound film extending substantially the whole effective width thereof through a guide in superposed relation to a sensitized continuous endless film directing light from a fixed source toward said records, interposing a light stop having a printing aperture of a narrow width and moving said stop transversely of the length of the film to print the variable density record on the endless film with successive sections arranged parallel to each other.

5. Apparatus for printing a continuous sound record on an endless sensitized film comprising, in combination, a film guide for a master film, a second film guide for a sensitized film parallel to but spaced from the first film guide, a stationary optical printing apparatus for imaging the sound record of a master film in the first film guide in the plane of a sensitized film in the second film guide, said printing apparatus comprising a cylindrical lens to extend the image laterally of the film guide to provide a relatively wide image area, together with a light stop having a printing aperture which is narrow as compared with the width of said wide image and cooperating with the second film guide and adjustable to move its aperture laterally across the film guide to effect printing on the sensitized film in the second film guide at a plurality of separated positions.

WALTER DÄLLENBACH.