Jan. 20, 1959 M. CAMRAS 2,869,878

SOUND MOTION PICTURE FILM

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Fig. 1

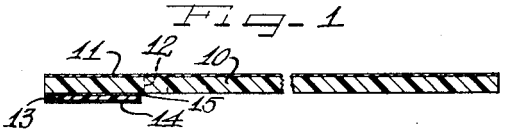


Fig. 2

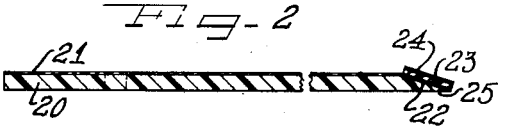


Fig. 3

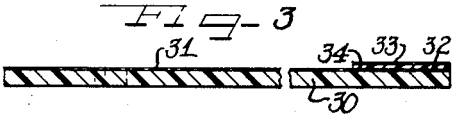


Fig. 3A

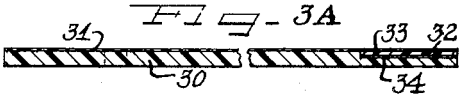


Fig. 4

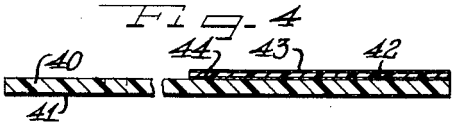


Fig. 4A

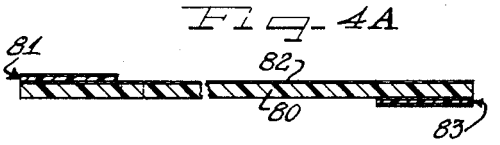


Fig. 5

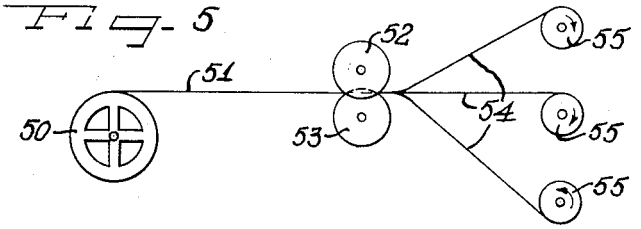
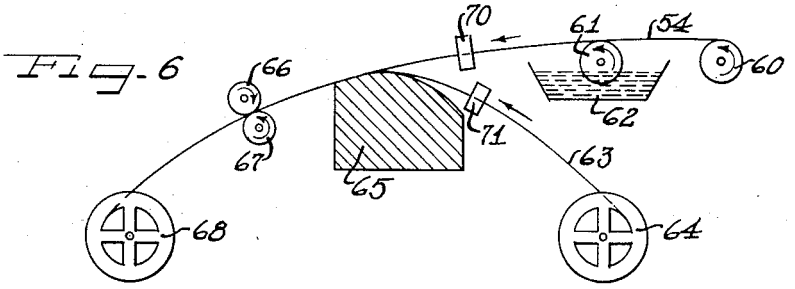


Fig. 6



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SOUND MOTION PICTURE FILM

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3 Claims. (Cl. 274—41.4)

The present invention relates to a motion picture film provided with a magnetic sound track for reproducing audio signals impressed upon the sound track. The present invention is also concerned with a new method for manufacturing motion picture films having magnetic sound tracks thereon.

Many attempts have heretofore been made to produce a commercially acceptable motion picture film with a magnetic sound track. Since the magnetic sound track ordinarily is disposed on an edge of the motion picture film, between the marginal edge of the film and the edge of the sprocket holes, only a very limited area is available. In order that the magnetic recording on the sound track give an accurate reproduction of the signals impressed thereon, the dispersion of magnetic particles in the magnetic sound track should be quite uniform within this limited area. The difficulty with previously used methods for applying such magnetic sound track on the surface of the film arises primarily in securing a sound track of uniform thickness and width in proper alignment along the edge of the film.

One of the earliest processes for applying a dispersion of magnetic particles onto an edge of a motion picture film involved extruding a dispersion of magnetic particles in a suitable vehicle through a very narrow extrusion orifice. Several difficulties were encountered in this process. For one, the extremely small orifice necessary to provide the very narrow sound track became clogged by the dispersion of metallic particles. Also, the extruded layer of magnetic particles did not adhere satisfactorily to the surface of the film, and could be brushed off accidentally after the vehicle had dried. In addition, the sound track was hardly ever of uniform width because of the tendency of the extruded material to flow into minute crevices or depressions in the surfaces of the film. This disadvantage was particularly noticeable in the regions of the film immediately adjacent the sprocket holes, as in these regions, the film contains very slight surface irregularities which tend to cause the extruded metallic dispersion to spread toward the sprocket holes. Furthermore, the sound tracks produced were not of uniform thickness, even under ideal conditions.

In another process for applying a magnetic sound track onto a motion picture film, the track is applied as a thin ribbon in a decalcomania process, the ribbon of magnetic particles being pressed against the surface of the film, followed by removal of the adhesived backing material from the magnetic ribbon with suitable liquids. This process has several drawbacks, including the fact that the backing material cannot always be removed from the magnetic ribbon without causing breaks to appear in the deposited ribbon.

In the present invention I have provided a novel sound track assembly for motion picture films which avoids the difficulties involved in the types of sound tracks previously employed on film. In the present invention, the motion picture film is provided with a separate sound

track which includes a self-sustaining support layer having the surface thereof coated with a relatively uniform dispersion of magnetic particles. This record member is securely bonded to the motion picture film, either at the surface of the film containing the photographic emulsion, or on the opposite surface.

Several advantages may be realized through the use of the motion picture film of the present invention. In a preferred embodiment of the invention, the magnetic sound track is elevated from the surface of the film by the thickness of the backing member employed. Thus, surface irregularities in the film do not present a problem, and the sound track can be applied to even severely scratched film. Another advantage of displacing the magnetic sound track from the surface of the film arises during winding of the film upon a reel, as the raised sound track serves to separate adjoining coils on the film, so that scratching of the adjoining surfaces are prevented during tensioning of the film upon the reel.

Another important aspect of the invention is the improved method for manufacturing the motion picture film of the present invention, as the method herein involved is quite economical, and lends itself very readily to continuous operation.

An object of the present invention is to provide an improved sound track for a motion picture film.

Another object of the present invention is to provide on a motion picture film a magnetic sound recording surface which is spaced vertically from the surface of the motion picture film.

Another object of the present invention is to provide a motion picture film with its sound track disposed at an angle to the plane of the film, thereby increasing the performance characteristics of the magnetic head with which the film is to be associated.

Another object of the present invention is to provide a method for incorporating a magnetic sound track on the surface of the motion picture film.

Still another object of the present invention is to provide a continuous method for applying a thin, magnetically coated ribbon on the edge of a photographic film in a rapid and convenient manner.

Another object of the present invention is to provide a method for manufacturing a motion picture film having a magnetic sound track of uniform thickness and width securely bonded thereto.

The sound film of the present invention includes a motion picture film base suitably composed of a cellulose derivative such as cellulose acetate or cellulose nitrate, or other transparent film material, coated with the usual photographic emulsion on a surface thereof. Securely bonded to either the emulsion surface or the non-emulsion surface of the photographic film is a self-sustaining flexible backing member of a thickness which is preferably less than that of the motion picture film, but still sufficient to provide a discernible difference in height between the surface of magnetic particles and the surface of the photographic film.

A further description of the present invention will be made in connection with the attached sheets of drawings in which:

Figure 1 is an end view, in elevation, of a sound track applied to motion picture film;

Figure 2 is a modified form of a motion picture film of the present invention in which the sound track is disposed on a beveled edge of a motion picture film stock;

Figure 3 is another modified form of the invention employing a film stock in which the sound track is disposed in a recess provided in the surface of the film;

Figure 3A is a modified form of the structure shown in Figure 3;

Figure 4 is another modified form of the invention in which a relatively wide sound track is incorporated onto the rear or non-emulsion surface of a photographic film;

Figure 4A illustrates a film with a dual magnetic sound track;

Figure 5 is a schematic representation of a method which may be employed in preparing the relatively narrow magnetic sound tracks of the present invention prior to their incorporation onto the surface of a photographic film; and

Figure 6 is a schematic representation of the process involved in applying the magnetic ribbon produced in Figure 5 to a surface of the photographic film.

As shown on the drawings:

In the form of the invention illustrated in Figure 1, the film stock comprises a base **10** of a material such as a cellulose acetate, cellulose, nitrate, or the like having the usual photographic emulsion surface **11** coated thereon. Ordinarily, this thickness of the stock of base **10** will be on the order of 5 to 6 mils (.005 to .006 inch), while the thickness of the emulsion layer will be on the order of ½ mil.

The film base has the usual spaced sprocket holes **12** extending therethrough for engaging a sprocket wheel on the motion picture projector.

On the surface of the film opposite the emulsion surface **11**, there is a magnetic sound track including a flexible, self-sustaining backing portion **13**, with its outer surface coated with a uniform dispersion of high coercive force magnetic particles **14**. The sound track may be bonded to the edge of the photographic film by means of an extremely thin layer of adhesive **15**, or by welding the surfaces of the film together by application of heat.

Any suitable flexible material can be employed for the backing **13**, as illustrated in Figure 1, provided that the material of the backing has a thermal coefficient of expansion of the same order of magnitude as the material of the film base. For example, cellulose derivatives similar to those used in the body **10** of the photographic film may be employed. Alternatively, material such as paper can be used to advantage. The use of a material for the backing layer **13** of the same composition as the body **10** of the photographic film has the advantage that the layer of adhesive **15** can be eliminated. When this type of structure is employed, the sound track can be rigidly secured to the body of the photographic film merely by moistening the base of the backing with a suitable solvent such as acetone in the case of cellulose acetate, or ethylene glycol monomethyl ether acetate, cellulose ethers and the like and pressing the two surfaces together. Upon evaporation of the solvent, or absorption into the body of the film, the sound track will be rigidly bonded to the surface of the film. Where the bonding is done by means of a solvent only, followed by pressure, the overall thickness of the finished product may be less than the combined thicknesses of the original component layer materials.

The thickness of the sound track may vary over a considerable range, but with a photographic film of a thickness from 5 mils to 6 mils, I prefer to use a sound track in which the thickness of the backing is on the order of 1½ mils, with a magnetic coating of about ½ mil in thickness uniformly distributed thereon, although a thinner backing may be provided to minimize buildup, and the thickness of the magnetic layer may also be varied considerably. In the case where an extraneous adhesive is added to the composition, such as a solution of cellulose nitrate in acetone, or in mixtures of solvents such as amyl acetate, ethyl alcohol, and toluene, the thickness of the adhesive layer will normally be less than $\frac{1}{10}$ mil.

In the form of the invention illustrated in Figure 2, a motion picture film including a body portion **20**, and the emulsion surface **21**, is provided with a beveled edge **22** along one marginal portion of the film. Secured along the beveled edge **22** is a magnetic sound track including

a self-sustaining backing **23**, a magnetic coating **24** on the backing, and, if desired, a thin layer of adhesive **25** joining the magnetic sound track to the beveled edge **22**. This type of structure has been found advantageous in certain installations because it permits better conformance of the magnetic sound track to the magnetic transducer head which is associated with the magnetic sound system.

Most organic adhesive substances adhere better to the base of cellulose derivative than they do to the photographic emulsion coated surface of a photographic film. This feature has been advantageously employed in the embodiment of the invention illustrated in Figure 3. The structure therein shown includes a body of a cellulose derivative **30** with a photographic emulsion layer **31**. In this instance, the magnetic sound track is applied directly to the base **30** by removing the emulsion along the marginal edge of the film to a width sufficient to accommodate the magnetic record track. A straight-edged cutting tool can readily be employed to remove the emulsion from selected areas of the film. The structure of the magnetic record track illustrated in Figure 3 is the same as in the previous figures and includes a backing member **32** and a magnetic particle layer **33** thereover, with the magnetic sound track being secured to the body **30** by means of a thin adhesive layer **34**. As previously illustrated, the thickness of the backing member **32** is substantially greater than the thickness of the emulsion layer **31**, so that even after removal of the emulsion layer, the magnetic record surface **33** is still spaced vertically from the emulsion surface **31** of the film.

While it is preferable that the sound track be elevated from the plane of the film, it will not always be necessary to use this type of structure. In some installations it may be desirable to have the sound recording surface flush with or even below the emulsion surface, as illustrated in Figure 3A.

In the form of the invention illustrated in Figure 4, a motion picture film of the conventional 16 mm. variety, having a body **40** and an emulsion surface **41** thereon is provided with a relatively wide magnetic sound track on the surface of the film opposite that of the emulsion surface **41**. The sound track includes a backing **42**, an outer layer **43** of magnetizable particles, and, if desired, a thin adhesive layer **44** joining the sound track to the surface of the film.

In Figure 4A, the film base **80** is provided with two sound tracks, one sound track, **81**, being secured to an edge of the emulsion surface **82** after removal of the emulsion, and the other track **83** being adhesively secured to the opposed edge and surface of the film. This type of structure equalizes reeling, and allows either track to be played alternatively on the same machine.

Clearly, it is far simpler to coat a relatively wide backing member with a dispersion of magnetic particles than it is to coat similarly a relatively narrow backing member. When coating a relatively wide member, the surface of the member can be coated with the magnetic particle dispersion by the use of a coating roller, doctor knife, extrusion through a relatively wide orifice, or even spraying. These techniques are not particularly feasible for the coating of an extremely narrow backing member. Accordingly, in producing the sound track of the present invention, a relatively wide backing member which has been precoated with a dispersion of magnetic particles is employed. In Figure 5, such a record member, which will normally have a width of about ¼" or more, is shown as being supplied continuously from a supply spool **50**. If desired, the record member may already contain a pre-recorded program thereon. The record member **51** is passed continuously through a series of cutting knives **52** and **53**. These knives include a series of staggered blades which function to slit the relatively wide record member **51** into a plurality of relatively narrow magnetic ribbons **54**. Each of the ribbons **54** is trained about a separate take-up reel **55**.

The width of the ribbon produced by the cutting knives will depend upon the width of the sound track desired on the film. For ordinary 8 or 16 mm. sound film, the width will ordinarly be between 1/64 and 1/32 of an inch. Thus, if the record member **51** were originally 1/4" in width, the member could be cut into eight ribbons each of a thickness of 1/32 of an inch.

A continuous process for applying the magnetically surfaced ribbon **54** to the surface of a photographic film is illustrated in Figure 6.

As shown in Figure 6, a magnetic ribbon **54** is continuously fed from a rotating supply reel **60** into contact with a rotating applicator roll **61** partially immersed in a liquid bath of an adhesive composition **62**. A thin film of adhesive is thereby applied to the surface of the ribbon **54** opposite from the surface containing the dispersion of magnetic particles.

At the same time, a continuous web **63** of motion picture film is unwound from a film supply reel **64**. The ribbon **54** is joined to the web **63** of motion picture film by passage of the ribbon and the web over an arcuately shaped forming surface **65**. Suitable guide means such as a pair of adjustable forked fingers **70** and **71** are associated with the forming surface **65** to align the ribbon **54** onto the proper area of the web **63**. After the original deposition of the ribbon **54** on the web **63**, the resulting laminated structure may be pressed by means of a pair of coacting pressure rolls **66** and **67**, and the completed structure is then wound upon a take-up reel **68** for storage.

If the magnetic track is secured to the film before photographic processing, it is advantageous to bond the track to the base of the film, rather than to the emulsion surface, since the latter softens and swells in the developing bath, and shrinks and rehardens when dried.

While the slitting, application of adhesive, and application of the sound track to the film have been illustrated in separate phases, it will be appreciated that all these operations can be carried out continuously on a single machine.

It will be understood that modifications and variations may be effected without departing from thhe scope of the novel concepts of the present invention.

I claim as my invention:

1. A motion picture film comprising a flexible base having a beveled marginal edge and a relatively narrow self-sustaining flexible strip having a surface covered with a relatively uniform dispersion of magnetic particles, said strip being secured to said base along and upon said beveled edge.

2. A motion picture film comprising a flexible base having a planar surface terminating in a beveled margin, a relatively narrow, self-sustaining strip of the same width as said beveled margin and having a magnetic particle coating on one surface thereof, and an adhesive uniting the opposite surface of said strip to said beveled margin, said coating being raised above said planar surface at the junction between said planar surface and said beveled margin.

3. A motion picture film comprising a flexible film base of cellulose acetate of 5–6 mils thickness presenting a planar surface to be exposed to light and terminating in a beveled margin and a self-sustaining flexible supporting strip of cellulose acetate of 1½ mils thickness narrower in width than the base for exposing a substantial width of the planar surface to light, said strip having one surface covered with a magnetizable layer of ½ mils thickness of magnetic particles secured to the strip and its opposite surface firmly secured to the beveled margin of said base, said magnetizable layer presenting an uncovered surface projecting beyond and angularly with respect to said planar surface to insure intimate contact between the magnetizable layer and a magnetic transducer head.

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