United States Patent

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[54] STRIP MATERIAL HANDLING MECHANISM FOR SOUND SYSTEMS

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[51] **Int. Cl.**.....**G11b 15/29**, G11b 15/34, G11b 21/16

[58] **Field of Search**.....179/100.1 A, 100.2 MP, 100.3 L; 272/4, 11

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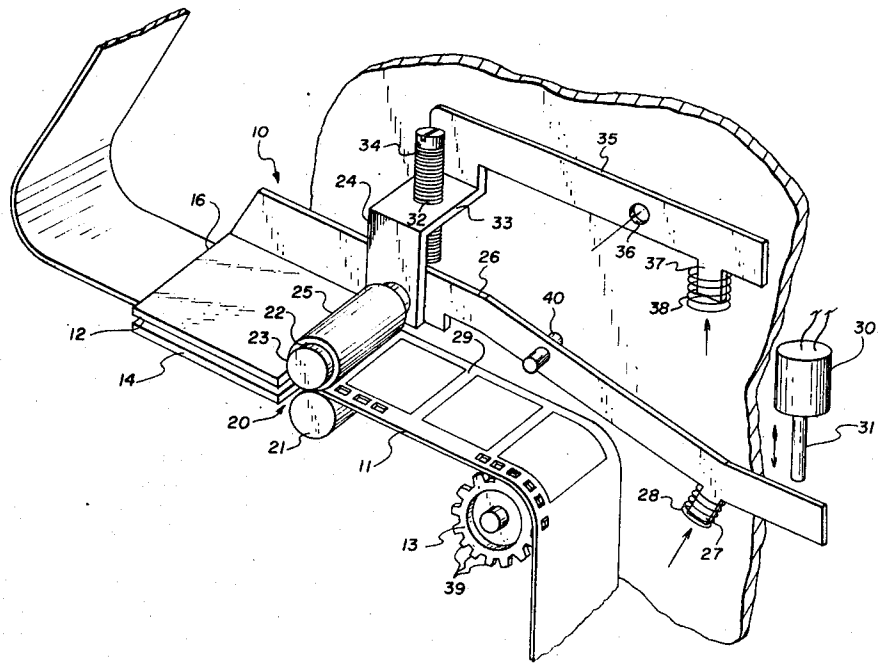
[57] **ABSTRACT**

A strip material handling mechanism comprises a rotatable sprocket wheel for moving strip material along a threading path in either of two directions through an openable sound gate having opposed pressure pads, a capstan drive assembly including a capstan and a pressure roller, and a single control element for enabling independent opening of the sound gate and capstan drive assembly during reverse projection. Utilizing a single control element, the pressure roller and one of the pressure pads are independently disengaged from the strip material during such operational mode, thereby permitting the rotatable sprocket wheel to move strip material substantially free of restraint that might otherwise be imposed by such pressure roller and pad.

5 Claims, 2 Drawing Figures



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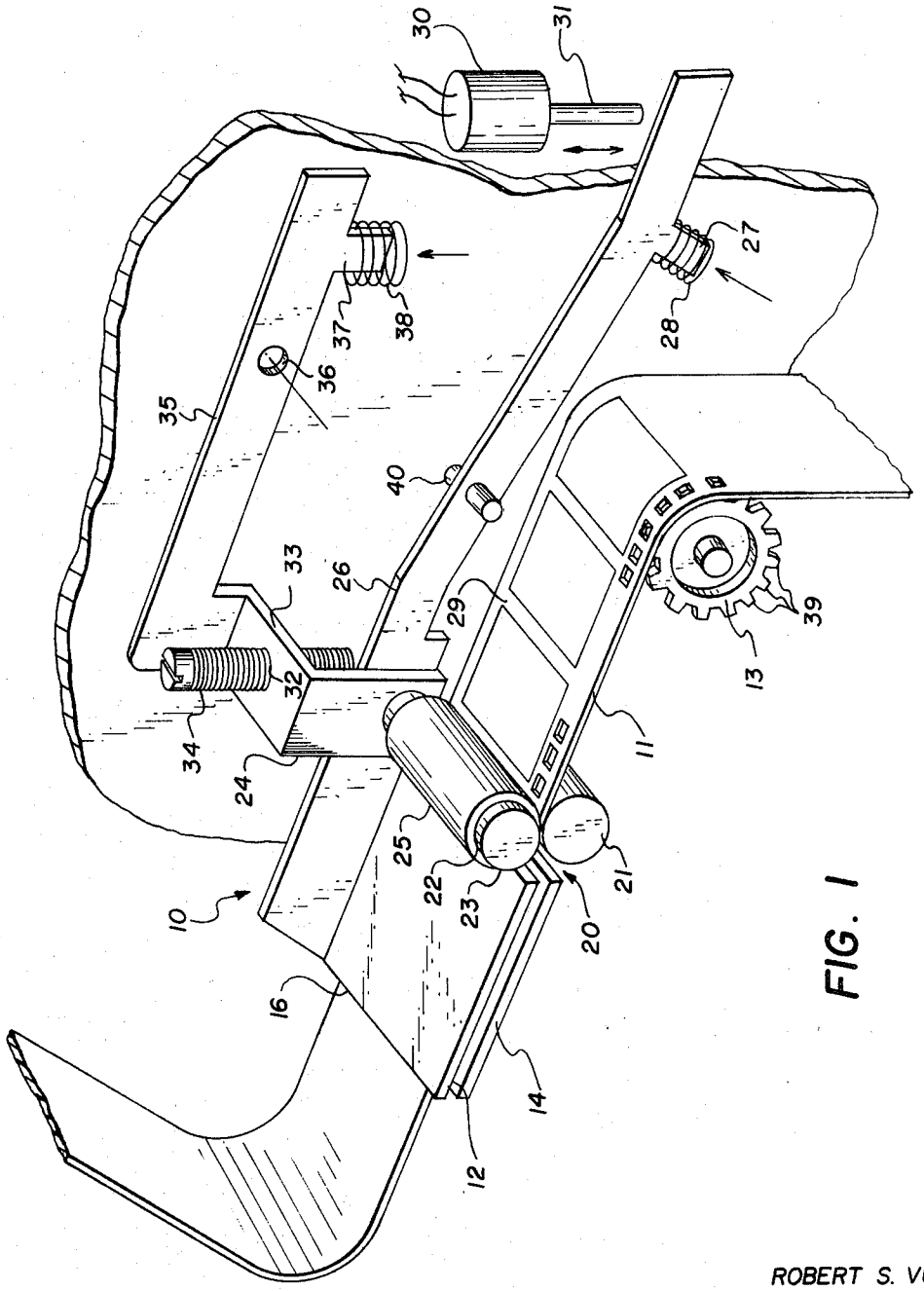

FIG. 1

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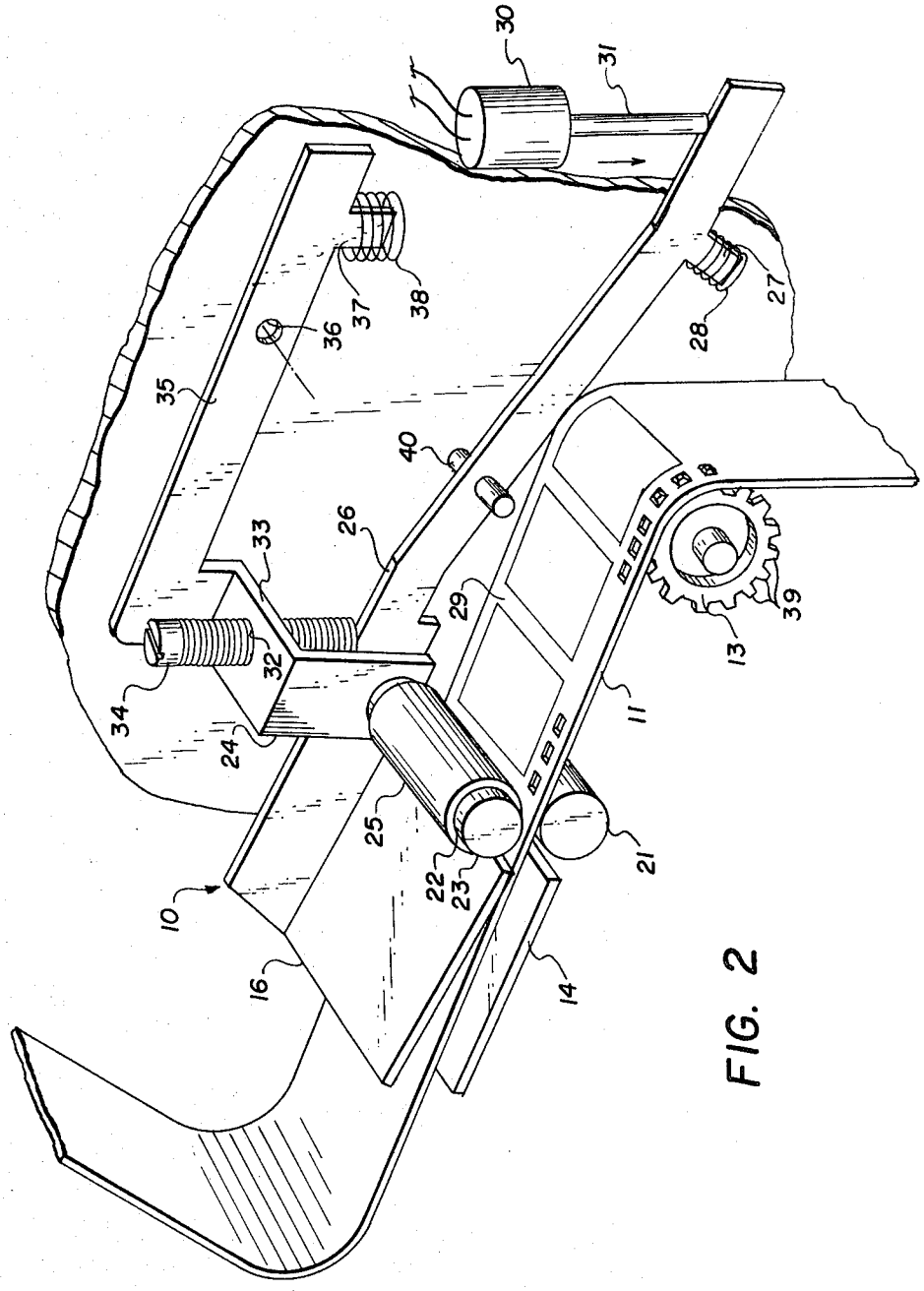

FIG. 2

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STRIP MATERIAL HANDLING MECHANISM FOR SOUND SYSTEMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to sound systems employing strip material and more specifically to an improved device for such systems for permitting reverse operation of the strip material.

2. Description of the Prior Art

Although not limited thereto, the sound system of the present invention is most useful with motion picture projectors having sound capability. In sound projectors, sophisticated mechanisms in close proximity to the film are needed to retrieve the recorded sound from the film. Some sound systems employ a sound drum arrangement while others provide a linear sound gate having a pair of opposed pressure pads which are aligned in a parallel configuration in close proximity to the upper and lower portions of the film track. The film is drawn through the pressure pads by a sprocket wheel, and devices, such as capstan pressure roller assemblies, may be used to provide a substantially constant film speed as the film moves between the pressure pads. Due to its flexibility, the film preferably is drawn rather than pushed through the pressure pads to prevent bunching up or banding at the entrance to the capstan pressure roller assembly and pads. This, of course, would prevent reverse film movement.

SUMMARY OF THE INVENTION

The subject invention provides a novel device for removing the sound related equipment from immediate proximity to the film during reverse projection whereby the film can be transported through the threading path by the same projector mechanism used for pulling film through the sound transducer in the forward project mode.

Accordingly, the illustrated embodiment of the present invention provides a sound transducer having two opposed pressure pads, a capstan drive assembly having a capstan and a pressure roller, means actuable for opening the transducer and capstan drive assembly including first and second lever arms connected to one of the pressure pads and to the pressure roller respectively, means for biasing the one pressure pad towards a film plane between the pads and the pressure roller towards the capstan and control means for engaging the first lever arm to move the one pressure pad away from the film plane. When thus moved, the first lever arm engages the second lever arm and thereby moves the pressure roller away from the capstan. By pivoting the pressure pad and the pressure roller free of the film plane, a sprocket wheel, which is used in the forward project mode for pulling film through the sound transducer and past the capstan drive assembly, can now be used for directly driving film in a reverse project mode.

By providing at least some degree of independent movement between the first and second lever arms, essentially constant film speed can be maintained in the forward project mode even when variations in the thickness of the projector film, such as due to a film splice, are encountered. This results because the pressure pad is free to independently respond to these variations in film thickness without relieving the pressure applied to the film by the capstan drive assembly.

The invention, and its objects and advantages, will become more apparent in the detailed description of the preferred embodiment presented below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiment of the invention presented below, reference is made to the accompanying drawings, in which:

FIG. 1 is a schematic drawing of a portion of a motion picture projector showing a strip material handling mechanism of the present invention; and

FIG. 2 is a schematic drawing of a portion of a motion picture projector showing the strip material handling mechanism of FIG. 1 in another position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Because sound projectors are well known, the present description will be directed in particular to elements forming part of, or cooperating more directly with, apparatus in accordance with the present invention. It is to be understood that all projector elements not specifically shown or described may take various forms well known to those skilled in the art.

Illustrated in FIG. 1 is a portion of a film threading path of a sound projector, identified generally by numeral **10**. In the forward project mode, strip material such as film **11** is pulled by a rotatable sprocket wheel **13** having teeth **39** engaging perforations in the edge of film **11**. Film **11** is advanced from a film supply reel (not shown), past a projection gate (also not shown), through a linear sound gate or transducer **12** for converting information on a sound track into electrical impulses and a capstan drive assembly **20**. After passing sprocket wheel **13**, film **11** is wound on a conventional film take-up reel (not shown). In a sound projection system of the type to which this invention is most applicable, the sound is coded directly on the film such as by magnetic and/or optical means. Sound is retrieved from film **11** in a known manner as the film moves past sound gate **12**.

Sound gate **12** is schematically represented in FIGS. **1** and **2** as having a stationary lower pressure pad **14** and movable upper pressure pad **16**. However, it will be understood that either or both pressure pads may be movable. Lower pad **14** and upper pad **16** can be thought of as either representing the sound transducer for a magnetic and/or an optical sound system. In the case of a magnetic system, lower pressure pad **14** would carry a suitable magnetic element formed of material such as ferric oxide and upper pad **16** would carry suitable magnetic to electric transducer means. In an optical sound system, lower pressure pad **14** would have a slit opening and carry a suitable light source for transmitting light through a sound track portion of film **11** to upper pad **16** which would carry a suitable electrical-optical device, such as a photocell, for converting the recorded audio signals on film **11** to appropriate electrical signals. The pressure pads may contact the film in non-image areas thereof.

Capstan drive assembly **20** includes a capstan **21** and a pressure roller **22**. Capstan **21** is in the form of a cylindrical shaft which is rotatably mounted on the projector housing immediately beneath the film threading path such that film **11** passes essentially tangential to the uppermost portion of capstan **21**. Capstan **21** is driven by frictional contact with film **11** which is in turn driven by sprocket wheel **13**. Speed variations of film **11** are smoothed out by a flywheel (not shown) which is attached to capstan **21** in a known manner.

Pressure roller **22** is located above the film threading path. Roller **22** comprises a cylindrical shaft **23** having a cylindrically shaped jacket **25**. The jacket **25** is preferably made of a non-abrasive material, such as rubber, so as not to scratch the film. Shaft **23** is rotatably mounted at one end to a right angle bracket **24**. Jacket **25** has an axial length sufficient to span the width of film **11**.

A lever arm **26** is rigidly secured to one side of upper sound pad **16** and extends in the direction of film travel during forward movement. Arm **26** carries a downwardly extending tab **27** at the opposite end. Tab **27** extends from arm **26** into the center portion of a helical spring **28** such that the top portion of spring **28** engages the underside of arm **26**. The bottom portion of spring **28** is disposed against a stationary member (not shown). Spring **28** biases lever arm **26** for rotation about a pivot **40** in a counterclockwise direction as viewed in the drawings, thereby urging upper sound pad **16** toward film **11**.

A solenoid **30** is mounted above the end portion of the lever arm **26** opposite sound pad **16**. The solenoid has an armature **31**, the axial length of which is substantially at right angles to

that portion of arm 26 immediately beneath solenoid 30. When voltage is applied to solenoid 30, armature 31 strikes lever arm 26, rotating the lever arm in a clockwise direction to open sound gate 12.

An adjusting screw 34 is threadably carried in a tapped hole 32 in leg 33 of bracket 24. Screw 34 and lever arm 26 are in the same plane, and the screw is adjusted such that upon clockwise movement of arm 26, the arm strikes an end portion of screw 34. A pivotal lever arm 35 is rigidly secured to the end of leg 33. Arm 35 is pivotally mounted on the projector at 36. Extending from the lower side of arm 35 is a tab 37 positioned, in the lengthwise direction on arm 35, such that pivot point 36 is between tab 37 and that portion of arm 35 secured to leg 33. Tab 37 extends into a helical spring 38. The upper end of spring 38 engages the underside of arm 35 and, at the lower end, engages a fixed member (not shown). Spring 38 biases pivot arm 35 in a counterclockwise direction to urge pressure roller jacket 25 against film 11. When jacket 25 bears against film 11, the axis of jacket 25 is parallel with the axis of capstan 21.

In operation, rotary motion is imported to sprocket wheel 13 by a power source such as an electric motor (not shown). In the forward project mode, sprocket wheel 13 rotates clockwise as shown in FIG. 1 to advance film from left to right. Teeth 39 of wheel 13 enter the perforations cut along the edge of film 11 and pull film 11 through sound gate 12 and capstan drive assembly 20. As brought out hereinbefore, sprocket wheel 13 ordinarily may not provide a sufficiently smooth film drive. The speed of film 11 as it passes through sound gate 12 is smoothed by capstan roller assembly 20. Capstan 21 is rotated by frictional contact with moving film 11 as the film moves past the capstan. A high inertia flywheel (not shown) is secured to one end of capstan 21. The flywheel damps out transient variations in the angular velocity of capstan 21 and hence in overall film speed.

With the apparatus in the forward project mode, the parts are positioned substantially as shown in FIG. 1. In these positions, armature 31 of solenoid 30 is spaced from lever arm 26. Springs 28 and 38 are effective to keep lever arms 26 and 35 in the counterclockwise position shown. Upper pressure pad 16 is substantially parallel with the film plane and with lower pressure pad 14. Pressure roller jacket 25 bears against film surface 29 and the axis of capstan pressure roller 22 is substantially parallel with the axis of capstan 21.

In reverse project mode, film 11 is moved from right to left as viewed in FIGS. 1 and 2. In this mode, sprocket wheel 13 rotates counterclockwise and pushes film 11 past capstan roller assembly 20 and film sound gate 12 as opposed to the forward project mode where film 11 is pulled through assembly 20 and gate 12. Because film 11 is pushed past capstan assembly 20 and sound gate 12 during any reverse mode and because of the flexibility of film 11, the film would band at the entrance to the capstan roller assembly 20 or sound gate 12 if they were not opened.

In accordance with the present invention, this problem can be circumvented because it is not necessary that the sound retrieval mechanism contact the film during reverse projection since the recorded sound is not being retrieved from the film. Since capstan drive assembly 20 is not needed to smooth film velocity transients and sound gate 12 is not needed to retrieve the recorded sound, gate 12 and assembly 20 can be opened.

Referring to FIG. 2, pressure on film 11 in the sound gate 12 and at the capstan assembly 20 is removed by lifting upper pressure pad 16 and capstan pressure roller 22. To lift these elements, a voltage is applied to solenoid 30 impelling plunger 31 downward, striking the end of the arm 26. The upward force applied by spring 28 is overcome and arm 26 pivots in a clockwise direction about pivot 40. As arm 26 pivots, upper pressure pad 16 swings away from film surface 29, thereby removing the pressure normally applied to the film from pad 16. Additionally, as arm 26 pivots, the uppermost portion of arm 26 engages adjusting screw 34, driving the screw and bracket 24 upward to pivot lever arm 35 about pivot point 36, overcoming the opposing force applied by the helical bias spring 38. As lever arm 35 pivots, sleeve 25 of capstan pressure roller 23 is lifted free of film surface 29.

With pressure roller 22 and pad 16 both free of surface 29 of film 11, sprocket wheel 13 can move film 11 in a reverse project mode without banding of the film at assembly 20 or gate 12.

It will be noted that there is a certain amount of lost motion between lever arms 26 and 35, the amount of which can be adjusted by means of screw 34. By applying film pressure in the forward mode through independent lever arms 26 and 35, pressure pad 16 and the pressure roller 22 can move independently in response to any variations of film thickness, such as a film splice or film tear. By enabling the film pressure devices to respond separately to film thickness variations, an enlarged section of film in gate 12 will force that gate open but will not relieve the pressure on the film surface applied by capstan roller 22. This ensures that the film is under the constant speed restraint of capstan roller assembly 20 even if gate 10 encounters a splice.

In the above description, solenoid 30 is actuated to open sound gate 10 and capstan drive assembly 20 only during reverse projection. Of course gate 10 and assembly 20 must also be opened during high speed sluing and rewind modes. However in these modes, all of the threading path defining members (such as the optical gate, the drive sprockets and the loop formers) must be opened and the same mechanism may be used to open everything. But it will be understood that the device of the present invention may also be used in these modes if desired.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. In a mechanism for handling strip material having a sound track and for moving the strip material through a threading path, a device comprising:

a transducer for converting information carried on the strip material sound track to electrical impulses, said transducer comprising two members positioned on opposed sides of said threading path, at least one of said members being movable toward and away from the other member;

spring means coupled to said one member for biasing said one member toward said other member to apply a pressure to the strip material therebetween;

drive means positioned along said threading path for selectively (1) pulling the strip material past said transducer at a normal forward speed and direction wherein sound may be retrieved from the sound track, said drive means being spaced from said transducer in the direction of strip material travel during sound retrieval, and (2) driving the strip material past said transducer for a purpose other than sound retrieval;

means actuable for moving said one member away from said other member against the bias of said spring means to relieve the pressure on the strip material therebetween; and

means for actuating said member moving means when said drive means drives the film strip past said transducer for said purpose other than sound retrieval.

2. A mechanism as defined in claim 1 further comprising:

a capstan drive assembly located along said threading path between said transducer and said drive means, said capstan drive assembly including (1) a capstan on one side of said threading path and (2) a movable pressure roller on the other side of said threading path;

means biasing said roller toward said capstan; and

means for moving said roller away from said capstan against the force exerted by said biasing means in response to movement of said one member away from said other member by said actuatable means.

3. A mechanism as defined in claim 2 wherein:

said actuable means comprises a first movable arm upon which said one member is mounted;

said actuating means is adapted to move said arm in a direction against the force of said spring means; and

said mechanism further comprises a second movable arm positioned with respect to said first arm to be engaged by said first arm as said first arm moves against the force of said spring means, said roller being mounted on said second movable arm whereby movement of said first arm and said one member away from said other member moves said second arm and said roller away from said capstan.

4. A mechanism as defined in claim 3 further comprising means carried by one of said arms for defining and adjusting a space between said arms to permit a predetermined amount of movement of said first arm without corresponding movement of said second arm.

5. In a motion picture projector having sound reproduction capabilities, a mechanism for handling film strip having a sound track, said mechanism comprising:

means defining a threading path along which film strip may be moved;

a housing;

a first arm movably mounted on said housing;

a transducer for converting information carried on the film strip sound track to electrical impulses, said transducer comprising two members positioned on opposed sides of said threading path, one of said members being mounted on said first arm for movement toward and away from the other member;

a spring for biasing said first arm in a direction to move said one member toward said other member to apply pressure to the film strip therebetween;

a sprocket wheel positioned along said threading path for selectively (1) pulling the film strip past said transducer at a normal speed and direction for sound retrieval and (2) driving the film strip past said transducer for a purpose other than sound retrieval;

a second arm movably mounted on said housing;

a capstan drive assembly located along said threading path between said transducer and said sprocket wheel, said capstan drive assembly including a capstan on one side of said threading path and (2) a pressure roller on the other side of said threading path, said pressure roller being carried by said second arm for movement toward and away from said capstan;

a spring for biasing said second arm in a direction to move said roller toward said capstan to apply pressure to the film strip therebetween;

means actuable for moving said first arm in a direction to move said one member away from said other member when said sprocket wheel drives the film strip past said transducer for said purpose other than sound retrieval; and

means for moving said second arm in a direction to move said roller away from said capstan in response to movement of said first arm by said actuable means.

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