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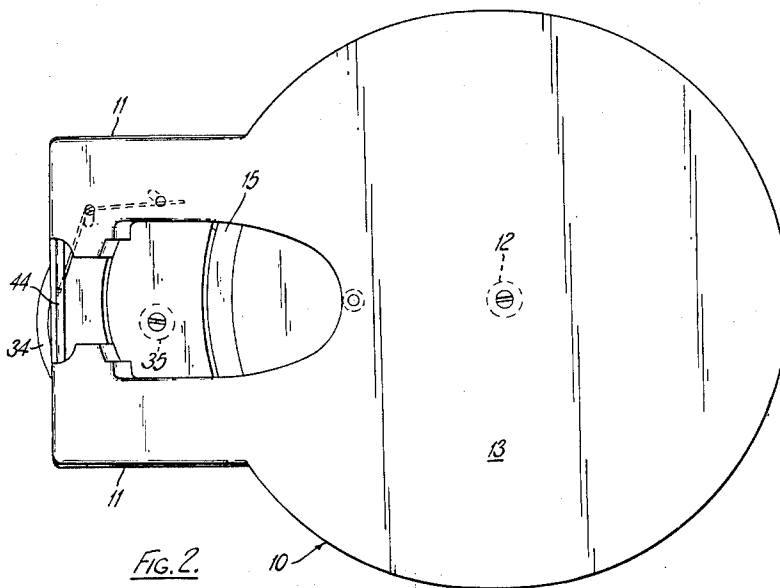
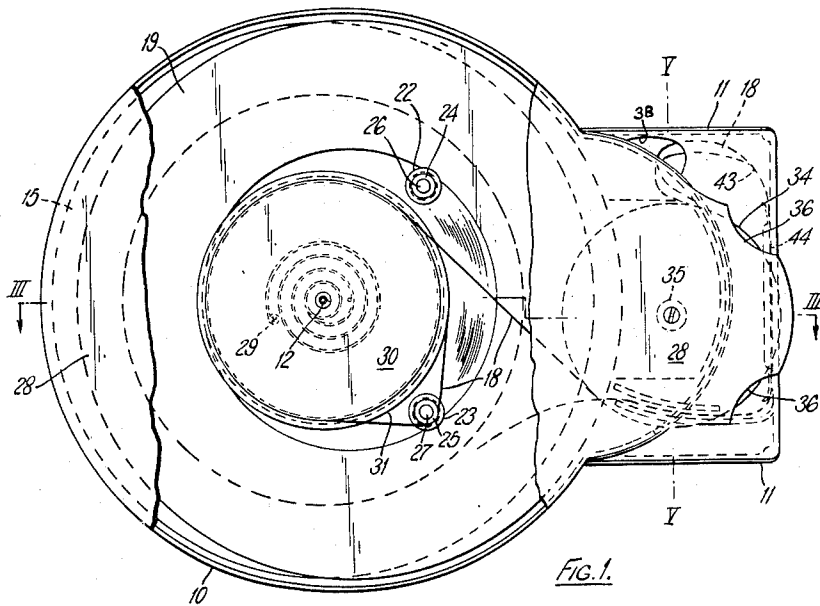
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3,259,332

ENDLESS STRIP WINDING DEVICE

Filed Oct. 16, 1963

2 Sheets-Sheet 1



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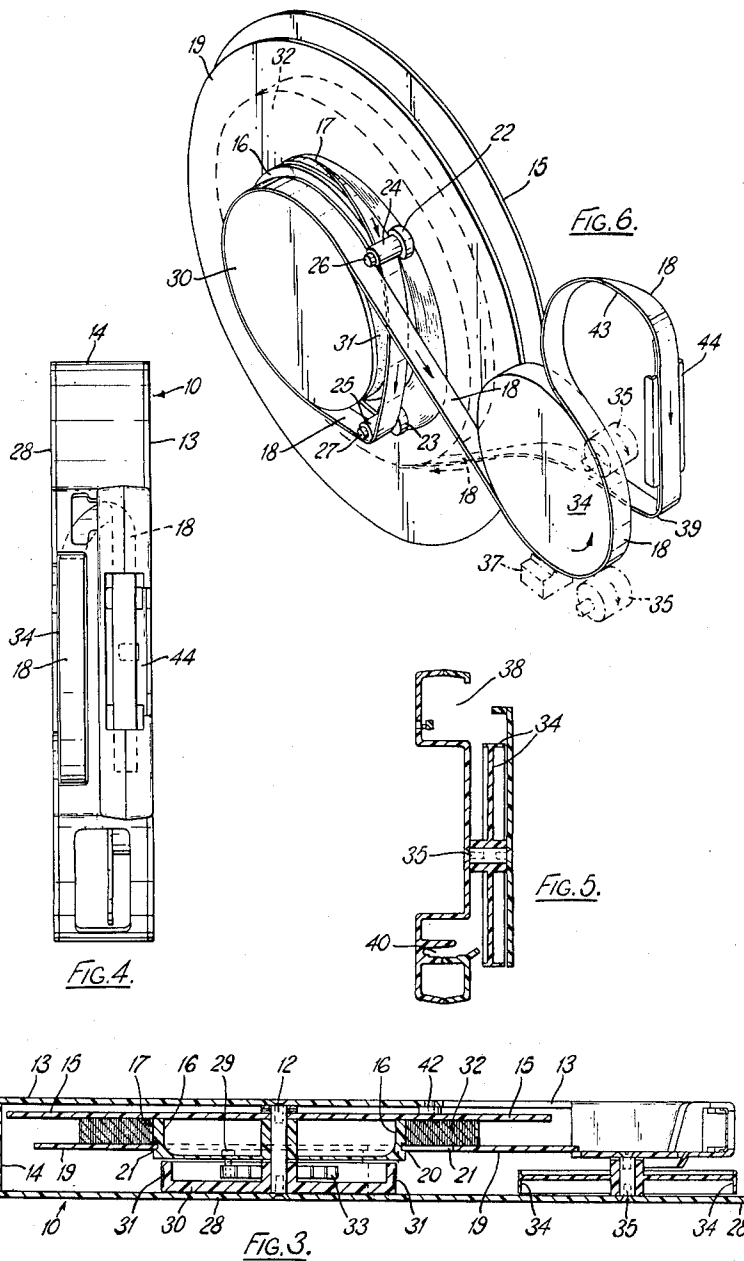
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ENDLESS STRIP WINDING DEVICE

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2 Sheets-Sheet 2



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3,259,332

ENDLESS STRIP WINDING DEVICE

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5 Claims. (Cl. 242—55.19)

This invention relates to apparatus for the storage and/or utilization of endless strips of flexible material of the kind in which an endless strip of material is coiled up into spiral form, a loose bight of strip extending between and joining the outer and inner convolutions of the spiral and constituting the active or effective part of the strip which co-operates with utilization means. In most cases the strip is a record-bearing strip such as a kinematograph film bearing a sequence of images or a sound record, either a photographic or magnetic sound record, or a combined kinematographic record and sound record, or such as may be used to store signals or data for programming the operation of processes or machinery. In use, such a strip is normally drawn out from the inner convolution, and the bight passes some form of utilization means, such as a kinematographic intermittent feed device and gate, or a sound head. The strip is fed back to and coiled upon the outside of the coil thereof. The whole length of the strip may be repeatedly or continuously fed through the utilization means in the same direction without any need for rewinding it as a separate operation.

When tension is applied from the bight to the inner convolution in order to draw out the strip from the coil, particularly if there is any tension applied to the end of the bight adjacent the outer convolution of the coil or if there is significant friction between the convolutions of the coil and any cheeks or the like between which the coil may be disposed, there is a tendency for the outer convolutions of the coil to be tightened upon the inner convolutions, coupled with a tendency for the outer and inner diameters of the coil to contract, owing to what may be termed the capstan effect. This entails increased friction between the convolutions and increase of tension required to pull out the strip from the innermost convolution of the coil. If the coil is wound about a core, moreover, owing to the tendency for the coil to contract, as mentioned, the inner convolution may become rather securely clamped to the core, so that it is practically difficult or even impossible to pull out the strip of the inner convolution into the bight. The effects mentioned tend to be cumulative and to be much increased with increase in the number of convolutions of the coil.

The principal object of the present invention is to provide a storage device for endless strips of the kind referred to in which a build up in tension of the strip in the various convolutions as the bight is drawn out from the inner convolution is reduced or, indeed, entirely obviated, so that the tightening of the outer convolutions of the coil upon those within them is obviated and the capstan effect is substantially or wholly eliminated.

According to the present invention, in a storage and/or utilization apparatus of the kind set forth, the endless strip material is coiled upon a circular core which is rotated at an average peripheral speed not less than and preferably slightly greater than the average linear speed at which the strip is drawn from the inner convolution into the bight. Thus the strip tends to be extruded from the inner convolution into the bight so that the convolutions of the coil are substantially relieved of tension, friction between the convolutions is minimized and clamping of the inner convolution against the core is eliminated.

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One general form of device according to the invention for storing and delivering in a bight endless strip of flexible material of the kind set forth comprises a core upon which the endless strip, other than the bight, is coiled, with the bight extending from the inner to the outer convolution, an endless movable traction surface arranged to receive the strip in the bight and to move the strip substantially at its own speed, and means for moving the traction surface and the core at pre-determined speeds such that the average peripheral speed of the core is not less than and preferably appreciably greater than the surface speed of the traction surface.

The traction surface will usually be a cylindrical surface of a drum, but it may be a continuous belt or even in some cases a sprocket, the teeth of which engage perforations in the strip. When the traction surface is that of a drum or a belt, it is preferably such as to provide a high degree of friction between that surface and the strip so that slippage between these two is minimized.

The part bearing the traction surface and the core are preferably interconnected with one another by a resilient connection permitting under resilient constraint limited variations of their respective speeds, and one of them has a drive imparted to it, the other being driven therefrom through the resilient connection. In a preferred construction the traction surface is constituted by the periphery of a cylindrical drum, which is coaxial with the core and is connected thereto by a torsion spring so as to transmit torque from one to the other. In this case the diameter of the drum should exceed that of the core. The necessary drive may be applied to the drum or other traction means frictionally through the strip itself, the bight of the latter being drawn out by other means such as a roller which, in the case of a kinematograph film bearing a sound record, or in the case of separate kinematograph pictures and sound records, guides and controls the speed of the sound record past the sound track pick-up. This roller may be driven. Alternatively, the necessary drive may be imparted to the drum through the strip by a friction roller bearing on the strip, and pressing it against the drum.

For the better understanding of the invention, one particular form of projector film cassette for 8 millimetre kinematograph film having a magnetic sound track along its edge outside the perforations will now be described by way of example only with reference to the accompanying drawings in which:

FIG. 1 is a side elevation of one side of a cassette according to the invention with part of the cover removed;

FIG. 2 is a side elevation of the other side of the cassette, with the film omitted;

FIG. 3 is a section on the line III—III of FIG. 1;

FIG. 4 is a front elevation;

FIG. 5 is a section on the line V—V of FIG. 1 with the film omitted; and

FIG. 6 is a schematic perspective view of the interior of the cassette, illustrating the run of the film.

Referring now to the accompanying drawings, the cassette proper comprises a shallow cylindrical tray 10 having at one side an extension 11 which may conveniently be of rectangular shape. A central spindle 12 is fixed to the base 13 of the tray coaxial with the cylindrical wall 14 thereof. Preferably a loose thin circular disc 15 of diameter slightly less than the internal diameter of the tray 10 is journaled freely upon the spindle 12, upon which is also journaled a circular core 16 overlying the disc 15. The disc 15 may be slightly spaced from the base 13 by a stud 42 fixed to the base, so as to preclude adhesion of the disc 15 to the base 13. A coil 32 of film 18 is wound upon the core 16 with its inner end protruding at the side of the core. The peripheral surface of the core 16 is preferably slightly conical in

order to facilitate the drawing out of the bight of film from the inner convolutions 17 of film 18 that will embrace it. An annular disc 19, the diameter of the aperture of which is greater than the diameter of the core 16, is laid over the coil, the inner end of the film passing through a gap between the core 16 and the inner periphery of the disc 19. The inner edge 21 of the annular disc 19 is received over a short part of its length in a groove 20 formed in the periphery of the core 16. The inner edge 21 of the disc 19 is further guided by being engaged beneath flanges 22 and 23 of rollers 24 and 25 that are freely journaled upon spindles 26 and 27 fixed to a cover 28 of the tray 10. The core 16 is hollow and is provided with an eccentrically disposed peg 29.

A cylindrical drum 30, constituting what has been termed an endless movable traction member, is freely journaled upon the spindle 12. The peripheral surface of this drum 30 is covered by high-friction material 31, such as rubber. The start of the bight of the film 18 is led around part of the periphery of the drum 30 and passes from the inner convolution of the coil 32 of film 18 wound about the core 16 inside but in contact with the roller 24 and from the periphery of the endless movable traction member or drum 30 outside the roller 25. A spiral torsion spring 33 has one end engaged with the drum 30 near its axis and its other end engaged with the eccentrically disposed peg 29 of the core 16.

The necessary drive is imparted to the drum 30 through the film 18. To this end an additional drum 34 is freely journaled upon a spindle 35 fixed to the cover 28 of the cassette. One or more friction driving rollers, 35 (see FIG. 6) forming part of the camera, projector or other utilization apparatus, bears on the outside of the film 18 against the drum 34 so as to apply pressure to the film 18 and thus to rotate the drum 34. A slot 36 (or slots) is provided in the edge of the cover 28 of the cassette to admit at least part of the periphery of the driving roller or rollers 35 for this purpose.

The additional drum 34 referred to may be that upon the surface of which the film is presented to a soundtrack pick-up 37. For this purpose the additional drum 34 may be driven at a regulated speed.

As illustrated in FIG. 6, from the nip of the driving roller 35 against the additional drum 34 the film 18 passes into the rectangular extension 11 of the cassette through a passage 38 when it is formed into a loop 43. It then passes a spring gate 44 that forms part of the boundary of the extension 11. Thence it is formed into another loop 39 and passes back to the outer convolution of the coil 32 within the cassette through a channel 40. The cassette is provided with a cover 23. The cassette, cover and disc are preferably made of a plastic material which has a low coefficient of friction.

In operation, when the cassette is in an operative projector, the film 18 is drawn from the inner convolution 17 of the coil 32 due to the drive imparted thereto by the friction-driving roller 35 of the projector. The drum 30 is consequently rotated by a drive imparted through the film 18. At the same time a drive at the same average angular speed is imparted to the core 16 through the spiral torsion spring 33. However, since the diameter of the core 16 is slightly greater than that of the drum 30, the peripheral speed of the core 16 is slightly higher than that of the drum. Thus the film of the inner convolution 17 of the coil 32 is relieved of tension, and the film 18 is fed into the bight under compression rather than under tension. The convolu-

tions of the coil 32 of film 18 are thus relieved of tension, so that they may slide freely upon one another.

It will be appreciated that one particular form of cassette in accordance with the invention has been described with reference to and illustrated in the accompanying drawings by way of example only, and that many modifications may be made without departing from the scope of the invention, as defined by the appended claims.

What is claimed is:

1. Apparatus for storing and feeding an endless strip formed in a coil with a bight extending between the inner convolution and the outer convolution of the coil comprising a cylindrical core on which the strip coil is supported, a drum engaging the bight, means mounting said core and drum coaxially and rotatively, and a spring coupling yieldingly connecting the core and drum, whereby, when the strip is drawn from the coil, the drum is rotated by engagement with the strip and drives the core through said spring coupling, thereby to prevent the inner turns of the strip coil from clamping on said core.

2. Apparatus according to claim 1 wherein the external diameter of the core is greater than that of the drum.

3. Apparatus for storing and feeding an endless strip formed in a coil with a bight extending between the inner convolution and the outer convolution of the coil comprising a cylindrical core on which the strip coil is supported, drive means for drawing the bight from the core, a drum engaging the bight, means mounting said core and drum coaxially and rotatively, and a spring coupling yieldingly connecting the core and drum, whereby, when the strip is drawn from the coil, the drum is rotated by engagement with the strip and drives the core through said spring coupling, thereby to prevent the inner turns of the strip coil from clamping on said core.

4. Apparatus for storing and feeding an endless strip formed in a coil with a bight comprising a cylindrical core roll for supporting the strip coil, drive means for drawing the bight from the core, an idler device having an endless orbiting friction surface for tractionally engaging the bight intermediate the core and drive means whereby said surface is orbited by frictional engagement with the bight as it is drawn by said drive member, and connecting means including a spring coupling between said core roll and idler device for driving said core roll at an average peripheral speed greater than that of said surface, thereby to prevent the inner turns of the strip coil from clamping on said core.

5. Apparatus according to claim 4 wherein said idler device is driven by frictional engagement of the strip with said friction surface.

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