

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) FILM REEL



(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a storage reel for motion picture film, and particularly but not exclusively to such a reel contained within a cartridge which is adapted to be mounted on a motion picture projector in a non-rotatable manner while the reel is rotated during operation of the projector.

According to this invention a film storage reel comprises a hub defining a surface on which a roll of film can be wound and supported, an axial bore extending through the hub for receiving a rotatable spindle of a motion picture projector, the bore having a spindle-engaging surface intermediate its ends and of smaller diameter than the said ends so that the reel can tilt on the spindle relative to the spindle axis, and an axial keyway extending through the spindle-engaging surface for receiving an axial key on the spindle to prevent rotation of the reel on the spindle.

The reel may be disposed within a cartridge from which the film may be removed as it unwinds from the reel rotating within the cartridge, the cartridge having means for cooperating with a motion picture projector to mount the cartridge in predetermined position on the projector with a rotatable spindle of the projector extending into the cartridge to engage in the bore of the reel therein.

A film storage reel in accordance with the invention and its mode of operation in a cartridge on a motion picture projector will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 shows an elevation of a cartridge-loading motion picture projector illustrating the manner in which a cartridge containing a

film reel may be positioned on the projector;

Figure 2 is a cross-sectional view of the cartridge and reel and a portion of the projector of Figure 1;

Fig. 3 is a fragmentary cross-sectional view similar to Fig. 2 but showing the reel-receiving portion of the projector spindle at an angle with respect to the cartridge walls;

Fig. 4 is a fragmentary cross-sectional view of the spindle and reel of Fig. 2 showing the manner in which the reel is rotatably supported and driven by the spindle;

Fig. 5 is a fragmentary cross-sectional view similar to Fig. 2 showing the reel axially displaced within the cartridge and the manner in which the spindle is adapted to correct for such displacement.

Referring now to the drawings and particularly to Fig. 1, a reel in accordance with the invention is particularly suitable for use with a cartridge-loading motion picture projector such as the projector described and illustrated in Patent Application No. 55365/68 (Serial No. 1254705). As shown, the projector comprises a casing 3 defining a front wall 5 adapted to support a supply cartridge 7 and a film take-up reel 9. The cartridge 7 contains a reel 11 of motion picture film and may be oriented and retained on the wall 5 of the projector by cooperating surface formations on the cartridge and projector (not shown) and by latching surfaces on the cartridge and latching levers on the projector (not shown). Suitable orienting and retaining means of this general type are disclosed in United States Patent Specification No. 3394901.

Movably secured to the front of the projector are means 13 and 15 for entering the cartridge to engage and remove film F from the cartridge and for directing the film to a threading mechanism of the projector which automatically feeds the film along a path to the take-up reel 9 in a manner well known to those skilled in the art. After projection in the usual manner, the film is rewound back

into the cartridge by an automatic rewind means.

The cartridge 7 to be latched to the projector may be of any suitable type, for example the two part casing adapted to contain a reel of 400-foot capacity such as described in Patent Application No. 26255/69. Generally, the cartridge defines side-walls 17 and 19 having central openings 21 and 23, respectively, through which the projector spindle 25 may extend.

Referring now to Figs. 2 to 5, the spindle 25 comprises a rotatable portion in the form of an elongated cylinder or sleeve 27 and an elongated member in the form of shaft 29. Shaft 29 passes through an opening 31 in the projector front wall 5 and is fixed to a spindle supporting means formed by the inner wall 33 of the projector.

At one end of the spindle 25 and preferably behind the projector front wall 5, the sleeve 27 is provided with means for rotatably driving the spindle, this means taking the form in the disclosed embodiment of a pulley 35 which is non-rotatably fixed to the sleeve 27 by a key 37 on the pulley 35 received in a slot 39 on the sleeve 27. The pulley 35 and sleeve 27 are rotatably driven by a motor (not shown) of the projector, which is operably connected to the pulley by a belt 30.

At the other end of the spindle remote from the projector the sleeve 35 defines an external surface 41 adapted to support the reel 11 carrying processed motion picture film. The reel rotates with the spindle and can be rotatably driven thereby through driving member or detent 43 (Fig. 4) which extends within a cooperating recess 45 in a core 47 of the reel.

Sleeve 27 also defines interior surfaces such as an annular opening or bore 49 having an internal diameter slightly larger than the external diameter of shaft 29. Thus the sleeve can be received on the shaft in the usual manner for rotation with respect to the shaft and projector. However, the sleeve is also mounted for axial movement with respect to the shaft and projector. A pin 51 on sleeve 27 cooperates with a circular recess 53 on shaft 29 and can move axially in recess 53 to permit axial movement of the sleeve 27. Excessive axial movement or disengagement of the sleeve from the shaft is prevented by this pin. This spindle construction forms the subject of copending Patent Application No. 26257/69 (Serial No. 1264008).

For satisfactory operation of the cartridge-loading motion picture projector, the supply reel should be centred between the cartridge walls to reduce frictional contact between the reel and the cartridge. However, it has been found with reels of 200' or larger capacity that, due to the frictional resistance to movement between the reel core and the outer sur-

face of the spindle, the reel will not centre itself adequately in the cartridge. This resistance to axial movement is due in part to the weight of the reel and film thereon and in part to the relatively high coefficient of friction between the plastics surfaces of the reel and the spindle which are not lubricated.

The reel 11 contained in cartridge 7 comprises a hub 52 having an annular outer surface 54 on which film may be wound, and an inner surface 55. A pair of spaced side flanges 57 and 59 extend radially outwardly from the hub to guide successive convolutions of film onto the hub when the reel is first loaded with film or during a rewind cycle of the projector. A web 61 extends radially inwardly from the hub and supports a core 47 coaxially therewith for mounting the reel on the projector spindle 25.

In accordance with the present invention, the core 47 of the reel 11 comprises a central bore 65 having an internal diameter at the centre which is less than the diameter at the ends of the bore. In the embodiment disclosed, the bore defines two opposed frusto-conical openings tapered toward the axial centre of the reel to a diameter which is slightly larger than the outer diameter of the projector spindle. This provides a spindle-engaging surface which is intermediate the ends of the bore and permits the reel to tilt on the spindle during rotation. While the degree of taper may be of any suitable amount for the intended purpose to be described more fully hereinafter, a taper within the range of 2°—7° and preferably about 5° has been found satisfactory.

Referring particularly to Fig. 3, the reel supporting surface of the spindle has been shown at an angle to the horizontal and out of alignment with the perpendicular to the projector wall. Such misalignment can occur for several reasons, such as poor manufacturing tolerances or wear between the rotatable and fixed portions of the spindle. This misalignment may be between the shaft 29 and the projector wall 5 or between the sleeve 27 and the shaft 29. Moreover, in weight-sensitive spindles of the type disclosed in U.S. Patent Specification No. 3,310,251, a certain amount of off-axis bending is expected during normal operation of the spindle.

In projectors which operate only with unenclosed reels, and in projectors operating with small size cartridges of less than 200 foot film capacity, this misalignment of the spindle may not be intolerable. However, in projectors adapted to operate with the larger cartridges, such as those containing 200 or 400-foot reels, the effect of any misalignment of the spindle is exaggerated due to the large diameter of the reel in such cartridges. Since the reel is closely confined within the cartridge, even a small amount of misalignment

of the spindle will cause previously known reels to engage the side-walls of these larger cartridges.

- 5 In accordance with the present invention, however, the reel core is provided with a symmetric tapered or arcuate bore, and the reel can wobble on the spindle or assume an angular position on the spindle as shown on Fig. 3, thereby to align itself with the cartridge in response to frictional and other forces between the cartridge and reel, regardless of the angular orientation or misalignment of the spindle.

WHAT WE CLAIM IS:—

- 15 1. A film storage reel comprising a hub defining a surface on which a roll of film can be wound and supported, an axial bore extending through the hub for receiving a rotatable spindle of a motion picture projector, the bore having a spindle-engaging surface intermediate its ends and of smaller diameter than the said ends so that the reel can tilt on the spindle relative to the spindle axis, and an axial keyway extending through the spindle-engaging surface for receiving an axial key on the spindle to prevent rotation of the reel on the spindle.

2. A reel as claimed in Claim 1, wherein the spindle bore tapers from the ends of the bore to the spindle-engaging surface substantially at the axial centre of the reel. 30

3. A reel as claimed in Claim 2, wherein the tapered portions of the bore are inclined at angles of between 2° and 7° to the axis of the bore. 35

4. A film storage reel as claimed in any preceding claim, disposed within a cartridge from which the film may be removed as it unwinds from the reel rotating within the cartridge, the cartridge having means for co-operating with a motion picture projector to mount the cartridge in predetermined position on the projector with a rotatable spindle of the projector extending into the cartridge to engage in the bore of the reel therein. 40 45

5. A film storage reel constructed and adapted for operation substantially as hereinbefore described with reference to the accompanying drawings.

6. A film storage reel contained within a cartridge, constructed and adapted for operation substantially as hereinbefore described with reference to the accompanying drawings. 50

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