

[54] **EXPANDABLE CASSETTE**

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[52] U.S. Cl.**242/197, 242/71.1, 242/71.2, 242/199, 352/72**

[51] Int. Cl.**G11b 23/10**

[58] Field of Search.....**242/199, 200, 198, 197, 194, 242/71.1, 71.2; 274/4 B, 4 C, 11 B, 11 C; 352/72, 78**

[56] **References Cited**

UNITED STATES PATENTS

2,165,739 7/1939 Verkinderen.....242/71.2

1,932,401	10/1933	Foster.....	242/71.2 UX
1,707,767	4/1929	Ponting et al.....	242/71.2
1,954,255	4/1934	Moreno.....	242/71.2
3,229,397	1/1966	Shaw.....	242/71.2 X

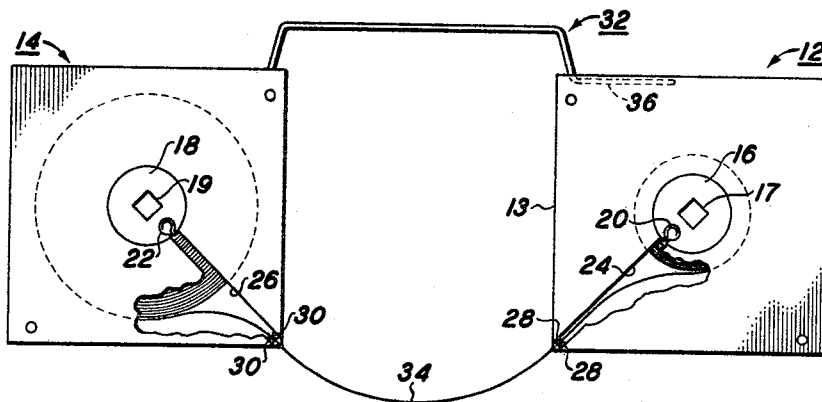
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[57] **ABSTRACT**

A microfilm cassette having two film cartridges connected by a spacer unit which permits the cartridges to be placed adjacent to one another for compact storage and separated to a variety of distances for viewing the microfilm. At least one edge of each cartridge contains a keyway in which a leg of the spacer unit slides relative to the cartridge to provide easy adjustment to the distance desired between the cartridges.

14 Claims, 18 Drawing Figures



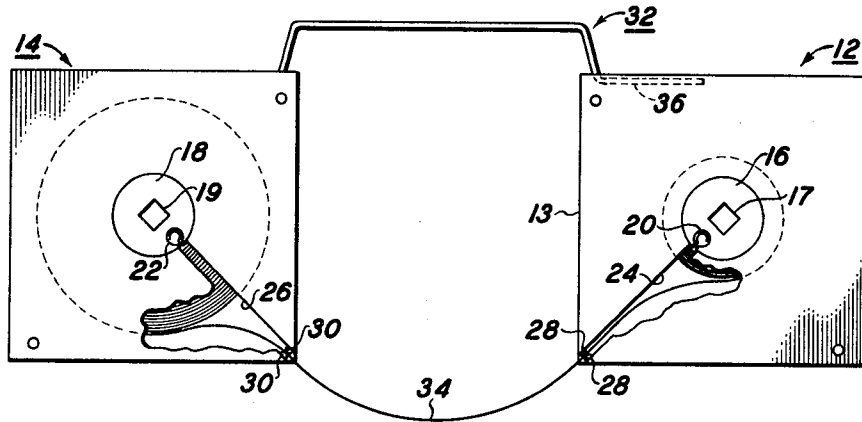


FIG. 1A

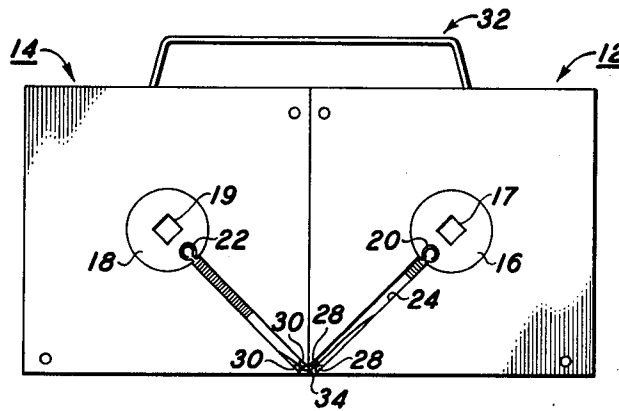


FIG. 1B

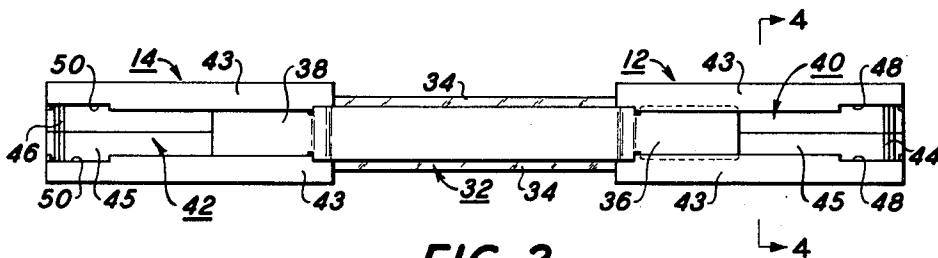


FIG. 2

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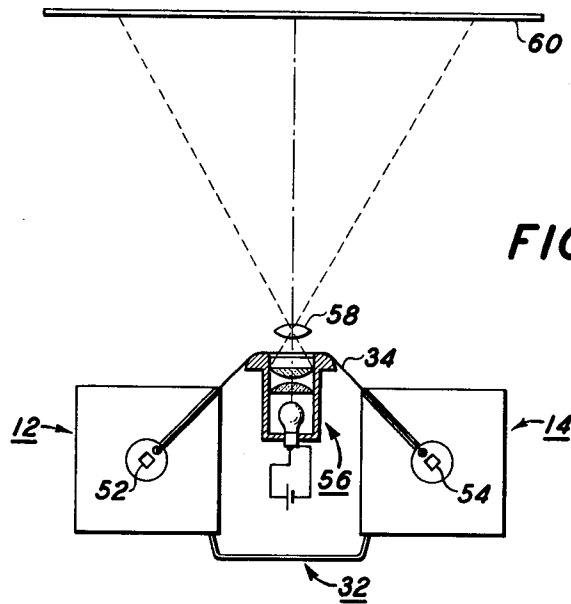


FIG. 3

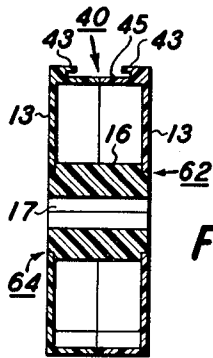


FIG. 4

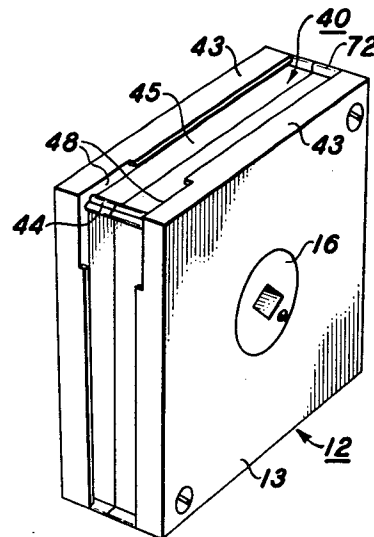


FIG. 5

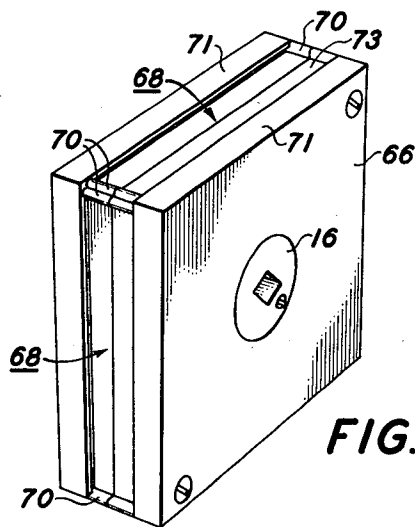


FIG. 7

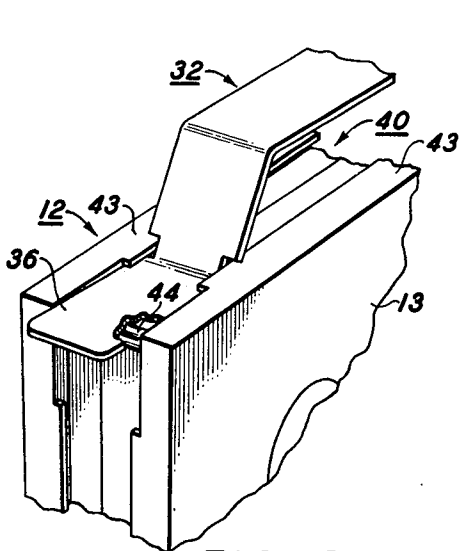


FIG. 6

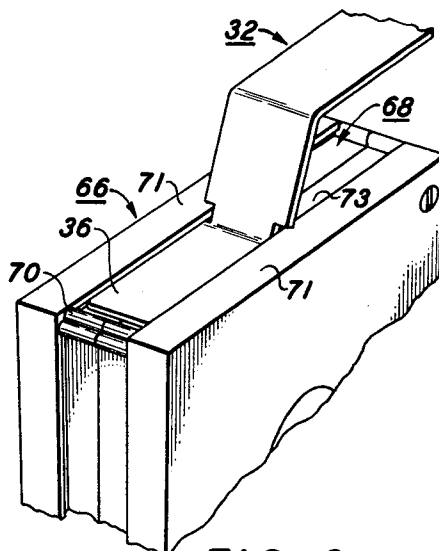


FIG. 8

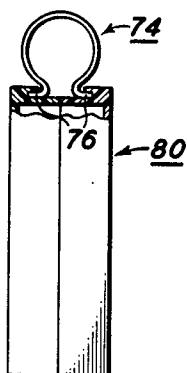


FIG. 10

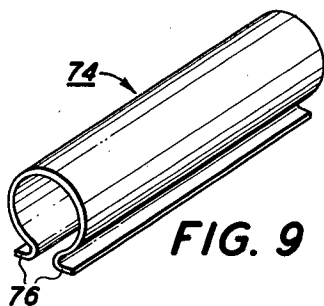


FIG. 9

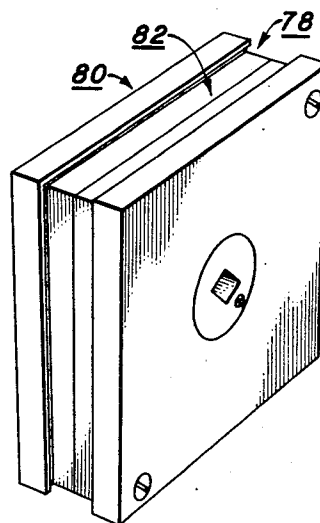


FIG. 11

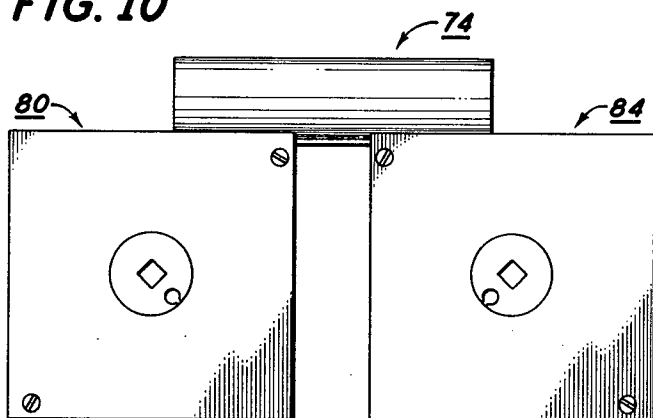


FIG. 12

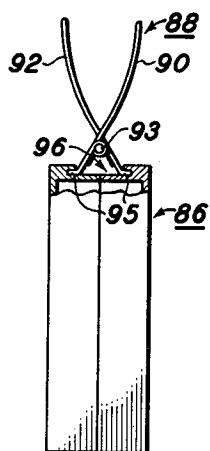


FIG. 13

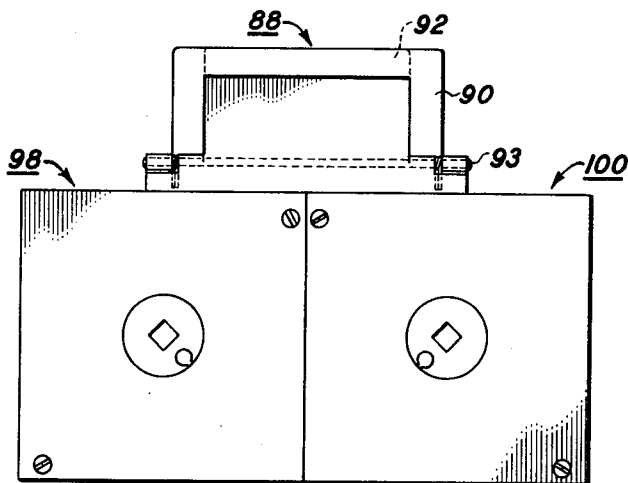


FIG. 14

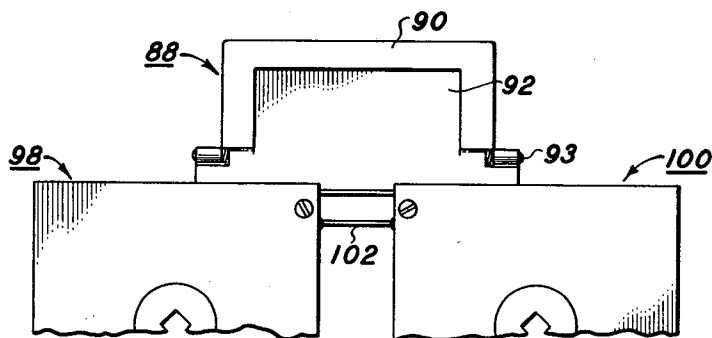


FIG. 15

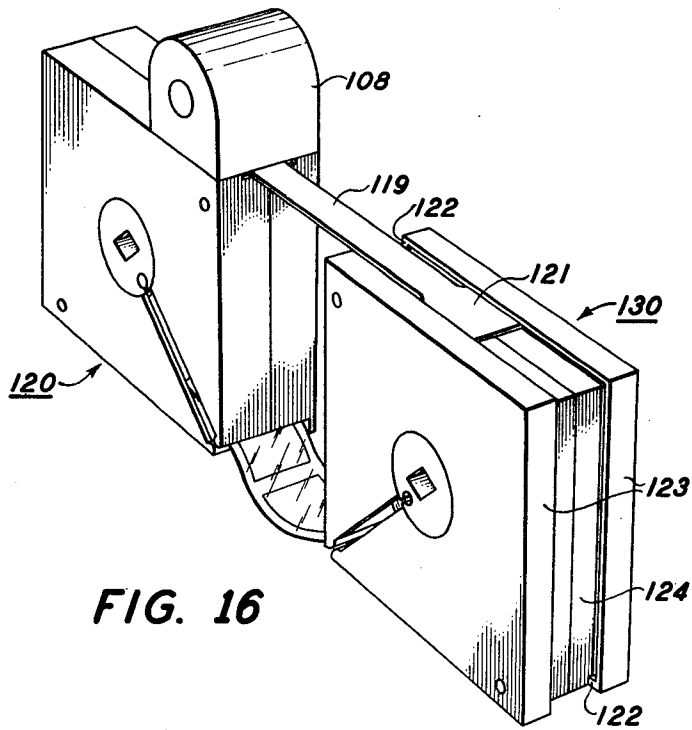


FIG. 16

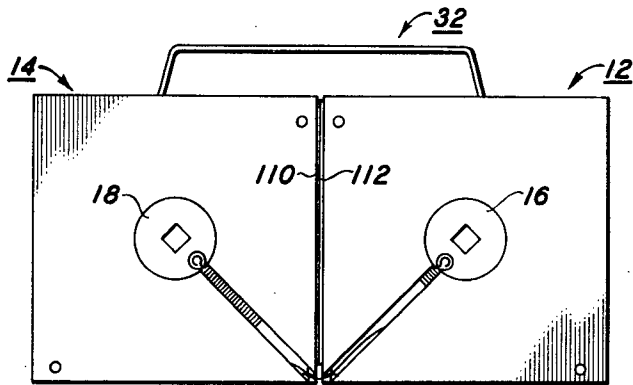


FIG. 17

EXPANDABLE CASSETTE

BACKGROUND OF THE INVENTION

A convenient and inexpensive manner in which large quantities of data and information can be stored is by reducing the size of the original materials. One commonly used method of storing reduced-sized materials is by copying them onto strips of microfilm which can be wound on a reel from compact storage. If a particular bit of information is to be retrieved from the microfilm, the reel can be removed from storage and placed in a viewer where the film is projected onto a screen for easy reading.

Microfilm strips are commonly wound onto storage reels and the like for convenient storage and handling. These reels usually are molded in plastic and have a cylindrical hub with a larger disc attached to each hub-face to hold the microfilm in a coiled position. Microfilm viewers generally contain two spindles upon which reels can be rotatably mounted, a first spindle on one side of the projection system for holding the storage reel and a second spindle on the other side of the projection system holding a reel upon which the film which has passed through the projection system is wound.

When a storage reel is placed in the viewer, the free end of the microfilm strip is threaded through the projection apparatus and onto a second reel, which can be similar to the storage reel and a permanent part of the viewer, and the microfilm fed between the two reels for viewing. After viewing is completed, the microfilm is entirely rewound on its storage reel and the storage reel is removed from the viewer. One undesirable aspect of using microfilm reels to store and handle film is that the film is exposed to foreign materials such as dust and is handled directly by the operator of the viewer. As a result, the quality of the film deteriorates over a period of use and the life of the film is shortened. To alleviate the problem of physically handling the microfilm, cartridges have been used to contain and protect the microfilm. A cartridge is an enclosure for a roll of microfilm which keeps dust and other foreign matter from reaching the film. It is normally constructed so that it holds the microfilm in a coil-like orientation, similar to a reel, and has an opening through which the strip can be fed out of the cartridge for viewing.

In the microfilm field, it has been found desirable to use two cartridges in combination to form a cassette. A cassette is a self-contained unit having two cartridges which function together, each cartridge having an end of the film strip joined to it. In the cassette device, the microfilm is freely fed from one cartridge to the other for display purposes without having to thread or completely contain the microfilm in either cartridge before or after use.

Cassettes are designed so that they can easily be placed on the spindles at a viewer. Consequently, one requisite of a cassette is that the spindle holes in its cartridges be separated a distance equivalent to that separating the spindles so that the cassette can be slipped onto the spindles and the microfilm therebetween placed in the projection system for instantaneous viewing. One known type of cassette contains two cartridges separated at a fixed distance by a rigid viewplate which guides the microfilm between the two cartridges. Although this type of cassette is a vast

improvement over the single cartridge approach to microfilm handling, there are three significant disadvantages to it. First, the cassette is rather inflexible since the overall size of the cassette is fixed and cannot be reduced for storage or expanded for greater access to the microfilm. Second, the cassette cannot be used in all viewers universally since its cartridges are separated at a fixed distance and not all views maintain the same distance between spindles. Third, due to the fixed viewplate arrangement, the optical path for the projection system must be fixed relative to the cartridge locations.

The disadvantages in the cassette having a fixed plate between the two cartridges is alleviated to a limited extent by another known type of cassette in which two cartridges are joined together at a pivot point. In this type of device, the cartridges can be placed immediately adjacent to each other for storage and separated a small distance for displaying the microfilm. Although some degree of flexibility as far as variation in spindle distance can be tolerated with this type of cassette, the variation is severely limited by the location and nature of the pivot device and the overall dimensions of the cartridges. Since viewers in the marketplace today have little uniformity in the distances between spindles, this type of cassette cannot be relied on as being completely universal.

The invention described herein is an expandable cassette which has increased flexibility over the known prior art devices. The cassette has the flexibility to permit the cartridges to be normally separatable over a wide variety of distances up to a fixed maximum distance so that it can be placed on the spindles of most viewers. However, there is an added feature to the cassette in that the fixed maximum limit of expansion can be overridden by simple manual manipulation of the device to accommodate a larger spindle distance if necessary. Consequently, the cassette can be contained in a very small volume during storage and separate to any distance permitted by the length of the microfilm strip for viewing.

The cartridges in the present device can be used singly for storage purposes in addition to being joined together to operate as a cassette. The cassette can be manufactured inexpensively, is assembled with ease very quickly, permits the microfilm to be stored and viewed without direct handling of the filmstrip, and can be removed from a viewer without first completely rewinding the filmstrip into one of the cartridges.

Accordingly, it is an object of this invention to improve cassette devices known in the prior art.

It is a further object of this invention to improve microfilm cassettes so that a cassette can be easily placed in a microfilm viewer regardless of the amount of separation between the cartridge spindles in the viewer.

It is a further object of this invention to improve microfilm cassettes so that the cassette can be removed from a microfilm viewer without having to entirely rewind the microfilm into one of the cartridges.

It is a further object of this invention to improve microfilm cassettes so that the cassette occupies as little space as possible during the storage. It is a further object of this invention to improve microfilm cassettes so that the maximum distance to which the cartridges

can be spaced is normally fixed but can be overridden if necessary by a simple manual manipulation of the cassette elements.

It is a further object of the invention to improve microfilm cassettes by biasing the cartridges to their storage position immediately adjacent to one another.

It is a further object of the invention to improve microfilm cassettes by permitting the microfilm to be projected anywhere between the cartridges.

It is a further object of the invention to improve microfilm cassettes by providing a flexible universal cassette that can be used with a great variety of viewers.

It is a further object of the invention to improve microfilm cassettes by providing slideable means to adjust the separation between the cartridges.

It is a further object of the invention to improve microfilm cartridges.

It is a further object of the invention to improve microfilm cartridges by providing a keyway in the cartridges which is engageable by a slideable spacer unit adapted to hold two cartridges together in a cassette.

SUMMARY OF THE INVENTION

The foregoing objects and others are accomplished in accordance with this invention which comprises two microfilm cartridges slideably engaged relative to one another through a spacer unit. Each cartridge contains a keyway adapted to accommodate a leg of the spacer unit in a slideable relationship therewith. The spacer unit permits the cartridges to be placed adjacent each other and for compact storage separated from one another over a variety of distances while maintaining control over the orientation of the cartridges relative to one another.

In one embodiment of the cassette, the maximum distance at which the cartridges can be separated is limited by the length of the spacer unit. In a second embodiment of the cassette, the maximum distance that the cartridges can normally be separated can be increased by manipulating one or both of the cartridges so that the spacer unit is removed from the cartridge. In other embodiments of the cassette, the spacer unit is made of a flexible material, a rigid material, and a stretchable material, and the cartridges are biased together so that the cassette normally assumes its compact storage position.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention as well as other objects and further features thereof, reference is made to the following detailed disclosure of this invention taken in conjunction with accompanying drawings wherein;

FIGS. 1a-b are front views of the invention in viewing and storage positions, respectively.

FIG. 2 is a top view of the invention.

FIG. 3 is a schematic illustration of the invention in a microfilm viewer.

FIG. 4 is a section view of a cassette in FIG. 2 taken through Section 4-4.

FIG. 5 is a perspective view of a first embodiment of the cartridge keyway.

FIG. 6 is a partial perspective view of the spacer unit being removed from the keyway shown in FIG. 5.

FIG. 7 is a perspective view of a second embodiment of the cartridge keyway.

FIG. 8 is a partial perspective view of the spacer unit engaged in the keyway of the cassette shown in FIG. 7.

FIG. 9 is a perspective view of a spacer unit of alternate design.

FIG. 10 is a partial section view of the spacer unit shown in FIG. 9 inserted in the keyway of a cassette.

FIG. 11 is a partial perspective view of the keyway adapted to engage the leg of the spacer unit shown in FIG. 9.

FIG. 12 is a front view of the cassette with the spacer unit shown in FIG. 9.

FIG. 13 is a partial section view of a spacer unit of alternate design engaged with the cartridge keyway.

FIG. 14 is a front view of the cassette with the spacer unit shown in FIG. 13.

FIG. 15 is a front view of a cassette having a flexible bias means attached to the cartridges.

FIG. 16 is a perspective view of a cassette having a spacer unit of alternate design.

FIG. 17 is a front view of the cassette with a biasing device of alternate design.

DESCRIPTION OF PREFERRED EMBODIMENTS

The cartridge and cassette described herein can be used in conjunction with any strip-like material such as microfilm, magnetic recording tape, plastic recording material, etc. However, for the purpose of this description, the invention is described only in conjunction with the use of microfilm in the cassette.

Referring to FIGS. 1a-b, there is shown in these two figures the same cassette in two positions. In FIG. 1a the two cartridges are separated as they would be when placed in a viewer. In FIG. 1b, the cartridges are positioned immediately adjacent each other as they would be when placed in storage.

The cassette includes two cartridges 12 and 14 and a spacer unit 32 connecting the two cartridges and controlling their orientation relative to each other. The ends of a strip of microfilm 34 are positioned in film retainer slots 20 and 22 which, in turn, are located in cartridge reels 16 and 18 respectively. The microfilm is wound about the cartridge reel in each cartridge and passes from cartridge 12 to cartridge 14 through rollers 28 and 30. Cartridge reels 16 and 18 contain spindle holes 17 and 19, respectively, through which spindles, such as those on a microfilm viewing machine, can be placed to control the movement of the microfilm back and forth in the cassette.

The cartridges can be made of any suitable material such as metal, molded plastic, cardborad, etc., and can be formed in any suitable shape permitting them to operate in the manner described herein. If the cartridges are formed in two parts as shown in FIG. 7, the two parts can be held together by any suitable fastening means 114 such as screws, welds, studs, rivets, etc.

FIG. 2 is a top view of the cassette showing the cartridges and spacer unit in positions similar to that shown in FIG. 1a. The spacer bar 32 contains legs 36 and 38 located at each end thereof and the cartridges 12 and 14 have keyways 40 and 42, respectively, in which the legs 36 and 38 can slide. Because of this spacer unit leg-keyway relationship, the cartridges can slide relative to one another for adjustment of the spin-

dle holes while maintaining the cassette intact as a single unit.

The spacer unit can be made of any suitable rigid or flexible material. In order to maintain complete control over the cartridges relative to one another while they are being separated or brought together, a rigid spacer unit is most desirable to assure that they move only in one direction relative to each other; i.e., parallel to the keyway. The overall shape of the rigid spacer unit can be any suitable one for the viewers the cassette will be used in.

On the other hand, if it is advantageous to allow the cartridges to move in two or more directions simultaneously while being expanded, a flexible spacer unit can be used to permit such movement. The flexible spacer unit is advantageous in those viewers having bulky or odd-shaped parts between the spindles which the spacer unit must clear when the cassette is placed in the spindles. In addition to being flexible, the spacer unit can be stretchable to give the cassette increased flexibility.

FIG. 3 is a schematic illustration of the cassette in a microfilm viewer, the elements of the viewer, the elements of the viewer including an illumination source 56 on one side of microfilm 34 and a projection lens 58 between the microfilm and display screen 60. The viewer also contains spindles 52 and 54 upon which the cartridges are mounted while the film is being displayed. The expandable cassette disclosed herein permits the cartridges to be easily separated to any desired distance to accommodate the distance between the spindles of the particular viewer being used. In addition, the cassette is designed so that the optical path of the projection system can pass anywhere between the two cartridges and the optical path is not limited to the midposition between the spindles.

FIG 4 is a section view of a cassette 12 taken through Section 4-4 to show the mounting of cartridge reel 16 within the cassette. The cassette walls 13 are shaped with a shoulder in the areas of 62 and 64 to rotatably engage reel 16 thereby allowing the reel to rotate relative to the cartridge. Because reel 16 is able to rotate relative to the cartridge, a spindle placed in spindle hole 17 can turn the cartridge reel 16 while the cartridge 12 remains stationary in the viewer. This movement permits the microfilm to be fed from cartridge reel 16 to the other cartridge in the cassette.

FIG. 5 shows the keyway of cassette 12 in detail. Keyway 40 extends across two adjacent sides of the cartridge and consists of keyway bottom 45 and lips 43. The reason for this is to permit any cartridge to be used on either side of the spacer unit. For instance, in FIG. 1a both cartridges 12 and 14 are exactly alike and can be used on either end of the spacer unit 32 and still feed microfilm to the other cartridge in the cassette.

The keyway has a keyway opening 48 adjacent one corner of the cartridge and two stops 44 and 72 which normally limit the travel of the spacer unit leg between the two corners of the cartridge. To enable the spacer to work properly, the distance between the keyway bottom and the lips is greater than the thickness of the legs on the spacer unit. Similarly, the distance between the two lips in all places but at the keyway opening is less than the width of the legs while the width of the keyway itself is wider than the width of the legs. The keyway

can be formed in the cartridge when it is manufactured or it can be placed on the cartridge thereafter. For instance, if the cartridge is molded in plastic, the key way arrangement could be made separately and attached to the cartridge by glue, screws, etc.

Referring to FIG. 6, it can be seen that the spacer unit 32 can be removed from the keyway 40 of the cartridge by manual manipulation. Normally, leg 36 travels in the keyway between stops 44 and 72, however, keyway opening 48 is large enough to allow the cartridge to be tipped relative to the leg 36 on the spacer unit so that the leg clears stop 44 when the spacer unit 32 is pushed across the cartridge. The presence of opening 48 permits leg 36 to be removed from or reinserted in keyway 40 when desired.

Through the keyway opening, the two cartridges in a cassette can be opened to any desired distance regardless of the length of the spacer unit. The length of a spacer unit can be chosen to allow the two cartridges to be separated to any convenient distance which is usually determined by the distance between the spindles on the machines in which the cassette is most likely to be used. However, in those instances when it is necessary to override the normal length of the spacer unit to display the microfilm or any other purpose, this can be accomplished by manually manipulating the cartridge relative to the spacer unit leg 36 to remove the spacer bar from the keyway of the cartridge.

If the cassette is intended for use on the same viewer, or on different viewers having a known range of spindle separations, keyway 68 in cartridge 66, shown in FIG. 7, is adequate. In this type of cartridge there is no provision to remove the spacer unit from the cartridges other than by taking the cartridge apart. The leg of the spacer unit can slide on keyway bottom 73 below lips 71 and between stops 70 as shown in FIG. 8. A keyway is still provided along two adjacent edges of the cassette shown in FIG. 7 since the spacer unit can be removed from one keyway and placed in the other by removing screws 114, which hold the sides of the cassette together, and separating the sides of the cartridge. The spacer unit can take a number of alternate designs. For instance, FIG. 9 shows the spacer unit as a clip-type device 74 having legs 76. The clip is a partial cylinder prestressed so that the legs are normally forced apart a distance greater than the width of keyway 82 in FIG. 11. To hold the cartridges together in a cassette, the clip is merely squeezed together with the fingers so that the legs can be inserted into the keyway of the cassette 80, as shown in FIG. 10, and then released. Due to the prestressing of the clip, legs 76 are forced apart in the keyway and the cartridges are held together. As shown in FIG. 11, the keyway 82 of cartridge 80 is adapted to engage the legs of clip 74 and must have an open end 78 so that the clip can extend between the two cartridges. Two cartridges held together with this clip-type spacer unit is shown in FIG. 12.

FIG. 13 shows another embodiment for the spacer unit, a scissors-type spacer unit 88. Keyway 96 accommodates legs 95 of the spacer. Each leg is attached to an arm, 90 and 92, and the arms are held together by pivot rod 93. Since the lower ends of the arms are biased apart by compression springs 94, the arms are merely squeezed together in their upper portions to cause legs 95 to come together. The keyway of the car-

tridge in this embodiment is narrower than the width of the legs when held open by spring 94 and the spacer unit is removed and inserted by squeezing the legs together. Cartridges 98 and 100 have an open end in their keyways similar to cartridges 80 and 84. FIG. 14 shows cassettes 98 and 100 being held in the storage position by scissors-type spacer unit 88.

It has been found desirable to bias the two cartridges together when not in the viewer to ensure that the cassette takes as little room as possible. In FIG 15, cartridges 98 and 100 being held by spacer 88 are biased towards one another by a flexible stretchable connector 102. The connector can be any suitable type which is joined to the edges of each cassette and normally maintains the cartridges in contact with each other. FIG. 17 shows another such device. Here cartridges 12 and 14 of the cassette shown in FIG. 1b contain magnets 110 and 112 to attract the cartridges adjacent one another.

FIG. 16 shows a type of spacer unit which allows the cartridges to slide relative to each other and biases the cartridges together. In this arrangement, a suitable recoil device 108 fastened to cartridge 120 biases the leg 121 of flexible connector 109 towards cartridge 120. Cartridge 130 contains a keyway 124 that leg 121 is adapted to slide in and lips 123 which retain the leg in the keyway. The keyway also contains stops 122 which prevent the leg from inadvertently coming out of the keyway. In the device shown in FIG. 16, lips 124 can be replaced by a smooth surface extending all the way across the edge of the cartridge. This type of keyway would present a better looking cartridge and prevent foreign matter from entering keyway since the keyway would be hidden.

In addition to the apparatus outlined above, many other modifications and/or additions to this invention will be readily apparent to those skilled in the art upon reading this disclosure, and these are intended to be encompassed within the spirit of the invention herein.

What is claimed is:

1. An expandable cassette for feedably housing strip material comprising:

- a. a first cartridge having means to feedably contain strip material;
- b. a second cartridge having means to feedably contain strip material located adjacent the first cartridge in a position where strip material can be fed between the two cartridges, at least one of said cartridges having a keyway, and
- c. connecting means in operative relation to the cartridges adapted to enable the cartridges to be separated and brought together in a predetermined direction while strip material is contained within the cartridges, said means comprising a spacer unit having a leg on at least one end, said leg slidably engaged with said keyway.

2. The cassette in claim 1 wherein the connecting means is slidably connected to one cartridge so that the connecting means and the one cartridge are able to move relative to one another.

3. An expandable cassette for feedably housing strip material comprising:

- a. A first cartridge having means to feedably contain strip material and a keyway along at least one edge thereof;

b. a second cartridge adjacent the first cartridge having means to feedably contain strip material and a keyway along at least one edge thereof; and

c. connecting means operably engaged in the keyway of each cartridge to enable the cartridges to move relative to one another, said means comprising a spacer unit having a leg at each end, each leg slidably engaged with a keyway in said cartridge.

4. The cassette in claim 3 wherein the keyway of each cartridge has a stop at each end thereof adapted to limit the travel of the legs of the spacer unit along the edges of the cartridges whereby the legs cannot be inadvertently removed from the keyways.

5. The cassette in claim 4 wherein the legs of the spacer unit are of predetermined width and thickness and the keyway in the cartridge comprises a bottom surface parallel to the cartridge edge and two lips separated at a gap from each other and parallel to and separated at a gap from the bottom surface, the gap between the lips and bottom surface being greater than the thickness of the legs and the gap between the two lips being less than the width of the legs.

6. The cassette in claim 5 wherein the keyway has at least one cartridge has an opening in its lips at one end thereof, the opening being larger than the width of the legs of the spacer unit, whereby the spacer unit can be removed from and reinserted in the cartridge keyway by manual manipulation thereof.

7. The cassette in claim 3 wherein the spacer unit is a rigid bar having ends which are used as legs.

8. The cassette in claim 3 wherein the spacer unit is flexible.

9. The cassette in claim 3 wherein the spacer unit is stretchable.

10. The cassette in claim 3 wherein the connecting means is a partial cylinder having a portion of its wall removed forming two edges separated by a gap, each edge having a leg facing away from the gap, the cylinder being prestressed so that the legs are normally maintained apart a distance greater than the width of the keyway.

11. The cassette in claim 3 wherein the connecting means comprises a scissors-type clip including two arms operably fastened together by a pivot device, each arm having a leg extending outwardly of the pivot device, and means to normally maintain the legs apart a distance greater than the width of the keyway.

12. The cassette in claim 1 further including means to bias the cartridges towards each other whereby the cassette normally assumes its most compact position.

13. A cartridge adapted to form a cassette for strip material when used in tandem in combination with a spacer unit comprising:

- a. a reel to support strip material in a coil;
- b. a housing adapted to rotatably support the reel therein having two edges, each of said edges having a keyway therein, either of said keyways being adapted to slidably engage the spacer unit;
- c. an opening in the housing adapted to enable strip material to be fed through the housing whereby an expandable cassette is formed by slidably engaging the spacer unit with two cartridges.

14. The cartridge in claim 13 wherein said keyways intersect to form a corner and the opening in the housing is located in that portion of the housing opposite the corner.