United States Patent

Katsuragi

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[54] **DAYLIGHT FILM DEVELOPING TANK**

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[52] **U.S. Cl.**.....**95/90.5,** 95/93, 95/94 R

[51] **Int. Cl.**.....**G03d 1/14**

[58] **Field of Search**.....95/89, 90, 90.5, 93, 94, 96

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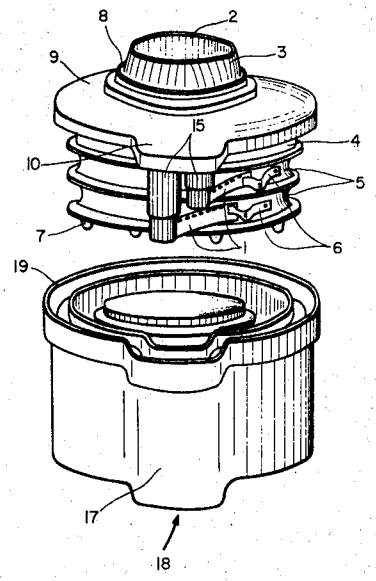
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[57] **ABSTRACT**

A daylight developing tank of roll films for simultaneously developing a plurality of comparatively short roll films. The tank includes a spool having a plurality of film-holding grooves, each of which grooves holds a film only at the upper and lower edges thereof. Film retainers are secured to the film-holding grooves, respectively, for retaining the outermost end of each film being loaded in a cassette, which cassette is disposed adjacent the spool during the development.

5 Claims, 3 Drawing Figures



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SHEET 1 OF 2

FIG. 1

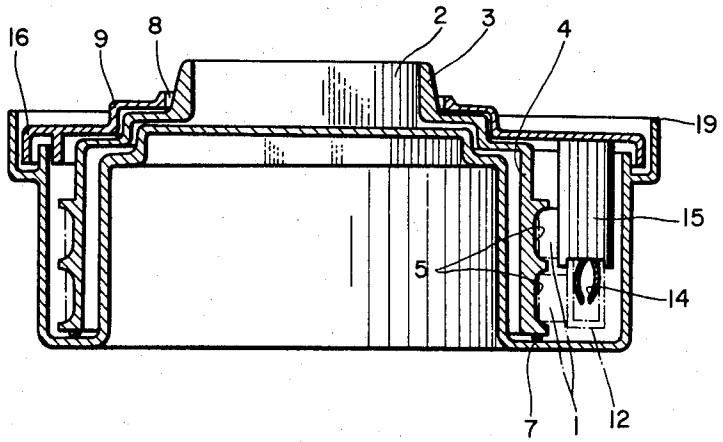
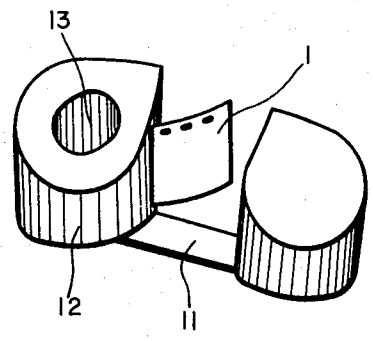


FIG. 3



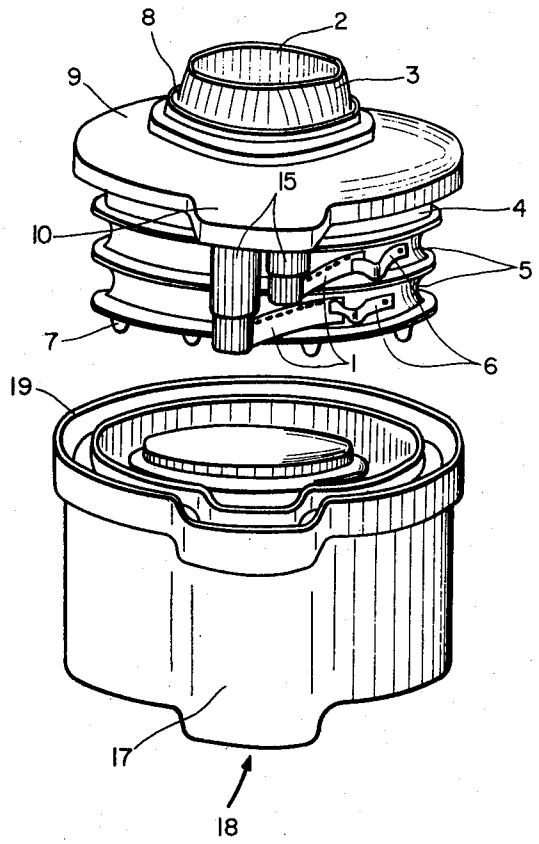
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FIG. 2



DAYLIGHT FILM DEVELOPING TANK

This invention relates to a daylight film developing tank, and more particularly to a developing tank for simultaneously developing a plurality of comparatively short roll films under daylight.

A typical roll film of comparatively short type, which is commonly used at the present moment, is a 16-mm roll film. For instance, according to JIS (Japanese Industrial Standard) B 7176 Shape and Size of 16-mm Camera Patrone (Cassette) (DRAFT), the standard film length is 475 mm. The recent trend with such films is to provide as a large picture area as possible without increasing the film width, so as to improve the picture quality. Accordingly, the spacing from the edges of the picture area to the edges of the film is getting smaller. For instance, according to JIS B 7176 Shape and Size of 16-mm Camera Patrone (DRAFT), the spacing from the lower edge of the picture area to the lower edge of the film is only 1 mm, in the case of 12 × 17 mm picture area.

Due to such trend in 16-mm films, it is becoming increasingly difficult with conventional developing tanks of belt type or groove type multiple roll system to properly treat the film without scratching the picture area thereof during the loading in the tank, or without causing any uneven development created by contacts of adjacent film portions. As a result, considerable skill and prudence are required for the loading and treating of the film in the developing tank. In the case of a developing tank of spiral single-layered roll type, the body of the developing tank includes a patrone loading means (e.g., a peripheral projection) for receiving a cassette, and during agitation of the developer in the tank, the flow of the developer is apt to be disturbed by the cassette loading means. As a result, turbulence may be caused, which possibly leads to uneven development of the film.

Furthermore, with known daylight developing tanks, only one roll film can be developed at a time. Since 16-mm roll films include only a few frames per roll, there has been a demand for a daylight developing tank capable of simultaneously developing a plurality of roll films.

Therefore, an object of the present invention is to obviate the aforesaid difficulties of the known daylight developing tank, by providing an improved daylight developing tank, which is capable of developing a plurality of roll films at a time, depending on the need.

With the developing tank of the present invention, the film being developed is held in such a manner that, although turbulence of the developer may be caused by a patrone holding means (e.g., the radial extension of a tank body) in response to developer agitation, such turbulence will not result in any uneven development. The film may be loaded in the tank of the present invention without touching the emulsion of the film, so that the film may be held in the tank by retaining only the upper and lower edges thereof. Thus, the picture areas of the film will never be scratched or soiled during the development in the tank of the invention.

Other objects and advantages of the present invention may be appreciated by referring to the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a vertical sectional view of a daylight developing tank, according to the present invention, shown in the state as completely assembled with a spool and a cover mounted on a tank body;

FIG. 2 is an exploded perspective view of the developing tank with a film patrone mounted thereon; and

FIG. 3 is a perspective view of a patrone for a 16-mm film, which is mountable on the daylight developing tank.

Like parts are designated by like numerals throughout the drawings.

Referring to FIG. 1, a preferred embodiment of the present invention includes a cup-shape spool **4** having a circumferential length substantially equivalent to the length of each roll film to be developed therein. A knob **3** with a central aperture **2** is integrally formed at the upper end of the spool **4**. Two film-holding grooves **5** are formed on the peripheral surface of the spool, with a suitable axial spacing between them. Each of the film-holding groove **5** holds a roll film **1** by operatively engaging only upper and lower edges thereof. A film retainer **6** is provided on each film-holding groove **5** for resiliently retaining the longitudinal end portion of each roll film, as shown in FIG. 2. To facilitate flow of a liquid developer through the cup-shape spool **4**, a plurality of downwardly extending projections **7** are provided on the annular bottom wall of the spool at uniform angular intervals about the vertical axis of the spool, so as to form passages of the liquid developer between the annular bottom wall of the spool and the upper surface of the bottom wall of a tank body **18**, to be described hereinafter. The shape and the position of such projections **7** are so selected that the disturbance of the flow of the liquid developer due to the presence of such projections is minimized.

A cover **9** is engageable with the top of the cup-shape spool **4**, while rotatably fitting the knob **3** of the spool **4** is a central aperture **8** of the cover **9** in axial alignment therewith. As best shown in FIG. 2, a radial projection **10** is integrally formed with the cover **9**, so that two cylinders **15**, each having a resilient cassette cassette holder **14**, can be mounted on the lower surface of the projection **10**. The cylinder **15** and the cassette holder **14** extend substantially at right angles to the plane of the projection **10**. The patrone holder **14** resiliently engages the central driving hole **13** of each patrone **12**.

In FIG. 3, in order to develop each exposed film **1** mounted on the cassette **12**, a bridging portion **11** of the patrone **12** is split, and the cassette **12** with the film thus separated is mounted on the cylinder **15** of the cover **10**, by inserting the resilient cassette holder **14** into the driving hole **13** of the cassette **12**. Thus, the outer end of the roll film **1** in the cassette **12** can be placed adjacent the film-holding groove **5** of the spool **4**. A vertical light-interrupting wall **16** is formed along the periphery of the cover **9**.

A body **18** includes a cylindrical portion for rotatably receiving the cup-shape spool **4** and a radial extension **17**, integrally formed with the cylindrical portion, for receiving the cylinders **15** with the cassette holders **14**. The cover **9** with the radial projection **10** fits on the top openings of the cylindrical portion and the radial extension of the body **18**. Another vertical light-interrupting wall **19** is integrally formed with the peripheral wall of

the body 18, so as to cooperate with the similar light-interrupting wall 16 of the cover 9.

In operation of the daylight film developing tank of the aforesaid construction, according to the present invention, the cassette 12 with an exposed film 1 is separated from the bridging portion 11 and mounted on the cylinder 15 of the cover 9 by inserting the resilient patrone holder 14 into the driving hole 13 of the patrone. The cover 9 is mounted on the spool 4, and at the same time, the outer end portion of the exposed film 1 is inserted between the outer peripheral surface of the film-holding groove 5 and the resilient lug portion of the film retainer 6, for resiliently holding the end portion of the film 1 in the film-holding groove. The spool 4 and the cover 9 thus assembled is mounted on the tank body 18, as shown in FIGS. 1 and 2. A dark chamber is formed by the body 18, the cover 9, and the light-interrupting walls 16, 19, so that the exposed film 1 is rotatably held in such dark chamber. As the knob 3 is rotated counter-clockwise, as seen in FIG. 2, the exposed film 1 is withdrawn out of the cassette 12 along the film-holding groove 5 of the spool 4, while holding only the upper and lower edges of the film 1. Since the inner end portion of the film 1 is secured to the core of the cassette 12, the operator can sense by feeling when the entire length of the film 1 is withdrawn from the cassette 12, because the resistance to the counter-clockwise rotation of the spool 4 will suddenly increase at this particular moment. After mounting the full length of the exposed film 1 on the film-holding groove 5 of the spool 4, liquid developer is poured into the body 18 of the developing tank through the central aperture 2 of the knob 3 of the spool 4, while keeping the cover 9 fitted on the top portion of the body 18. Then, the film 1 is developed by agitating the liquid developer by shaking the entire developing tank. After a predetermined developing time, the liquid developer is poured out of the developing tank, while keeping the spool 4 and the cover 9 as mounted on the body 18.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention, as hereinafter claimed.

What is claimed is:

1. A daylight developing tank of roll films, comprising a tank body including a cylindrical portion and a radial extension; a cylindrical spool rotatably engageable with the cylindrical portion of the body and having a plurality of separate, vertically spaced, horizontal, annular film-holding grooves circumferentially formed on the peripheral outer surface of the spool, the circumference of the spool being at least the same in length as films being developed, the film-holding groove engaging only upper and lower edges of a single length of film: a cover including a circular portion and a radial projection engageable with the cylindrical portion and the radial extension of the tank respectively, in a light-interrupting manner at the top thereof, said cover having an aperture rotatably engageable with the spool; a plurality of cassette holders secured to the lower surface of the radial projection of the cover so that when the cover and spool are so engaged the holders extend various distances along the outer surface of the spool so as to dispose cassettes adjacent to respective film-holding grooves, and a plurality of film retainers, each being mounted on the film-holding groove for retaining the outermost end of the film from the corresponding cassette carried by the cassette holder.

2. A daylight developing tank according to claim 1, wherein said spool has a knob integrally formed therewith and extending through the aperture of the cover in a rotatable manner.

3. A daylight developing tank according to claim 1, wherein said film retainers are made of resilient lug members, so as to urge the outermost end of each film being developed against the outer surface of the film-holding groove.

4. A daylight developing tank according to claim 1, wherein said cover has a vertical light-interrupting wall integrally formed along the periphery thereof, and the body has another light-interrupting wall integrally formed with the peripheral wall thereof at the uppermost edge thereof so as to cooperate with light-interrupting wall of the cover, for defining a dark chamber receiving the film being developed.

5. A daylight developing apparatus for roll films, comprising a tank for containing developer including a cylindrical portion and a radial extension; a cylindrical spool coaxially and rotatably engageable with the cylindrical portion of the tank in the interior thereof and having a plurality of independent film-holding grooves circumferentially formed on the periphery of the spool, each of said independent grooves being arranged substantially in parallel with each other with an axial space therebetween and having a circumference substantially the same as the length of the film to be developed, each of said grooves having such configuration in its axial section as to engage only the side edges of the film; a cover including a circular portion and a radial projection engageable respectively with the cylindrical portion and the radial extension of the tank in a light-interrupting manner at the top thereof, said cover having an aperture rotatably engageable with the spool; a plurality of film cassette holders secured to the lower surface of the radial projection of the cover so as to dispose each of the film cassettes adjacent the corresponding film-holding groove when the cover is mounted on the tank; and a plurality of film retainers, each being mounted in a film-holding groove for retaining the leading edge of the film in the corresponding film cassette carried by the film cassette holder.

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