The invention relates to a spooled film developer box in which the film is kept in motion from outside by rotating said spool, and serves the purpose to treat several films at the same time. This invention represents an improvement over known film developing apparatus in which several flanged film spools are horizontally mounted in a light-proof box and are only partially immersed in the developing or fixing bath, in consequence of which they must be maintained in constant rotation by means of a drive common to all spools. Such developers, therefore, require a motor drive and a developing box of sufficient length to receive several spools in successive axial arrangement.

My invention is based on the fact that a number of flanged film spools are vertically mounted alongside each other and are adapted to rotate in the bottom and in the cover of a developing box. The spools, which are individually removable, are arranged closely adjacent each other in a circle and are adapted to be fully immersed in the developing bath. The inner-wall surface of the box encloses the spool flanges over a substantial portion of their periphery and thus limits the internal cross-section of the box almost to the total surface space of the flanges of all spools standing in the developing box. The spools are provided with gear engaging means which mesh with a centrally arranged intermediate gear wheel and which can be driven through a turning button arranged externally at the box cover and passing through the cover thereby rotating all of the film spools simultaneously.

The advantages of my new film-developing unit reside chiefly in that the film spools may be immersed completely in the developing bath and therefore do not require a drive constantly maintaining them in rotation, in that the film spools stand in the box individually removable, thereby making possible the simultaneous yet individual treatment of films of different light sensitivity and developing time, and in that the right arrangement of the spools makes possible the adaptation of the structural height of the developing box to the standard motion picture film widths whereby a substantial saving in bath liquid is achieved. Owing to the fact that in my new film developing box the film spools themselves present the tooting necessary for their rotation, the spool shafts which protrude to the outside in the boxes of known design are eliminated and the drive part remaining in the box is reduced to the intermediate gear wheel which couples the spool gear wheels with each other. This design of the drive of the spool is possible only because it is required only for the brief rotation of the film spools, completely immersed in the developing bath, at fairly long intervals of time.

The drawing illustrates, by way of example, several modes of execution of the developer boxes designed according to the invention, the Figs. 1 and 2 being a perspective view of and a central-section through an embodiment for three developer spools with the drive arranged in the center. Fig. 3 is a partial section through a modified kind of the drive, Fig. 4 is a perspective view of a modified design of the casing, Fig. 5 is a part-section through a modified bearing arrangement of the developer spools for interior insertion, whereas the Figs. 6 and 7 are a central-section and a plan of a modified embodiment having three developer spools and an eccentrically arranged drive.

According to the mode of execution shown in the Figs. 1 and 2 the box 1, e. g. made from plastic masses or drawn metal sheets has outwardly, in cross-section, the shape of an equilateral triangle with rounded-off corners. For reducing the quantity of developing liquid required the inner wall snugly nestles to the developer spools so that the inner space has the shape of a trefoil leaf. Made into one with the bottom of the box 1, by casting, pressing or jet-casting, there are three stub axles 2 for the developer spools and a fourth stub axle 3, of a smaller diameter, for the drive. The cover 4 is made in a similar manner as the casing and is so joined to the box 1 as to prevent the light from penetrating into same. Each stub axle 2 carries a developer spool 5 for the film to be treated, said spool consisting of a perforated core 6, and an upper and a lower flange 7 and 8, the outer part of the latter being machined into a toothed wheel 9. To the stub axle 3 a driving shaft 10, provided with a bored bearing, is joined which, at its top end, carries a driver pinion 11 meshing with the toothed wheel 9, whilst, at its top end, same is provided with a diametrical groove. The knurled turning button 13, that in driving the spool, is journaled in the cover 4, and the bottom end of its bearing stub axle is provided with a diametrical rib 14 engaging the groove 12.

For use the cover 4 is removed from the box 1, and the spools are taken out, whereupon the films to be developed are spooled on same in the
dark. Then the box is filled with the developer fluid, and the spools are reinserted into same, whereby the toes arranged on said spools are made to engage the driving pinion. Then the cover 4 is put on again, and the turning button 13 is reinserted whereby the rib 14 of the latter engages the groove 12 of the driving shaft 10, thus coupling said shaft to the turning button. Then, as usual, during the first minute of the development, the turning button 13 is rotated, whereby all spools contained in the box are put into rotation at the same time. As the diameter of the driving pinion 11 is superior to that of the toothed wheels 9, one complete revolution of the driving pinion 11 entails more than one complete revolution of the toothed wheels 9.

For checking the developing process it suffices to remove the cover 4 together with the turning button 13. Then, in the manner known, any film spool may be easily removed, checked and reinserted. Films whose development is completed may at any moment be removed from the box independently of the others, and other films may be inserted in their place. This warrants a considerable saving of time and material.

In conformity to Fig. 3, the toothed wheels 9 are arranged on the upper flanges of the developer spools so that the driving shaft 10 need not be continued down to the bottom of the box. On the contrary, it is formed into a short stub shaft, axially and slantably journaled in the cover. By lowering or lifting the turning button 13 the driving pinion 11 arranged on the bottom end of the stub shaft 10 is made to engage the toothed wheels 9, or to be disengaged from same.

Fig. 4 shows an embodiment in which, for saving material, also the outer contour of the casing presents the shape of a trefoil.

It is perceptible from Fig. 5 that the stub axle 2 need not be made in one with the box, but may also be inserted into same ulteriorly. For this purpose each stub axle 2 terminates downwards in a threaded bolt 15. The bottom of the casing is perforated so that the bolt 15 may be passed through same and then be firmly clamped by means of a screwed-on nut 16, the packing 17 providing a reliable seal against the passage of liquids.

The embodiment according to the Figs. 6 and 7 replaces the central turning button by a turning button 13 eccentrically located so that its axis coincides with that of one of the spools which entails a modification of several individual parts. In this embodiment the cover 4—above one of the spools is provided with a pan 18 serving for introducing the developing liquid, said pan being perforated in the middle and being continued into a bearing sleeve 19 protruding downwards, in which the stub axle 20 of the turning button 13 is journaled. The core 6 of the respective spool is, at its bottom end, journaled e. g. in the same manner as in the Figs. 1 and 2 whilst it is additionally journaled in the bearing sleeve 19. As means for having the turning button 13 and the spool core 6 cooperate again, a groove 12 and a rib 14 are used. In this case the driver 11 is formed by the toothed wheel 9, fixed to the bottom end of this spool core and acts on the intermediate wheel 23, which has on its lower end but one stub axle 21 journaled in the bottom of the casing 22. The two other spools are arranged in the same manner as those according to Figs. 1 and 2, the middle gear wheel 23 being secured against displacement upwards by the lower flanges of the spools.

Instead of three spools a greater number may be lodged in one casing, all these spools being rotated by means of a joint drive. In this case too the cross-section of the casing is designed so that not more developer liquid is consumed than is absolutely necessary, the shapes resulting being e. g. those of a four or five leaved clover or trefoil.

By using intermediate bands, provided with wart-like projections and the like, it is possible—as already known—to coil on one and the same developer spool two or more film strips or bands so as to further enhance the efficiency of the implement according to the invention.

If the inner wall of the casing snugly nestles to the spool carrier flanges and embraces an angle of more than 180 degrees, the stub axles serving for bearing the spools can be entirely dispensed with, the flanges themselves serving as guides.

The coupling of the turning button with the driving shaft appertaining may be also effected by means different from groove and rib, without exceeding the scope of the invention.

What I claim is:

1. In combination, a film developing box adapted to be filled with developing liquid and having side walls, a bottom defining a lower inner surface and a removable cover defining an upper inner surface, a first gear wheel rotatably mounted interiorly of said box adjacent one of said inner surfaces and centrally thereof, a plurality of flanged individually-removable film spools having hollow shafts disposed at right angles to said bottom and flanges lying in planes substantially parallel to said bottom, said spools being rotatably supported in said box between said bottom and said cover in a circle around said first gear wheel, one end of each of said spools being provided with a fixed gear wheel in meshing engagement with said first gear wheel, said spools being arranged in said circle in such manner that the gear wheels of all of said spools are in simultaneous engagement with said first gear wheel, said box further comprising turning means rotatably mounted in said cover and extending interiorly of said box for rotating one of said gear wheels whereby to rotate all of said spools simultaneously.

2. In combination, a film developing box adapted to be filled with developing liquid and having side walls, a bottom defining a lower inner surface and a removable cover defining an upper inner surface, a first gear wheel rotatably mounted interiorly of said box adjacent said lower inner surface and centrally thereof, a plurality of flanged individually-removable film spools having hollow shafts disposed at right angles to said bottom and flanges lying in planes substantially parallel to said bottom, said spools being rotatably supported in said box between said bottom and said cover in a circle around said first gear wheel, the lower end of each of said spools being provided with a fixed gear wheel in meshing engagement with said first gear wheel, said spools being arranged in said circle in such manner that the gear wheels of all of said spools are in simultaneous engagement with said first gear wheel, said box further comprising turning means rotatably mounted in said cover and extending interiorly of said box for driving engagement with one of said spools to rotate said spool and thereby to rotate all of said spools simultaneously.

3. In combination, a film developing box adapted to be filled with developing liquid and having
side walls, a bottom defining a lower inner surface and a removable cover defining an upper inner surface, a first gear wheel rotatably mounted interiorly of said box adjacent upper inner surface and centrally thereof, a plurality of flanged individually removable film spoons having hollow shafts disposed at right angles to said bottom and flanges lying in planes substantially parallel to said bottom, said spoons being rotatably supported in said box between said bottom and said cover in a circle around said first gear wheel, the upper end of each of said spoons being provided with a fixed gear wheel in meshing engagement with said first gear wheel, said spoons being arranged in said circle in such manner that the gear wheels of all of said spoons are in simultaneous engagement with said first gear wheel, said box further comprising turning means rotatably mounted in said cover and extending interiorly of said box for rotating one of said gear wheels whereby to rotate all of said spoons simultaneously.

4. In combination, a film developing box adapted to be filled with developing liquid and having side walls, a bottom defining a lower inner surface and a removable cover defining an upper inner surface, a first gear wheel rotatably mounted interiorly of said box adjacent one of said inner surfaces and centrally thereof, a plurality of flanged individually-removable film spoons having hollow shafts disposed at right angles to said bottom and flanges lying in planes substantially parallel to said bottom, said spoons being rotatably supported in said box between said bottom and said cover in a circle around said first gear wheel, one end of each of said spoons being provided with a fixed gear wheel in meshing engagement with said first gear wheel, said spoons being arranged in said circle in such manner that the gear wheels of all of said spoons are in simultaneous engagement with said first gear wheel, said box further comprising turning means rotatably mounted in said cover and extending interiorly of said box for rotating one of said gear wheels whereby to rotate all of said spoons simultaneously.

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