

Sept. 6, 1949.

W. H. RICHARDS
DEVELOPER-ROLL FILM

2,480,880

Filed Dec. 19, 1945

4 Sheets-Sheet 1

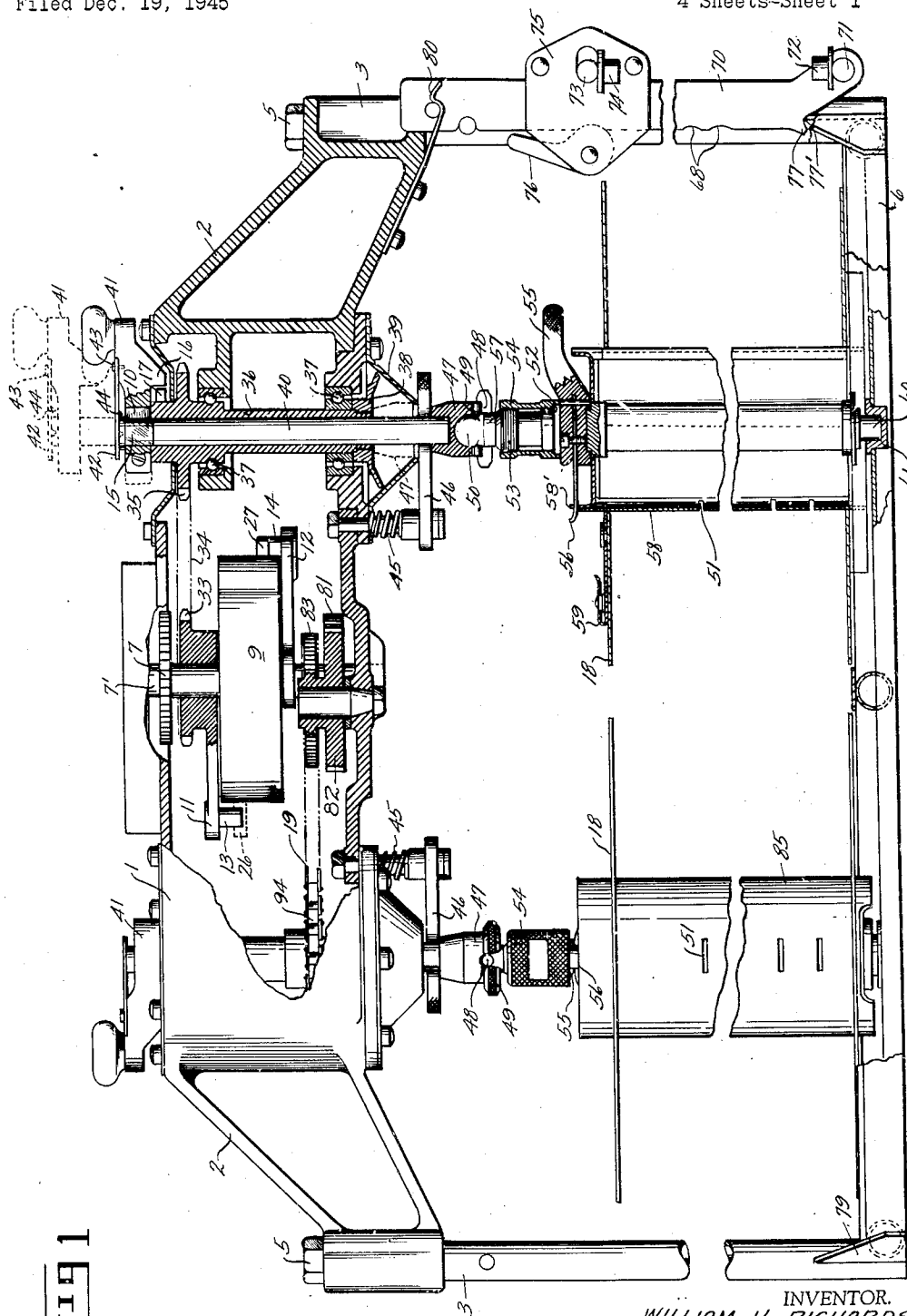


Fig 1

BY

INVENTOR.
WILLIAM H. RICHARDS
Charles Loomis and
Russell O. Wyatt
ATTORNEYS

Sept. 6, 1949.

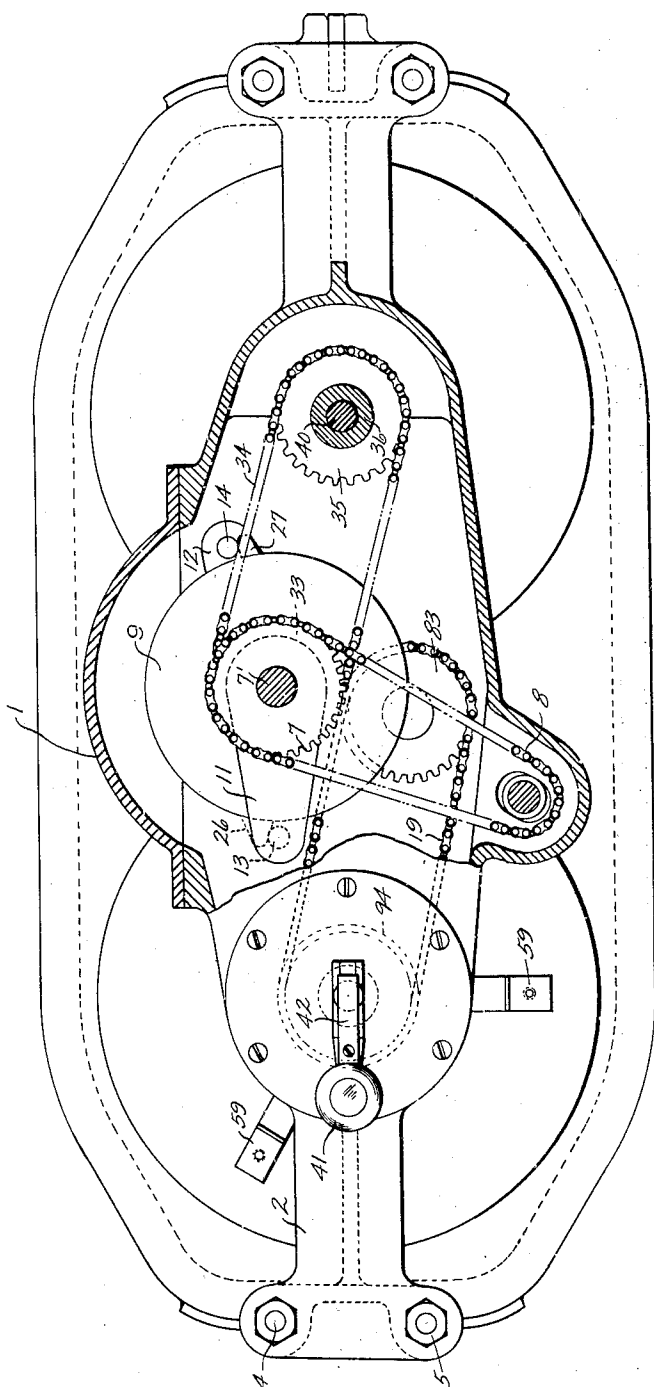
W. H. RICHARDS
DEVELOPER-ROLL FILM

2,480,880

Filed Dec. 19, 1945

4 Sheets-Sheet 2

Fig 2



BY

INVENTOR.
WILLIAM H. RICHARDS
Charles Kooty and
Samuel O. Wyatt
ATTORNEYS

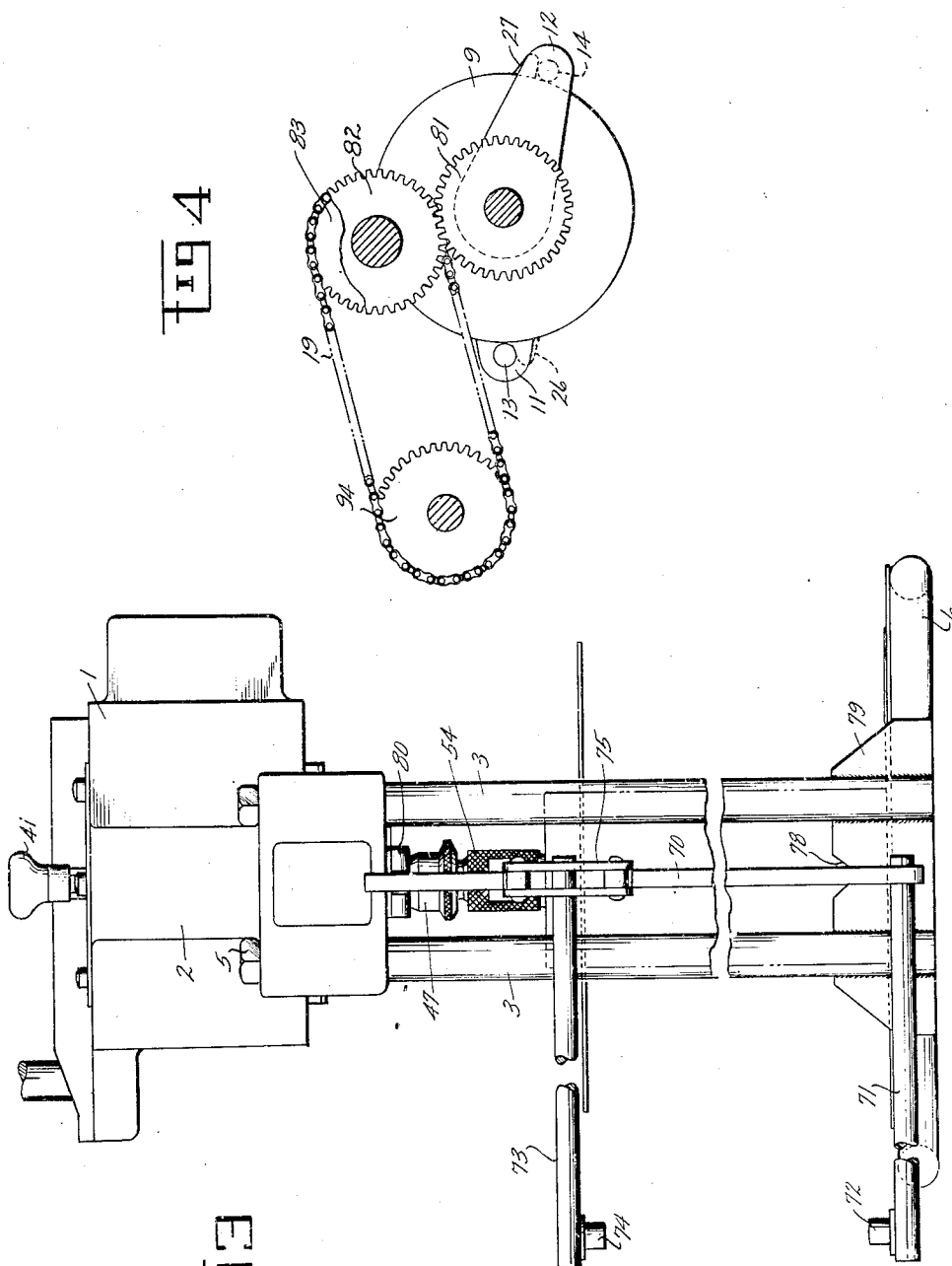
Sept. 6, 1949.

W. H. RICHARDS
DEVELOPER-ROLL FILM

2,480,880

Filed Dec. 19, 1945

4 Sheets-Sheet 3



BY

INVENTOR.
WILLIAM H. RICHARDS
Clare County and
Ramsey O. Hyatt
ATTORNEYS

Sept. 6, 1949.

W. H. RICHARDS
DEVELOPER-ROLL FILM

2,480,880

Filed Dec. 19, 1945

4 Sheets-Sheet 4

FIG 5

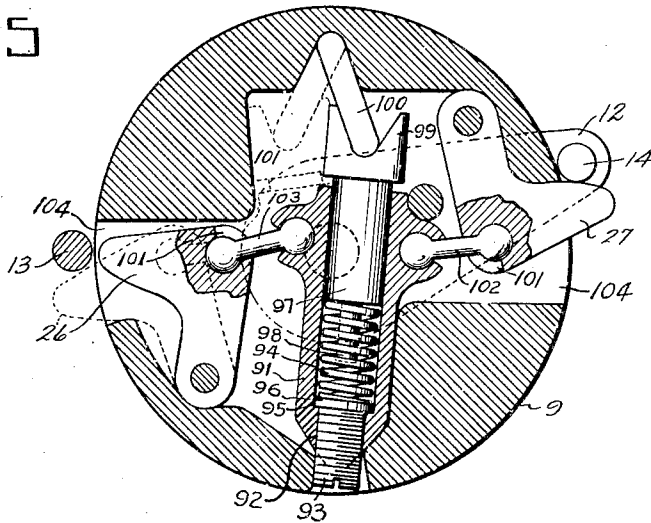
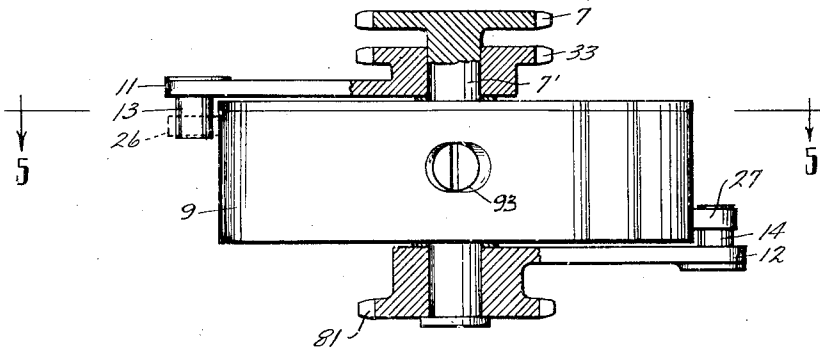


FIG 6



INVENTOR.
WILLIAM H. RICHARDS

BY

Clade County and
Samuel O. W. Galt
ATTORNEYS

UNITED STATES PATENT OFFICE

2,480,880

DEVELOPER-ROLL FILM

William H. Richards, Dayton, Ohio

Application December 19, 1945, Serial No. 636,042

8 Claims. (Cl. 242—55)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a roll film developing device.

In developing roll film of various width and length it is necessary to agitate the film within the developing tank during the process of developing. Where such operations must be conducted in the field or in improvised dark rooms or laboratories considerable difficulty has been experienced in developing film of great length. The apparatus for this purpose at present known to the art have not been found satisfactory for such work, said apparatus being too slow and comprising too many working parts causing serious delays and loss of the film being developed in the event of breakdown.

In accordance with this invention, a framework is constructed to be set within a film developing tank. This framework supports a power motive means, as an electric motor, that is coupled through a torque responsive reversing clutch mechanism to two film reels which are selectively powered for rotation in winding film alternately thereon. The torque responsive clutch mechanism has a shaft that is integral with and extends from a hollow drum to be driven by the motive power means. This shaft has a sprocket journaled thereon which includes a lever arm that projects over the peripheral edge of the drum. The other end of the drum has a similar shaft extension with a gear journaled thereon which gear includes a lever arm projecting over the peripheral edge of the drum. The gear is in mesh with another gear of a gear-sprocket cluster. Within the drum is a spring biased plunger having two related members with outer cam faces that extend alternately through peripheral openings at diametrically opposite points of the drum. The plunger is spring biased to be tripped longitudinally over center to force one or the other of the related cammed members radially outward to extend through the respective drum peripheral opening, one cammed member being engageable by the sprocket lever arm projection and the other cammed member being engageable by the gear lever arm projection. A predetermined pressure of one of the lever arm projections on its companion cammed member will force the plunger to shift over center to cause the other cammed member and cooperating lever arm projection to engage. Each sprocket is coupled through sprocket chains to rotate a sleeve member journaled in the

2

framework. Each sleeve member has a shaft extending therethrough that is coupled to the sleeve member by a clutch and coupled to each one of the film reels by a clutch. By this construction, one or the other of the reels is powered by the motive power means and any great load on the powered reel, as by the end of a film being reached during the developing process, will increase the torque in the coupling from the reel to the motive power means to cause the plunger to shift whereby the other reel will be powered to wind the film. In this manner, a film of great length can be continuously wound alternately on the reels in a developing tank without manual attention providing rapid development of the film in a simple manner with little or no cause for film damage. In the event of motive power failure, manual actuator means are provided on the shafts extending through the sleeves for use in carrying out the developing process.

It is an object of this invention to provide a roll film developing device that will accommodate films of great length and of various widths.

It is another object of the invention to provide a device of the character described of simple construction and manufacture, of relatively few working parts and that may be easily transported and readily assembled.

It is another object of the invention to provide a device of the character described that may be quickly and easily converted to manual operation in the event of power failure or mechanical failure of the driving mechanism without damage to the film being developed.

It is another object of the invention to provide a device of the character described having a novel reversing mechanism that will automatically wind and rewind roll film of considerable length within the developing tanks at a high rate of speed.

The above and other objects will be apparent from the following description and as illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical side view, partly in section,

Fig. 2 is a top plan view partly in section of the device shown in Fig. 1,

Fig. 3 is a side elevation showing the reel loader mounted on the framework.

Fig. 4 is a bottom view of the reversing mechanism illustrating the means of transmitting rotation to one of the film reels.

Fig. 5 is a cross-sectional view of the reversing mechanism taken on the line 5—5 of Fig. 6, and

Fig. 6 is an elevational view of the reversing mechanism shown partly in section.

Referring now more specifically to the drawings, the numeral 1 designates the driving mechanism housing having outwardly extended supports 2 which are supported by the side bars of the framework 3 and detachably secured thereto by the bolts 4 and nuts 5. Said framework comprises said supports 2, four side bars 3, and the base 6.

Mounted within the housing 1 is a suitable driving element (not shown) such as a conventional electric motor, which imparts power to the sprocket 7 through the chain 8, the shaft 7' of the sprocket 7 being integrally connected with the drum 9. Within the drum 9 is mounted a reversing mechanism, to be hereinafter more specifically described. Freely mounted on the shaft 7' adjacent the opposing sides of the drum 9 are the driven arms 11, 12, which extend outwardly and have the projecting lugs or fingers 13, 14, said finger 13 extending downwardly and said finger 14 extending upwardly with relation to the position of the drum.

On opposite sides of the drum 9 are the pivotally mounted alternately retractable driving arms 26, 27. Said driving arms 26, 27 are gradually reduced toward the outer end thereof forming dog faces. As the drum 9 rotates one of the driving arms 26, 27 will contact one of the projecting fingers 13, 14, of the driven arms 11, 12, depending on the direction of rotation of the reels to be hereinafter described, and impart rotation thereto. To reverse the mechanism, when arm 11 or 12, whichever is being driven, is stopped due to the end of the roll of film being reached, this driven arm will no longer turn and the driving arm in contact with the driven arm will be forced inwardly in a transverse direction forcing the opposing driving arm to move outwardly, moving the said driving arm into position to contact the respective driven arm, and impart rotation thereto, reversing the direction of wind of the film being developed.

When the finger 13 is in contact with the driving arm 26 the arm 11 is rotated, imparting rotation to the sprocket wheel 33, which drives the chain 34 which in turn rotates the sprocket wheel 35. The shaft of the wheel 35 is in integral connection with the sleeve 36 which rotates on suitable bearings 37, 37'. Mounted on the lower end of the sleeve 36 is a splash baffle 38 and mounted on the framework adjacent said baffle 38 is the outer splash baffle 39, designed to keep the developing fluid in the tanks from splashing into the driving mechanism hereinabove described during the developing process. Rotatably mounted within said sleeve 36 is an inner tubular shaft 40. The shaft 40 has a squared portion of reduced diameter at 15 which is fitted in the aperture 10 of the handle 41. This aperture is shaped to form an elongated slot adapted to permit transverse movement of the handle 41 on the shaft 40. The handle 41 has the projection 16 adapted to engage the pin 17 on the sleeve 36 through which rotation is imparted to the shaft 40. Mounted on the handle 41 is the spring 42, one end of said spring being secured to the handle 41 by means of a set screw 43 and the other end of the spring 42 extending over the aperture 10 in the handle through which the upper end of the shaft 40 extends. A conical shaped lug 44 on the spring 42 fits into a corresponding groove in the shaft 40 when the handle is in engaged position and moves out of said groove and out of

engagement with the sleeve 36, by a transverse movement of said handle, which also moves the projection 16 out of engagement with the pin 17, and permits the shaft 40 to be manually rotated free of the driving mechanism.

Mounted on the framework 1 by a suitable spring bolt 45 is the locking clamp 46 consisting of a flat hook-shaped member knurled at the free end, the hook thereof adapted to fit closely against 10 and partially enclose the shaft 40. Mounted on the lower end of the shaft 40 is the head 47 which is slotted at 48 to receive a drive pin 49 which is mounted in the reel shaft head 50 of the reel shaft 57. The reel shaft 57 is externally threaded at 53 to receive the knurled internally threaded hood 54 which is provided for a purpose to be hereinafter explained. The reel shaft 57 has a squared portion having an elongated aperture 52 to receive a locking member 55 having an elongated thin spring arm forming a reel clamp 56 adapted to fit into a notch 58' in the reel 58, which locks the reel in engagement with the shaft 57. The lower surface of said locking member 55 being notched to receive the lower surface 25 of the aperture 52. When the locking member 55 is in locking position, the knurled hood 54 may be screwed downwardly forming a locking means for holding the locking member 55 in engaged position.

The reel 58 and reel shaft 57, which form the subject matter of a copending application having Serial No. 635,815, filed by me on December 18, 1945, granted on May 16, 1947 and bearing the Patent Number 2,425,344, will now be more particularly described. The reel 58 comprises a tubular housing of noncorrosive metal, or similar material, with apertures 51 therein at spaced intervals to receive the clamps 59 for the adjustment of the loosely mounted film guides 18 to films of varying size. The shaft 57 is inserted into the reel 58 through suitable apertures provided therefor, and has the axial bearing 60 seated in the depression 61 of the base 6. The film to be developed is mounted on the reels 58, 55.

Mounted on one side of the framework 1 between the posts 3, 3 is the removable camera spool holder 70 comprising a post having a lateral bar 71 mounted on the lower end thereof, said bar 71 having an upstanding spindle 72 on the free end thereof adapted to receive the socket of a camera film spool. A similar bar 73 is adjustably mounted on said post 70 having a downwardly extending camera film spool spindle 74 on the free end thereof. The bar 73 is secured to the post 70 by means of the clamp 75, comprising a pair of plates embracing said post 70 and the handle 76 eccentrically fulcrumed on said plates, the offset projection of said handle fitting into one of several spaced depressions 68 in the post 70. The post 70 has an outwardly flared projection 77 on the lower end thereof forming a notch 77' to fit into the notch 78 of the cross plate 79 mounted on the lower end of the framework 1. The upper end of the post 70 is received by an embracing spring clamp means 80 mounted on the upper portion of the framework 1 between the posts 3, 3.

In operation the construction above described and shown in detail is that portion of the mechanism operated when driven by the arm 11. When the film has been entirely wound on the reel 58, the reversing mechanism will function and the power will be transmitted to the driven arm 12 which will transmit power through the gear 81 to

5

the gear 82 and sprocket wheel 83 and chain 19 to the driving mechanism 94 of the reel 85. The driving mechanism and construction of the reel 85 is substantially identical to that above described for the reel 58.

When it is desired to remove or replace a reel in the mechanism, the hook 46 is moved out of locked position and the handle 41 is raised lifting the driving mechanism off of the shaft 57, then the reel assembly is capable of being removed from the tank. In the event it is desired to remove the shaft 57 from the reel for the purpose of removing torn film, or for any other reason, the hood 54 may be unscrewed and the locking member 55 removed and the shaft 57 withdrawn from the reel through the apertures therein.

Referring now more particularly to the reversing mechanism as illustrated in Figs. 5 and 6, within the drum 9 is the actuator 91 seated in a depression in the walls of the drum shaped to permit the actuator to rock. The actuator has the concentric bore 92 in which is mounted the adjusting screw 93. The coil spring 94 is limited in its longitudinal movement by the shoulder 95 in the bore 92, and is in contact at one end with the washer 96 and adjusting screw 93, and at the other end with the base of the actuator arm 97, said actuator arm 97 having the elongated extension 98 extending from the base thereof through the axes of the coil spring 94 to maintain alignment of said spring. Mounted on the actuator arm 97 is the notched head 99 in which is positioned the free end of a pivotally mounted compression lever 100. The fixed end of said compression lever is mounted in the wall of the drum 9 diametrically opposite the rocking end of the adjusting screw 93, and said lever provides a snap action for fast, positive movement of the actuator, assuring movement of the actuator into full transverse position. Pivotally mounted in the drum and positioned on opposing sides of the actuator 91 are the dog levers 26, 27. Channels 101 in the dog levers 26, 27, and on opposing sides of the actuator 91 receive the ends of the link connections 102, 103, tying the dog levers to the actuator. Apertures 104, 104 in the side wall of the drum permit the dogs of the dog levers to move in and out of the drum 9. All of the mechanism within the drum is seated in a depression in the drum walls formed as shown in Fig. 5 of the drawing.

As power is transmitted through the gear 7 the drum 9 is rotated. One of the dog levers 26, 27 will be extended outside of the drum housing through one of the apertures 104 and will be contacted by the lug of one of the driven arms 11, 12. If the dog 26 is extended the lug 13 of the driven arm 11 contacts the dog 26 and imparts rotation through the driven arm 11 to the sprocket wheel 33, said wheel 33 carrying the chain 34 which drives sleeve 36 and the film reel 58 in one direction. When the film being wound is entirely wound on one reel, the opposing end of the film being locked in the other reel, the reels will stall holding the driven arm 11 immovable, and the torque of the drum 9 will force the dog 26 to move inwardly to clear the lug 13 of the driven arm 11. The inward movement of the dog 26 forces the actuator through the link connections 102, 103 to swing past center. The transverse movement of the actuator 91 causes actuator arm 97 to be placed under greater tension by moving the actuator through dead center position with the compression lever 100 compressing the coil spring 94, which after passing dead center the snap action of the lever 100 forces the actuator to the new

6

position quickly and will force the dog 27 to its fully extended position, the dog face thereof projecting outwardly through the aperture 104. The newly extended dog 27, upon completion of a partial rotation of the drum, will come in contact with the lug 14 of the driven arm 12 and rotation will be imparted to the gears 81 and 82 and thence through the sprocket wheel 83 and chain 19 to the sprocket wheel 94 which in turn drives the opposing reel 85 in a reverse direction, causing the film being developed to be re-wound on said reel. This reversing action is repeated each time the film is exhausted from one of the reels, the torque of the drum and immobility of the driven arm causing the driving arm to move inwardly and forcing the opposing driving arm outwardly into driving relation with the respective driven arm.

The film to be developed is usually received by the operator while it is still on the camera spool. The camera spool is mounted on the spool holder 70 by placing one end of the spool on the spindle 72 and adjusting the bar 73 and spindle 74 to the width of the spool so that spindle 74 holds the opposing end of the spool. The clamp 75 is then moved into clamping position, holding the bar 73 immovable on the post 70. The spool holder is then mounted on the developing device by fitting the notch 77' into the notch 78 of the cross plate 79 and the upper end of the post 70 urged into engagement with the clamp 80 on the framework 1. The free end of the film is then threaded through an aperture (not shown) in the reel housing 58 and an aperture (not shown) in the core of the reel shaft 57 locking the film thereon as more particularly described in the copending application above referred to. The locking member 55 is then inserted into the aperture 52 of the reel shaft 57, and fitted into locking position, locking the reel 58 and shaft 57 in rotatable relation. The hood 54 may be manually screwed down onto the locking member 55 holding same in locked position. The driving mechanism may then be activated either through activation of the motor or by moving the handle 41 out of engagement with the sleeve 36 and turning the reel manually through the shaft 40. After the film has been transferred from the camera film spool to the reel, the spool holder 70 may be removed from the framework of the developing device, the free end of the film threaded into the empty reel in the same manner as above described, the empty reel locked to the shaft as above described and the reels immersed in the developing tanks and the motor activated, and the developing process thus commenced. In the event of failure of operation of the driving mechanism due to motor failure or similar reasons, such as are often encountered in the field, the handle 41 may be moved out of engagement with the sleeve 36 by a transverse movement of the handle and the inner shaft 40 manually rotated by rotating the handle 41 and the film thus developed as above described. When the film is entirely wound on one reel, the handle of the empty reel will be used to reverse the wind, which procedure will be repeated until the film is developed.

The embodiments of the invention herein shown and described are to be regarded as illustrative only, and it is to be understood that the invention is susceptible to variation, modification, and change within the scope of the appended claims.

I claim:

1. In a film developing device for roll films and the like the combination of a power driven

reel winding and reversing mechanism and a pair of film reels, said mechanism being adapted to alternately drive said pair of film loaded reels, said driving mechanism having driving connections with a pair of driven sleeves, longitudinally slidable shafts within said sleeves having clutch members mounted on one end thereof, reel shafts in said reels having driving connections on one end thereof adapted to be engaged by said clutch members, transversely movable handles on one end of said slidable shafts having clutch members adapted to engage cooperating clutch members on said sleeves, manually operable locking means for locking said slidable shafts and reel shafts in clutched position and adapted to be moved out of locking position to permit the slidable shafts to be longitudinally moved into and out of clutching relation with said reel shafts.

2. In apparatus of the character described, a driving unit including a motor, and, on opposite sides thereof, substantially similar mechanisms each comprising a rotatable sleeve, means for driving the sleeve from the driving unit, a vertically movable shaft within the sleeve, clutching means adapted to impart rotation from the sleeve to the shaft, a film loaded reel, clutching means adapted to impart rotation from the shaft to the reel, locking means maintaining the shaft and reel in engagement, said locking means being adapted to be moved out of locking position to permit the shaft to be manually moved vertically within the sleeve and out of engagement with the reel.

3. In apparatus of the character described, a driving unit including a motor, and, on opposite sides thereof, substantially similar mechanisms each comprising a rotatable sleeve adapted to be driven by the driving unit, a vertically movable shaft within the sleeve, clutch means on the sleeve and the shaft consisting of a handle mounted on said shaft and adapted to impart rotation thereto and being movable transversely of the shaft, and a projection on the handle adapted to be carried into and out of engagement with a corresponding projection on the sleeve, a reel, clutching means on the shaft adapted to engage the reel to impart rotation from the shaft to the reel.

4. An apparatus of the character described having an automatic torque responsive reversing mechanism comprising an input shaft, a drum driven by said shaft, interconnected clutching elements carried by said drum and adapted to be extended and retracted from operative clutching position, cooperating driven elements mounted for free rotation concentric with said drum, snap action means within said drum and responsive to predetermined torque thereon for urging said interconnected clutching elements into and out of clutching engagement with the respective driven elements, and oppositely rotatable output drives actuated by the respective driven elements.

5. A reversing mechanism for roll film developing devices comprising a drive shaft, a drum mounted on said shaft, a pair of driven members freely mounted on said shaft concentric with said drum, a pair of driving members pivotally mounted within said drum, apertures in the side walls of said drum through which the contact ends of said driving members move into driving position, means for moving said driving members alternately into driving relation, each with its respective driven member.

6. An apparatus of the character described having an automatic torque responsive reversing mechanism comprising an input shaft, a drum driven by said shaft, interconnected clutching elements carried by said drum and adapted to be extended and retracted from operative clutching position, cooperating driven elements mounted for free rotation concentric with said drum, snap action means within said drum responsive to a predetermined torque thereon for urging said interconnected clutching elements into and out of clutching engagement with the respective driven elements, means on said driven elements for moving the engaged clutch elements inwardly out of clutching engagement, and oppositely rotatable output drives actuated by the respective driven elements.

7. An apparatus of the character described having an automatic torque responsive reversing mechanism comprising an input shaft, a drum driven by said shaft, interconnected clutching elements carried by said drum and adapted to be extended and retracted from operative clutching position, cooperating driven elements mounted for free rotation concentric with said drum, snap action means within said drum responsive to a predetermined torque thereon for urging said interconnected clutching elements into and out of clutching engagement with the respective driven elements, dog faces on said clutching elements adapted to engage lugs on said driven elements, and oppositely rotatable output drives actuated by the respective driven elements.

8. An apparatus of the character described having an automatic torque responsive reversing mechanism comprising an input shaft, a drum driven by said shaft, interconnected clutching elements carried by said drum and adapted to be extended and retracted from operative clutching position, cooperating driven elements mounted for free rotation concentric with said drum, snap action means within said drum responsive to a predetermined torque thereon for urging said interconnected clutching elements into and out of clutching engagement with the respective driven elements, comprising an actuator adapted to rock in a depression in said drum, a coil spring mounted in said actuator, an adjustable screw in contact with and determining the torque of said spring, a movable head guiding the movement of said actuator in contact with said spring at one end and notched at the other end, a pivotally mounted compression lever positioned diametrically opposite the base of said actuator, the free end thereof seating in said notch on said head adapted to urge said actuator into its respective lateral positions, means connecting said actuator with said clutching elements, and oppositely rotatable output drives actuated by the respective driven elements.

WILLIAM H. RICHARDS

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,213,489	Binder	Jan. 23, 1917
1,969,823	Smith	Aug. 14, 1934
2,356,421	Morse	Aug. 22, 1944