July 19, 1966 J. L. JIRUSKA 3,261,278

FILM PROCESSING APPARATUS

Filed Dec. 9, 1963 3 Sheets-Sheet 1

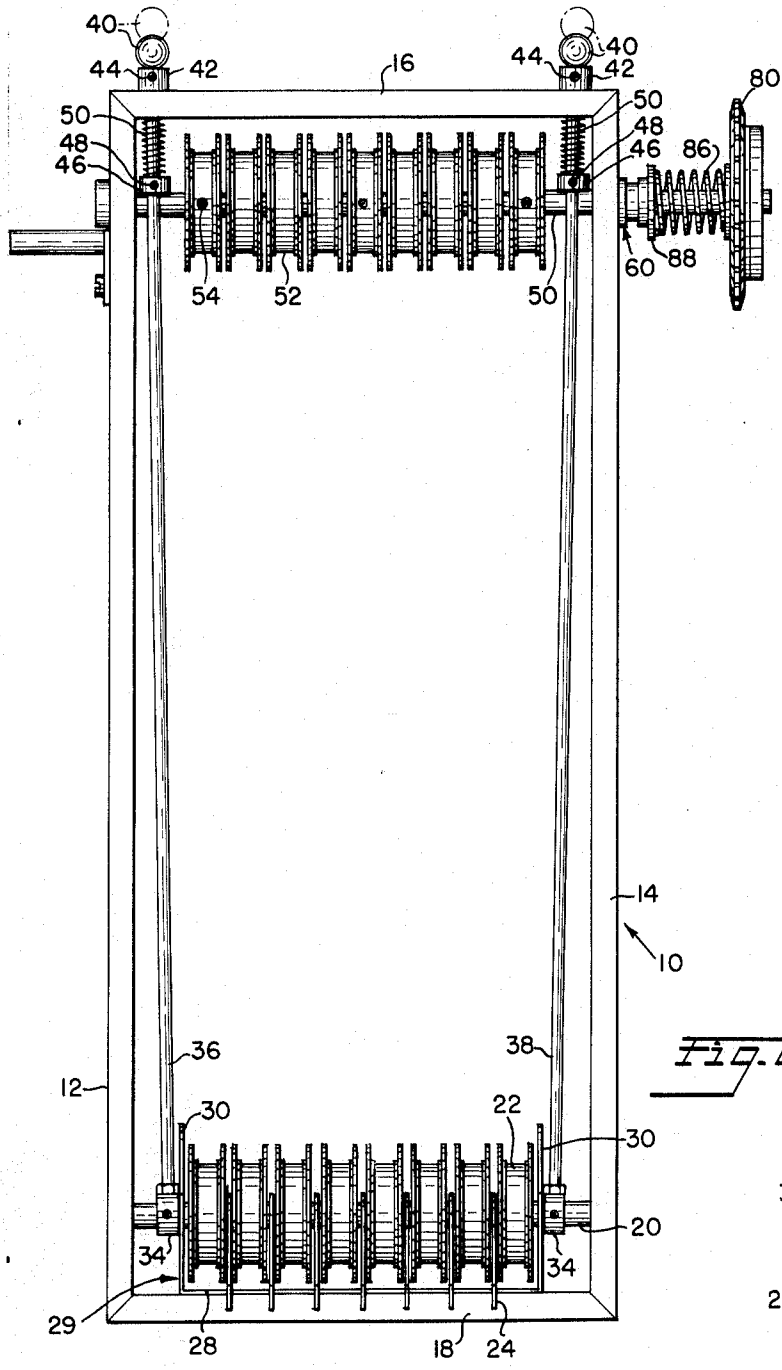


Fig. 1

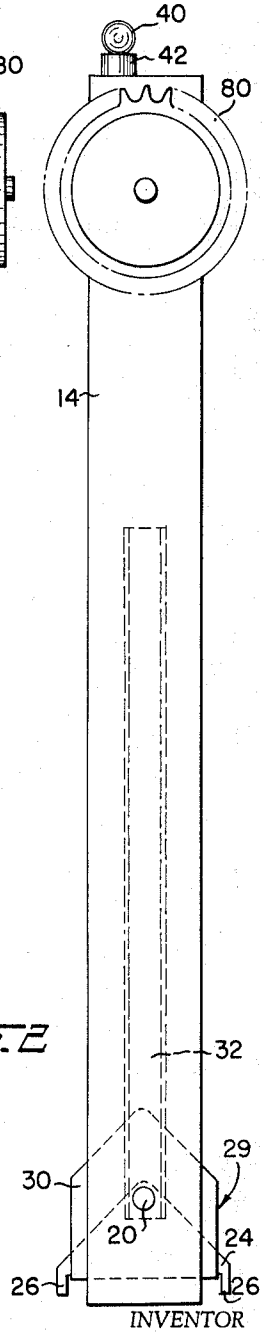


Fig. 2

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July 19, 1966 J. L. JIRUSKA 3,261,278

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Filed Dec. 9, 1963 3 Sheets-Sheet 2

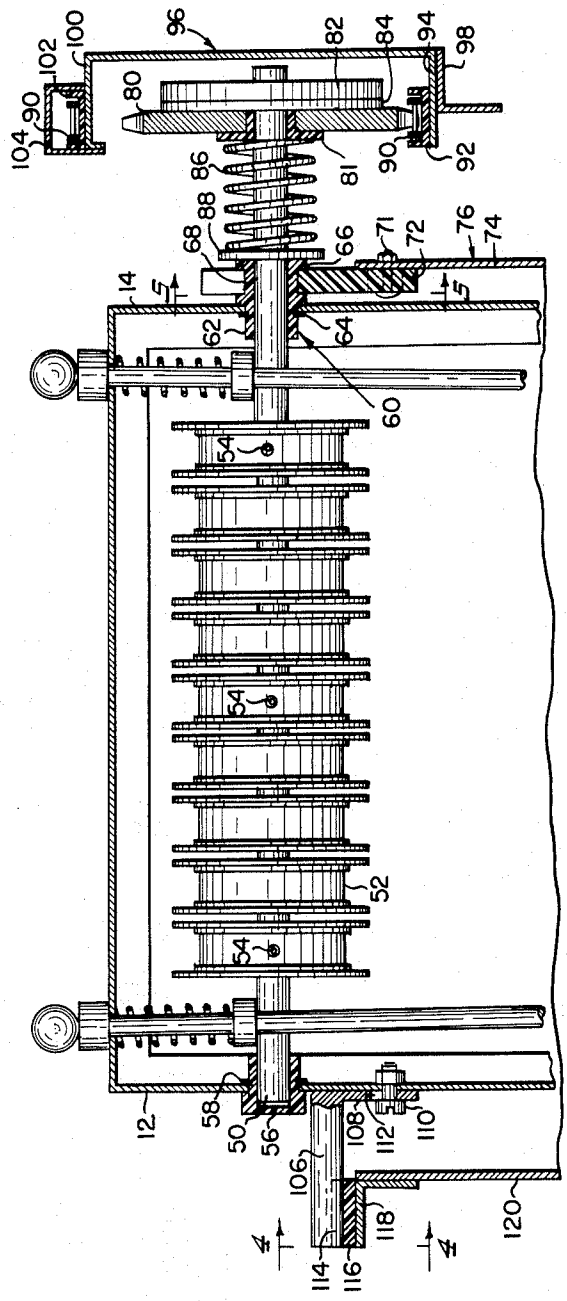


FIG. 3

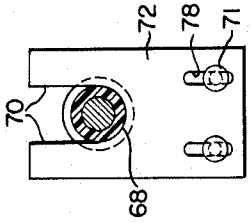


FIG. 5

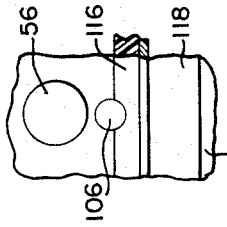


FIG. 4

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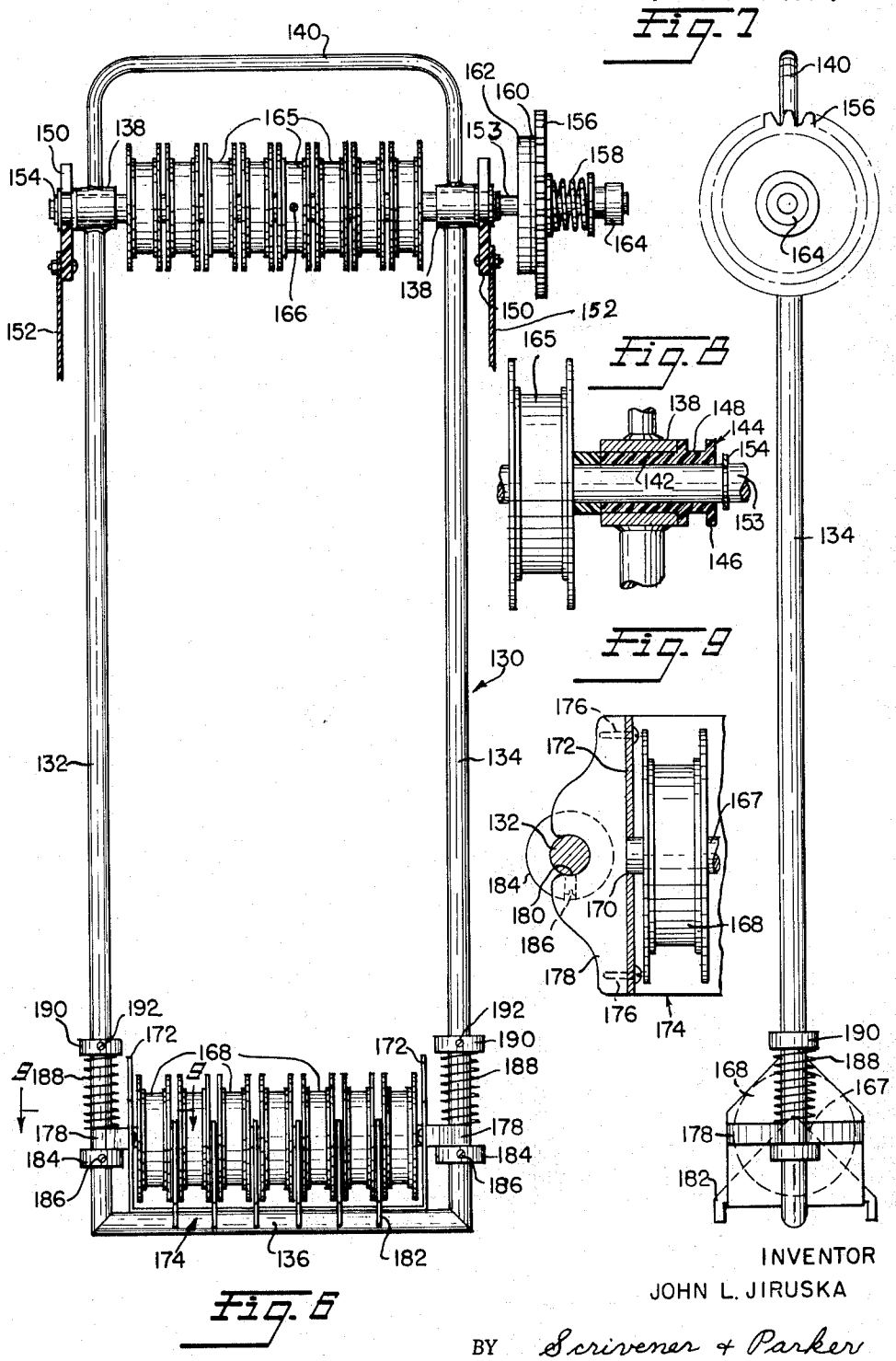
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July 19, 1966 J. L. JIRUSKA 3,261,278

FILM PROCESSING APPARATUS

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3,261,278

FILM PROCESSING APPARATUS

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11 Claims. (Cl. 95—94)

The present invention relates to film processing apparatus particularly of the type which utilizes a plurality of transportable racks for conducting a long length of film through the various baths used in developing film.

Film processing apparatus of the rack type is well known to the prior art. Heretofore, however, it had been the general belief and practice of the art to provide means for driving the lower spool shaft of each rack, as shown for example, in the patent to Good, No. 2,967,473, or where the upper shaft of the several racks have been positively driven it has been thought necessary to advance the film by means of sprocket type spools fixed to the upper rack as shown, for example, in the patent to Capstaff, No. 1,664,735. In modern times, however, much film is not provided with sprocket holes and this type of film has heretofore been advanced through rack type processing machines by frictional engagement with spools carried on the positively driven lower shaft of the film rack and the concept of frictionally advancing film in a multi-rack machine through the medium of a positively driven upper shaft has simply not been resorted to. Obviously the mechanism required to drive the lower shaft is expensive, cumbersome and subject to frequent break-down because of the complex shafting and gearing required to transmit the driving power at the upper end of the developing tanks downwardly through the tanks to the lower shaft. Further with the lower shaft being positively driven, it will be apparent that the lower shaft cannot be vertically adjusted with respect to the upper shaft to control the time of film treatment in the individual tanks.

The object of the present invention is to provide an improved rack construction wherein the upper shaft carries friction type rollers and is positively driven from a central power source which serves to drive all of the corresponding upper shafts of the several racks which may be employed in film processing apparatus.

Another object of the invention is to provide a simplified rack construction which permits the rapid removal of a rack in the event of film breakage by a mere lifting action of the rack which eliminates the connection or disconnection of the rack from the driving means except as afforded by the lifting action alone.

Yet another object of the invention is to provide a rack of the foregoing nature which in addition affords means for adjusting the film footage capacity of the rack by raising or lowering the lower shaft with respect to the upper shaft without in any way affecting the drive means of the upper shaft while at the same time providing uniform yielding tension on the film regardless of the adjusted position of the lower rack.

Still another object of the invention is to provide improved means for stabilizing the lower shaft.

Yet another object is to provide an improved rack construction which accomplishes all of the foregoing objects yet is strong and rigid while being simple and inexpensive to manufacture.

Other objects and their attendant advantages will become apparent as the following detailed description is read in conjunction with the accompanying drawings wherein:

FIG. 1 is a front elevational view of a rack incorporating the features of the invention;

FIG. 2 is a side elevational view of the rack of the invention;

FIG. 3 is an enlarged cross-sectional view, partly in elevation of the upper end of the rack of the invention;

FIG. 4 is a detailed view looking in the direction of the arrows 4—4 of FIG. 3;

FIG. 5 is a detailed cross-sectional view taken on the line 5—5 of FIG. 3;

FIG. 6 is a front elevational view of a second embodiment of a rack incorporating features of the invention;

FIG. 7 is a side elevational view of the embodiment of FIG. 6;

FIG. 8 is an enlarged cross-sectional view of a detail of the second embodiment of the invention; and

FIG. 9 is an enlarged horizontal cross-sectional view taken substantially on the line 9—9 of FIG. 6.

Referring now to the drawings and particularly to FIG. 1 the rack **10** of the invention comprises a continuous rectangular frame having flanged side parts **12, 14** and upper and lower parts **16, 18**. At the lower end of the rack is a shaft **20** having freely mounted thereon a plurality of friction type film spools **22** which are preferably separated from each other by spacer members **24** which are pivoted at their upper ends to the shaft **20** as indicated in FIG. 2. The spacer members **24** are of conventional construction and have downwardly extending legs **26** which straddle the outer edges of the lower part **28** of a shallow U-shaped bracket member **29** whose opposed ends **30** are pivoted to the shaft **20** outwardly of the outermost spools as clearly shown in FIG. 1. The ends of the shaft **20** are slideably received in vertical guide channels **32** fixed to the inner surface of the frame side parts **12, 14** and the shaft **20** is supported in its position of use by a pair of opposed rings **34** to the exterior surfaces of which are threadedly connected the lower ends of rods **36, 38** whose upper ends extend upwardly through suitable apertures in the upper frame part **16** and have affixed thereto suitable knobs **40**. Carried on the shafts **36, 38** between the knobs **40** and the upper surface of the frame part **16** are collars **42** which are releaseably fixed to the rods by set screws **44**. Also fixed to the rods **36, 38** below the upper frame **16** is a second set of collars **46** which are likewise releaseably fixed to the rods by means of set screws **48** are interposed between the upper surface of the lower collars **46** and the lower surface of the upper frame part are compression springs **50** which yieldingly resist tendency of the lower shaft to move upwardly with respect to the frame as may occur when film tension increases. It will be apparent that the lower shaft may be vertically adjusted to any desired operative position by merely backing off the set screws **44, 48** of the respective collars **42, 46** so that the rods **36, 38**, may be pulled upwardly to the desired position whereupon the set screws **44** of the upper collars **42** are tightened to retain the rods in their adjusted position. Thereafter the set screws **48** of the lower collars **46** are tightened with the upper ends of the spring **50** barely engaging the lower surface of the frame part **16** so that the lower shaft in an adjusted position has the same degree of movement upwardly due to film tension against the spring force as it does in the initial position of FIG. 1.

Referring now to FIG. 3 the rack of the invention is provided with an upper spool shaft **50** carrying thereon a plurality of friction type spools **52** of which one or more (three being shown) are positively fixed to the shaft by means of set screws **54**, the remaining spools being freely mounted on the shaft. The shaft **50** is rotatably supported at one end in a suitable bearing **56** which may comprise a headed, partly bored cylindrical member of plastic such as high density polyethylene

which is inserted through a suitable opening in the side part 12 of the frame and retained in place by a conventional spring clip 58. The opposite end of the shaft 50 is supported in a bearing member 60, also of plastic, having a reduced diameter inner end 62 which is inserted through an opening in the side frame member 14 and retained in place by a spring clip 64. The enlarged outer end 66 of the bearing member is provided with an annular groove 68 which is cradled in a U-shaped slot 70 formed in the upper end of a bearing support member 72 which is affixed by bolts 71 to the inner upper edge of the side wall 74 of a developing tank generally indicated in FIG. 3 by the numeral 76. As illustrated in FIG. 5 the bearing support member may be adjusted slightly in the vertical direction, for purposes that will become apparent, by providing slots 73 for receiving the fastening bolts 71.

The right hand end of the shaft 50 extends outwardly beyond the bearing member 60 and carries adjacent its outer end a sprocket wheel 80 which is operatively connected to the shaft through a clutch arrangement comprising an end disc 82 rigidly fixed to the shaft and a friction member 84 sandwiched between the sprocket wheel 80 and the disc. The sprocket wheel is provided with a central, flanged bearing member 81 of plastic which is free to rotate with respect to the shaft 50. The sprocket 80 is urged against the friction member 84 by a compression spring 86 whose outer end bears against the flange of the bearing member 81 and whose inner end bears against one side of a disc 88 which is free to rotate on the shaft and whose opposite side engages the confronting face of the bearing 66.

In accordance with the invention the teeth of the sprocket wheel 80 are engaged with an endless sprocket chain 90 whose lower run is slideably supported in a channel shaped member 92, which may also comprise polyethylene plastic, fixed to the upper surface of the inwardly extending flange 94 of a frame member 96 supported outwardly of the developing tanks 76 on a suitable welded framework composed preferably of channel members and generally indicated by the numeral 98. The upper flange 100 of the frame member 96 supports a second channel 102 which serves to slideably support the upper run of the endless sprocket chain 90 and desirably the upper channel is enclosed in a suitable housing 104. Those skilled in the art will recognize that the frame member 96 and the elements supported thereby run the entire length of the developing machine and adjacent one end of the machine suitable power means such as an electric motor (not shown) is provided to drive the sprocket chain.

Referring now to the left hand side of FIG. 3, the frame 10 of the invention is supported in its position of use on that side by the provision of an outwardly extending rod 106 integral with a bracket member 108 fixed by bolt means 110 to the side part 12 of the frame. If desired the bolt may extend through a slot 112 in the bracket so as to permit a limited degree of vertical adjustment of the rod 106. The outer end of the rod rests in a groove 114 formed in a continuous strip 116 preferably of plastic and supported on the horizontal flange 118 of a continuous channel member which is fixed to the outer surface of the left hand wall 120 of the several developing tanks used in the apparatus.

In use, blank leader strip is threaded around the spools of the several racks, as is conventional and the racks are installed in their position of use in the tanks merely by being lowered until the rod 106 on the left hand side of the frame is engaged in its groove 114 and the annular groove 68 of the bearing member 60 on the right hand side of the frame is received in the notch 70 of the bearing support 72. Initially, it may be necessary to adjust the bearing support slightly vertically by releasing the bolts 71 until the teeth of the sprocket wheel are properly received in the sprocket chain; that is to say, the teeth should engage the chain but should be just clear of the upper surface of the chain support. In actual practice, it has been found that there is no difficulty in maintaining reasonable production line tolerances so that only a very slight adjustment of the bearing support 72 is ever required with this adjustment being of such small degree that whatever slight cocking of the rack may result is almost imperceptible and is never sufficient in any way to interfere with the efficiency of the apparatus.

After the apparatus has been operated and should the exposed film be broken, as quite often occurs, the entire frame nearest the break is merely lifted free of the tanks in one quick lifting action and a second frame already pre-threaded with lead film is immediately lowered into position and the two ends of the broken, exposed film are stapled to the ends of the pre-threaded lead film and developing operation proceed. With applicant's improved frame, the time required to replace a frame and recommence developing operations following a film break has never exceeded twenty seconds.

As has been previously described, if the particular type of film requires a less period of time in a particular developing solution, the lower spool shaft 20 is merely adjusted vertically upwardly with respect to the upper spool shaft 50 and is retained in the raised position by suitable manipulation of the collars 42, 46 carried on the rods 36, 38. It will be apparent that where the lower shaft is positively driven as is customary in the prior art such vertical adjustment is not possible.

The embodiment of the invention disclosed in FIGS. 6 through 9 is functionally substantially identical to the described first embodiment. The second embodiment, however, instead of being composed of a frame of flanged sheet material is constructed of welded rod material, preferably stainless steel, to form a strong, integrated structure which is inexpensive to manufacture and is particularly, though not exclusive suited for use in developing apparatus of limited size and capability, such as for the quick development of black and white film for use in local television studios.

The rack illustrated in FIGS. 6 and 7 is generally indicated by the numeral 130 and comprises a pair of vertical side rods or bars 132, 134 which are preferably circular in cross section and are joined together at their lower ends by a horizontal cross bar 136 whose ends are preferably welded to the lower ends of the side bars 132, 134. Welded to the upper ends of the respective side bars are bearing supports 138 which are preferably circular in cross section and have integrally connected to their upper side, as by welding, the ends of an inverted U-shaped rod 140 which serves to rigidify the rack and also functions as a handle.

As illustrated in FIG. 8 each bearing support 138 is a short, hollow tube which is adapted to receive with a substantially force fit the cylindrical part 142 of a bearing member 144 composed of a plastic material which is preferably high density polyethylene. The outer end of each bearing memebr 144 is provided with a flange part 146 which has an annular groove 148 thereon adapted to nest in a U-shaped notch of respective support members 150 which are fixed to the upper inner edges of opposite tank side walls 152.

The bearing members 144 rotatably receive the upper spool shaft 153 which extends outwardly beyond the bearing members on both sides to receive spring clips 154. On the right hand side, the spool shaft 152 extends substantially beyond the bearing support and carries thereon a freely mounted sprocket 156 which is urged by a spring 158 against a friction pad 160 whose inner face bears against a clutch plate 162 fixed to the shaft 152. The outer right hand end of the shaft 152 may be suitably threaded to receive a nut 164 which serves as a backup for the clutch spring 158.

The shaft **153** carries friction type rollers or spools **165** one or more of which is fixed to the shaft by means of set screws **166**. When the rack of FIGS. 7 and 8 is in its position of use the sprocket wheel **156** engages a sprocket chain (not shown) which may be arranged substantially as shown in FIG. 3.

The lower spool shaft **167** carrying freely rotatable spools **168** is supported at its opposite ends in aligned openings **170** through upstanding end flanges **172** of a U-shaped bracket member **174**. Fixed to the outer sides of the flanges **172** by screws **176** are combined guide and support members **178** which are provided at their outer ends with arcuate slots **180** adapted to straddle the side members **132, 134** of the rack as illustrated in FIG. 9. The rollers **168** are separated from each other by spacer members **182** which are identical in function to the spacer members **24** shown in conjunction with FIGS. 1 and 2.

It wil be apparent in FIG 6. that the lower roller assembly may be readily removed from the rack by raising one end thereof until the groove **180** is free of its side rod whereupon the entire assembly may be moved clear of the rack. Thereafter the lower shaft may be disconnected from the bracket **174** merely by forcing the flanges **172** away from each other until the openings **170** are clear of the ends of the shaft **167**. When the assembly is to be replaced in its position of use the reverse procedure is followed and as the assembly is moved to its normal horizontal position of FIG. 6 the guide members **178** react against the side rods **132, 134** to urge the flanges **172** slightly towards each other whereupon the lower shaft is effectively locked in place.

The lower shaft assembly may be adjusted vertically with respect to the upper shaft through the use of lower collars **184** which are secured by set screws **186** to the side rods **132, 134**. The lower surfaces of the guide members **178** engage the upper surfaces of the collars **184** and acting downwardly on the upper surfaces of the guide members **178** are springs **188** whose upper ends engage collars **190** which are fixed to the side rods by means of set screws **192**. It will be apparent in FIG. 6 that when the lower shaft assembly is to be raised, it is only necessary to loosen all of the set screws of the collars **184, 190** and then push upwardly on the lower collars until the entire assembly is in the selected raised position whereupon all of the set screws are tightened. It will be obvious that with this arrangement regardless of the selected position, the lower shaft assembly will always have limited freedom of movement in an upward direction against the springs **188** so as to compensate for film tension increase.

From the foregoing description it should be apparent that the present invention has provided a film rack and drive means of extreme simplicity and reliability which incorporates the necessary elements required by sound film developing practices and achieves this through frictional advance of the film by means of positive drive of the upper spool shaft from a power source common to each rack with the rack being readily removable from its position of use without requiring any external connections between the rack, the drive or the rack support. It will, of course, be quite apparent to those skilled in the art that the invention is susceptible of a variety of changes and modifications without however departing from the scope and spirit of the appended claims.

What is claimed is:

1. A portable film rack for film processing apparatus comprising a closed rigid frame having side parts and upper and lower end parts, an upper spool shaft rotatably fixed in the frame between the side parts thereof, a lower spool shaft, guide means fixed in said frame and cooperating with said lower spool shaft to permit vertical movement thereof with respect to said upper spool shaft, a support for said lower shaft, vertically movable rod means connected to said support and slidably extending through the upper end part of said frame, releasable locking means cooperating with said rod means and with said frame for retaining said lower shaft in a selected vertical position with respect to the upper shaft, said upper spool shaft extending outwardly at one end beyond its adjacent side part a sprocket wheel carried by said extending end part, and clutch means operatively connecting said sprocket wheel and said shaft.

2. The rack of claim **1** wherein said releasable locking means comprises a releasable collar on said rod above said upper end part and adapted to engage the upper end part to positively limit the downward movement of said rod means and said lower shaft with respect to said upper shaft and including a second releasable collar carried by said rod means below said upper end part of said frame and spring means interposed between said second collar and said upper end part yieldingly opposing upward vertical movement of said lower shaft with respect to said upper shaft.

3. In combination with film processing apparatus including tank means, a continuously driven endless sprocket chain and an upwardly open, supporting and guiding means adjacent the upper end of said tank means for at least one of the runs of said sprocket chain, a portable film rack comprising a closed rigid frame having side parts and upper and lower parts, an upper spool shaft rotatably fixed in said side parts and having a projecting end part extending beyond the adjacent side part, a lower spool shaft in said frame, a sprocket wheel carried by the projecting end part of said upper spool shaft, clutch means operatively connecting said sprocket wheel to said shaft, and support means cooperating with said tank means and said frame for supporting the latter in said tank with said sprocket wheel operatively engaged with the supported and guided run of said sprocket chain.

4. The combination of claim **3** wherein said support means comprises outwardly extending projection fixed to the side parts of said frame and including fixed projection receiving parts adjacent the upper ends of said tank for supporting said projections solely under the influence of gravity.

5. A portable film rack for film processing apparatus comprising a closed rigid frame having side parts and upper and lower end parts, an upper spool shaft rotatably fixed in the frame between the side parts, a lower spool shaft, a plurality of spools carried by said shafts, each of said spools being of the friction variety, at least one of said spools being fixed to said upper spool shaft for rotation therewith, guide means carried by said frame and cooperating with said lower spool shaft to permit vertical movement thereof with respect to said upper shaft, resilient means cooperating with said frame and said lower spool shaft for yieldingly opposing movement thereof towards said upper spool shaft, and driven means including a clutch carried by said upper spool shaft for connecting said shaft to a source of power external to said rack.

6. A portable film rack for film processing apparatus comprising a closed frame having laterally spaced vertical side parts and vertically spaced upper and lower horizontal end parts, a rotatable upper spool shaft extending between said side parts adjacent the upper end of said frame, friction type film spools carried by said upper spool shaft, at least one of said spools being fixed to said shaft for rotation therewith, driving means carried by said upper spool shaft for operatively connecting said shaft to a source of power, a lower spool shaft carried by said frame, a plurality of friction type spools freely carried by said lower spool shaft, means for adjusting the vertical position of said lower spool shaft with respect to said upper shaft, said means comprising a pair of guide means, each adjacent the opposed ends of said lower spool shaft, a pair of laterally spaced, releasable abutment means engaging said frame and said guide means for positively preventing downward movement of said lower spool shaft from a selected raised position while permitting upward movement thereof, and adjustable spring means acting on said lower spool shaft and yieldingly opposing

upward movement of said lower shaft from its selected raised position with respect to the upper shaft.

7. A portable film rack for film processing apparatus comprising a closed metallic frame having side parts and upper and lower end parts, an upper spool shaft rotatably fixed to said frame adjacent the upper end thereof, friction type film spools carried by said upper spool shaft, at least one of said spools being fixed to said shaft for rotation therewith, means for operatively connecting said upper spool shaft to a source of power to rotate the same, a lower spool shaft assembly comprising a shallow U-shaped bracket member having opposed upstanding side parts adjacent the side parts of said frame and containing aligned openings, a lower spool shaft having opposed ends received in said openings, a plurality of friction type spools freely carried on said lower spool shaft, guiding means connected to said lower spool shaft assembly and extending in opposite directions away from the side parts of said bracket member and into sliding engagement with the side parts of said frame whereby said lower assembly may be moved vertically with respect to said upper said spool shaft and in parallelism with the latter, adjustable, releasable abutment means cooperating with said lower assembly and with said frame for preventing movement of said assembly downwardly from a selected raised position while permitting upward movement of said assembly, and resilient means acting at all times on said assembly when in a selected position to yieldingly oppose upward movement of said assembly from said selected position.

8. The rack of claim 7 wherein said side parts of said frame comprises rod-like members and wherein said guide means comprise laterally extending parts fixed to the end parts of said U-shaped bracket and having at their outer ends notches complementary in shape to the cross-section of said rod-like members, said notches slidably receiving said rod-like members.

9. The rack of claim 8 including bearing means for supporting said upper spool shaft, said means comprising aligned tubular parts fixed adjacent the upper ends of said rod-like members, flanged cylindrical sleeve-type bearings received in said tubular members and rotatably supporting said upper spool shaft adjacent the ends thereof, said upper member of said frame comprising an inverted, U-shaped rod-like member having ends fixed to the upper sides of said tubular members.

10. The rack of claim 8 wherein said abutment means comprises releasable collars carried by said side members and engaging the lower sides of said laterally extending parts and wherein said resilient means comprise springs slidably received on said side members and having lower ends engaging the upper side of said laterally extending parts, and second releasable collars carried on said side parts and engaging the upper ends of said springs.

11. A portable film rack for film processing apparatus comprising a closing frame having laterally spaced side parts and upper and lower end parts, an upper spool shaft rotatably fixed in said frame adjacent the upper ends thereof, a plurality of friction type spools carried on said upper spool shaft, at least one of said spools being fixed to said shaft and adapted to frictionally advance film trained thereover, one end of said upper spool shaft extending laterally beyond a side part of said rack, a sprocket wheel freely carried on said projecting end, clutch means operatively connecting said sprocket wheel to said shaft, a lower spool shaft carried in said frame, means cooperating with said frame and said lower spool shaft for enabling said shaft to be guided in said frame towards and away from said upper spool shaft, adjustable means cooperating with said lower spool shaft and said frame for positively limiting the downward movement of said lower spool shaft from a selected position with respect to said upper spool shaft, adjustable spring means acting on said lower spool shaft to yieldingly oppose movement of said lower spool shaft from its selected position with respect to said upper spool shaft and a plurality of film spools freely carried on said lower spool shaft.

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