Aug. 5, 1941. J. G. ZUBER 2,251,772

REEL DRIVE

Filed July 13, 1939 3 Sheets-Sheet 1

Fig. 1.

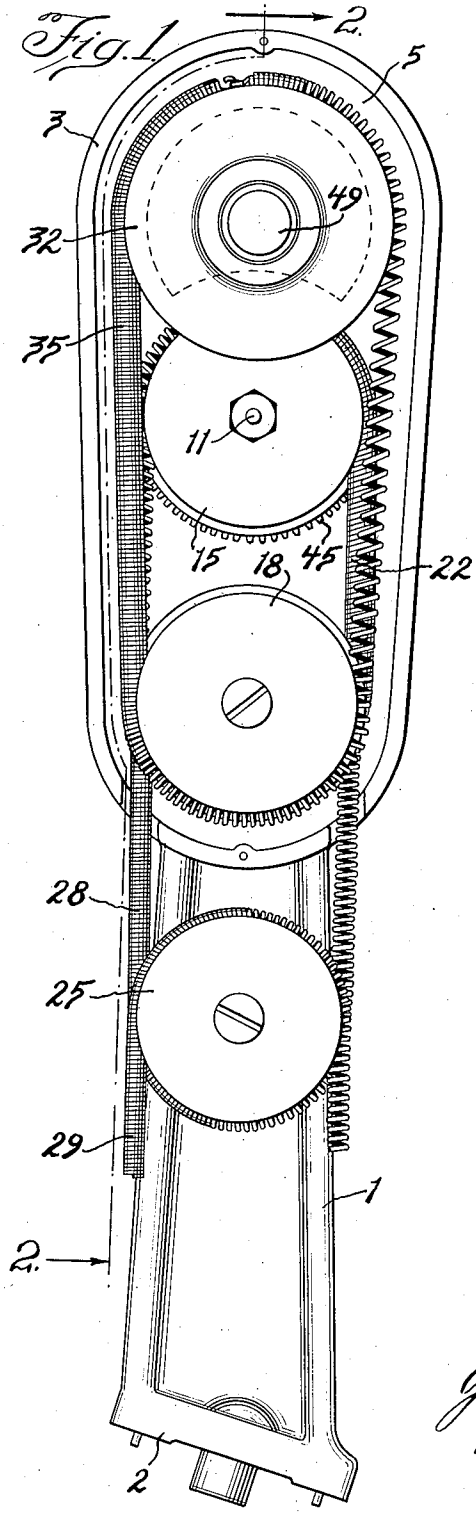
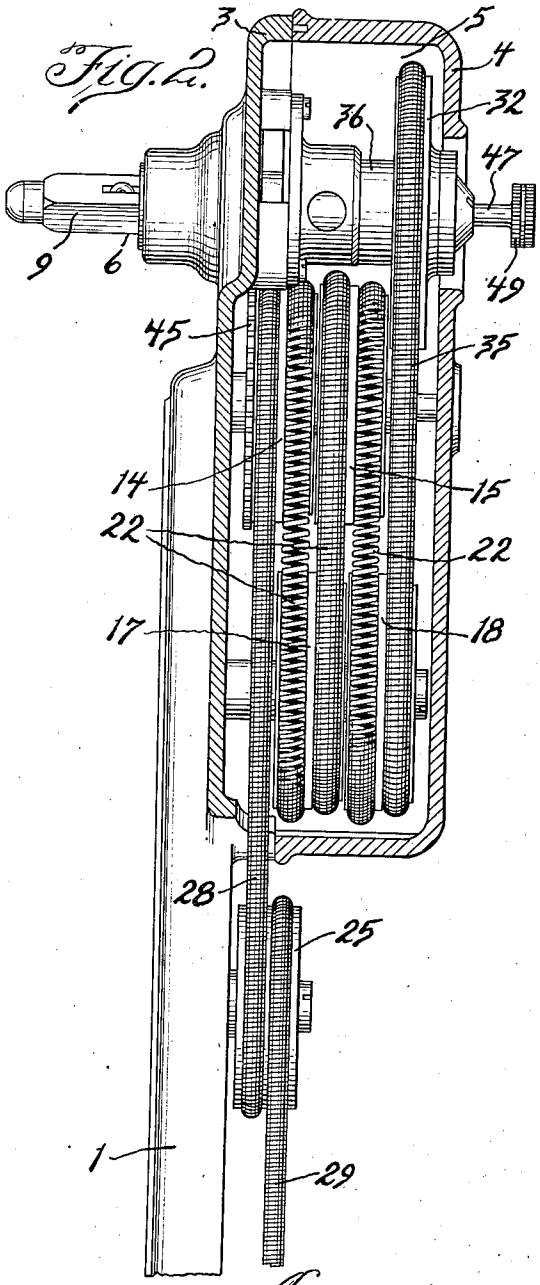


Fig. 2.



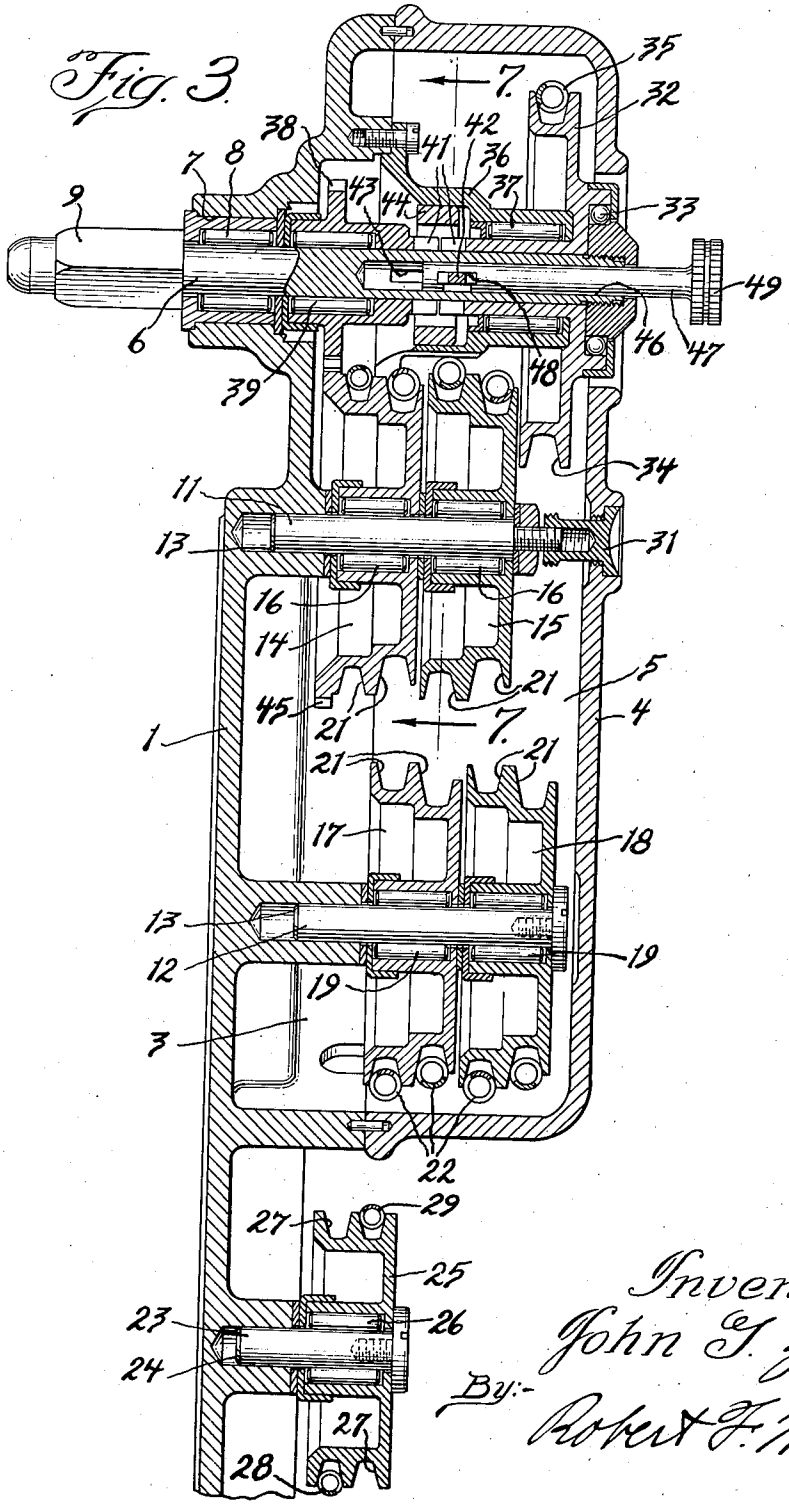
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Fig. 3.



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Fig. 4.

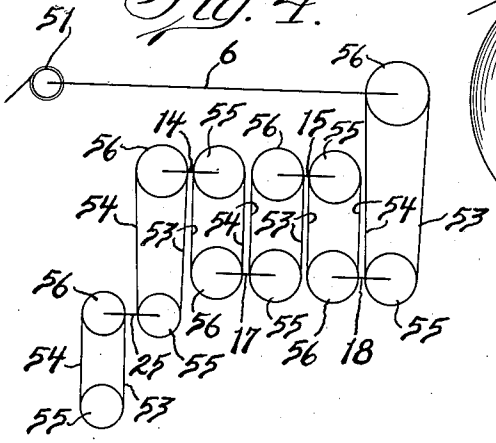


Fig. 5.

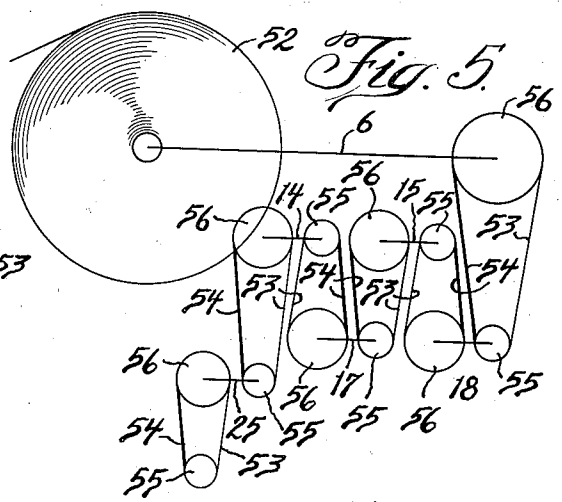


Fig. 6.

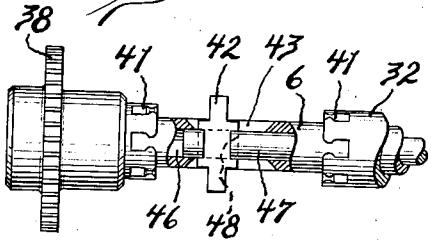
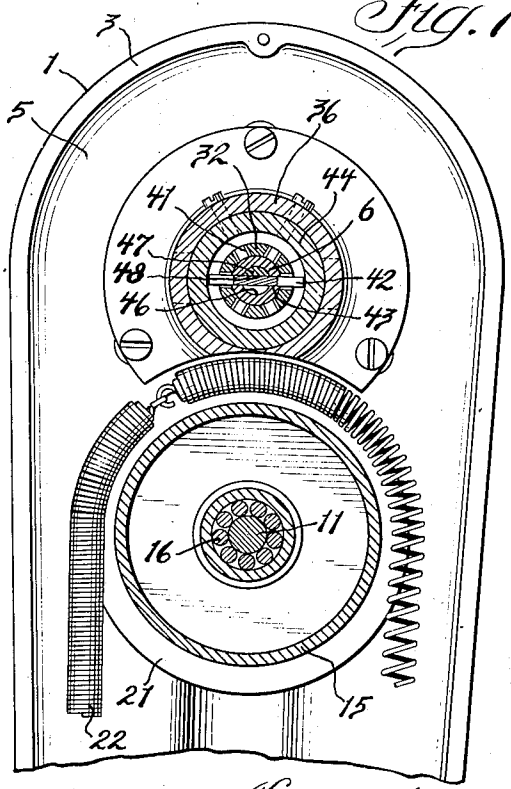


Fig. 7.



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Patented Aug. 5, 1941 2,251,772

UNITED STATES PATENT OFFICE

2,251,772

REEL DRIVE

John G. Zuber, Chicago, Ill., assignor to The Bell & Howell Company, Chicago, Ill., a corporation of Illinois

Application July 13, 1939, Serial No. 284,280

4 Claims. (Cl. 242—55)

My invention relates particularly to the driving mechanism of the film reels of motion picture machines although not limited to this use alone.

In the conventional motion picture machine the film is positively driven by the mechanism of the machine and is drawn from a roll thereof on a feed reel and wound on a take up reel which is driven with the mechanism of the machine by means of a suitable yielding driving mechanism, the yielding take up reel driving mechanism accommodating for the slowing up of the take up reel as the film roll thereon increases in diameter. The conventional yielding take up reel driving mechanism provides a substantially constant power of the driven or take up reel member with the result that the take up tension on the film undesirably decreases as the diameter of the film roll on the take up reel increases.

One object of the invention resides in the provision of a reel drive which automatically varies the power of a reel member in inverse correspondence with the speed thereof with a view toward maintaining uniform take up tension irrespective of the diameter of a roll of film on the take up reel and which automatically varies the driving ratio between the mechanism of the machine and the reel to the end that the slowing up of the take up reel as the film roll thereon increases in diameter is accommodated by variance of the aforesaid driving ratio rather than by the usual frictional slip driving device.

Another object resides in the provision with such mechanism of means for effecting maximum power of the reel member at high speed for the instant purpose of "rewinding" the film at high speed.

With these objects in view my invention consists in certain features of novelty in the construction, combination and arrangement of parts by which the said object and certain other objects, hereinafter appearing, are effected all as fully described with reference to the accompanying drawings and more particularly pointed out in the appended claims.

In the said drawings—

Figure 1 is a side elevation of a reel drive embodying my invention, with parts removed;

Figure 2 is a sectional view substantially on the line 2—2 of Figure 1;

Figure 3 is a section taken in the axial plane of the rotating elements of the mechanism;

Figures 4 and 5 are diagrammatic illustrations of the device showing different operating conditions;

Figure 6 is a partial side elevation of the reel spindle assembly of the device with the reel spindle partially broken away and shown in section and with parts in partially assembled position thereon; and

Figure 7 is a partial sectional view substantially on the line 7—7 of Figure 3.

Referring to the drawings, 1 designates a frame arm one end of which is arranged, as designated at 2, for attachment to a motion picture machine. The other end portion of this arm is provided with an enclosing flange 3 extended longitudinally of the arm, and a similarly elongated detachable flanged cover 4 cooperates with the flange 3 to form an enclosure 5. See Figures 1, 2 and 3.

A film reel spindle 6 extends through a bore 7 through the arm 1 in the region of said other end of the arm and is rotatably mounted in this bore by means of a roller bearing 8. The spindle 6 extends within the enclosure 5 and one end thereof projects from the frame arm and forms a reel mount portion 9 upon which a film reel, not shown, may be detachably mounted in driven engagement with the spindle as is usual.

Two spaced and parallel studs 11 and 12, both spaced from the reel spindle 6 and parallel thereto, are secured on the arm 1, as designated at 13, these studs and the spindle 6 being disposed in a common axial plane extending longitudinally of the frame arm 1 and these studs projecting within the enclosure 5. See Figure 3.

Two pulley members 14 and 15 are rotatably mounted on the stud 11 within the enclosure 5 by means of roller bearings 16, and two pulley members 17 and 18 are rotatably mounted on the stud 12 within the enclosure 5 by means of roller bearings 19. Each of these pulley members is provided with two belt grooves 21 and thus provides in effect two coaxial angularly fixed pulleys. The pulley members 14 and 15 are so disposed, with respect to the pulley members 17 and 18, that the belt grooves 21 of the pulley member 17 aline respectively with adjacent belt grooves 21 of the pulley members 14 and 15 and that a belt groove 21 of the pulley 18 alines with the other belt groove of the pulley member 15. Endless coiled spring belts 22 are trained about the alined belt grooves of the pulley members 14, 15, 17 and 18.

A stud 23 is secured, as designated at 24, on the frame arm 1 between the enclosure 5 and the end 2 of the arm and is disposed in parallelism with the spindle 6 and studs 11 and 12 and in the common axial plane thereof. A pulley member 25 is rotatably mounted on the stud 23 by

means of a roller bearing 26 and is provided with two belt grooves 27 thus providing in effect two coaxial angularly fixed pulleys. One of the belt grooves 27 alines with the belt groove 21 of the pulley member 14 which is not engaged by one of the belts 22, and an endless coiled spring belt 28 is trained about these alined belt grooves 21 and 27. An endless coiled spring belt 29 is trained about the other belt groove 27 of the pulley member 25 for driving the pulley member 25 from the mechanism of a motion picture machine, not shown.

The cover 4 is detachably secured on the frame arm 1 by means of a headed nut member 31 passing through a bore of the cover and screw-threaded on the projecting end of the stud 11.

An axially bored pulley 32 within the closure 5 is rotatably mounted on the spindle 6 in coaxial relation therewith by means of its bore engaging on the spindle and a ball bearing 33, and is provided with a belt groove 34 which alines with the belt groove 21 of the pulley member 18 which is not engaged by one of the belts 22, and an endless coiled spring belt 35 is trained about these alined belt grooves 21 and 34.

A bored bracket 36 is secured on the frame arm 1 and a roller bearing 37 between the bore of this bracket and the hub of the pulley 32 cooperates with the bearing 8 to rotatably support the spindle 6 and associated parts.

An axially bored gear 38 within the enclosure 5 is rotatably mounted on the spindle 6 by means of a roller bearing 39. The adjacent ends of the hubs of the pulley 32 and gear 38 are provided with opposing clutch formations 41, and a clutch member 42 extends through a longitudinally extending diametrical slot 43 through the spindle 6 and is shiftable axially of the spindle to alternately engage the opposing clutch formations 42 and thus alternately drive the spindle from the pulley 32 and the gear 38. See Figures 3, 6 and 7. A ring 44 secured in the bore of the bracket 36 maintains the clutch member 42 radially of the spindle 6. A gear 45 on the pulley member 14 meshes with the gear 38 to form a positive drive for the spindle from this pulley member.

The spindle 6 is axially bored as designated at 46, and a rod 47 is slidably engaged in this bore and is provided with a diametrical slot 48 in which the clutch member 42 is engaged for shifting the clutch member with longitudinal movement of the rod, the projecting end of the rod being provided with a knob 49 for the convenient manual shifting thereof to alternate the drive of the spindle as aforesaid.

Assuming the clutch member 42 to be positioned to clutch the pulley 32 with the spindle 6, the drive of the spindle from the pulley member 25 is effected by a plurality of belt and pulley drives sequentially connected to drive in series and each drive comprises a pair of revoluble pulleys and a longitudinally resilient belt trained thereabout.

Referring to Figures 4 and 5 illustrating the sequentially connected plural belt and pulley drive of the reel mount spindle 6 under different conditions of film take up on a motion picture machine, Figure 4 illustrates the driving condition where a take up roll of film 51 on a reel mounted on and driven by the spindle 6 is relatively small in diameter and Figure 5 illustrates the driving condition where the take up roll of film is relatively large in diameter as indicated at 52.

Referring to Figure 4 illustrating the driving condition when the take up film roll 51 is relatively small, the driving stretches 53 of the driving belts have a tension slightly greater than the non-driving stretches 54 thereof, this condition being illustrated in Figure 4 by reason of the lines illustrating the driving and non-driving stretches 53 and 54 being of the same thickness.

Assuming that the film is fed to the film take up roll at a constant lineal speed, as from the positive film feeding means of a motion picture machine from which the take up drive is driven, the speed of the take up film roll and the reel spindle 6 decreases with the result that the power thereof is increased and the tension of the driving stretches 53 of the driving belts is increased correspondingly as compared with the tension of the non-driving stretches 54, this condition being illustrated in Figure 5 by reason of the lines illustrating the driving stretches 53 being thinner than those illustrating the non-driving stretches 54. As the power of the spindle 6 increases by the slowing up thereof due to increase in diameter of the take up film roll the driving stretches 53 of the driving belts feed on to the driving pulleys of the belt and pulley drives in an increasingly tensioned or stretched condition whereas the non-driving stretches 54 of the driving belts feed on to the driven pulleys of the belt and pulley drives in a less tensioned or stretched condition, so that the belts grip the driving and driven pulleys in correspondingly increasing differences in tension or stretch. As a result the driving ratio between the driving and driven pulleys changes automatically in correspondence with the slowing up of the take up film roll so that the slowing up of the take up film roll as it increases in diameter is accommodated for without consequent frictional slip, it being observed that the driving ratio accumulates through the sequentially connected belt and pulley drives to the end of permitting a relatively large range of take up film roll diameter.

In Figures 4 and 5 the driving pulleys of the belt and pulley drives are designated at 55 and the driven pulleys thereof are designated at 56, and in Figure 5 the driving pulleys are shown smaller than they are in Figure 4 to illustrate the driving ratio difference under the different conditions of these figures.

The pulley grooves 21, 27 and 34 of the drive train pulleys, as shown, are tapered to obtain more belt traction on the pulleys and to augment the aforesaid driving ratio difference in that as the driving belts are stretched they decrease in diameter and vice versa, and thus engage deeper or shallower into the pulley grooves in correspondence with their instant tension or stretch.

Assuming the clutch member 42 to be positioned to clutch the gear 38 with the spindle 6, the drive of the spindle is effected from the pulley member 14 through the gear train comprising the meshed gears 38 and 45, this pulley member being adjacent the spindle 6 but drivingly remote therefrom in the belt and pulley drive. Drive of the spindle through these gears effects maximum power of the spindle at high speed for the purpose of "rewinding" the film.

While I have thus described my invention, I do not wish to be limited to the precise details described as changes may be readily made without departing from the spirit of my invention,

but having thus described my invention I claim as new and desire to secure by Letters Patent the following:

1. In a reel drive the combination with a revoluble reeling member, of a plurality of belt and pulley drives sequentially connected in series to drive said reeling member, each drive comprising a pair of revoluble pulleys provided with tapered belt grooves and an endless coiled spring belt trained thereabout and engaged in said grooves, one of said pulleys being coaxial with said reeling member and others of said pulleys being arranged in two series of coaxial pulleys both spaced from said reeling member, and a pulley of each pair being angularly fixed with a coaxial pulley of another pair to provide the sequential drive connection of said drives.

2. In a reel drive the combination with a revoluble reeling member, of a plurality of belt and pulley drives sequentially connected in series to drive said reeling member, each drive comprising a pair of revoluble pulleys and a longitudinally resilient endless belt trained thereabout, one of said pulleys being coaxial with said reeling member and others of said pulleys being arranged in two series of coaxial pulleys both spaced from said reeling member, and a pulley of each pair being angularly fixed with a coaxial pulley of another pair to provide the sequential drive connection of said drives.

3. In a reel drive the combination with a revoluble reeling member, of a plurality of belt and pulley drives sequentially connected in series to drive said reeling member, each drive comprising a pair of revoluble pulleys and a longitudinally resilient endless belt trained thereabout, the final drive pulley of said drives being coaxial with said reeling member and others of said pulleys being arranged in two series of coaxial pulleys both spaced from said reeling member, and a pulley of each pair being angularly fixed with a coaxial pulley of another pair to provide the sequential drive connection of said drives, a gear train drive for said reeling member and driven from one of said pulleys drivingly remote from said reeling member and including a gear coaxial with said reeling member, and clutch means operative to alternately clutch said final drive pulley and said gear with said reeling member.

4. In a reel drive the combination with a frame arm provided with a longitudinally extending enclosure and a revoluble reeling member carried thereby, of a plurality of belt and pulley drives disposed within said enclosure and sequentially connected in series to drive said reeling member, each drive comprising a pair of revoluble pulleys and a longitudinally resilient endless belt trained thereabout, the final drive pulley of said drives being coaxial with said reeling member and others of said pulleys being carried with said arm and arranged in two series of coaxial pulleys both spaced from said reeling member and spaced longitudinally of said arm, and a pulley of each pair being angularly fixed with a coaxial pulley of another pair to provide the sequential drive connection of said drives, a gear train drive within said enclosure for said reeling member and driven from one of said pulleys of the series adjacent to and drivingly remote from said reeling member and including a gear coaxial with said reeling member, and clutch means operative to alternately clutch said final drive pulley and said gear with said reeling member.

JOHN G. ZUBER.