Sept. 22, 1936. C. L. FARRAND 2,055,124

POWER SUPPLY FOR PLURAL MOTOR INTERLOCK SYSTEMS

Filed April 18, 1935 3 Sheets-Sheet 1

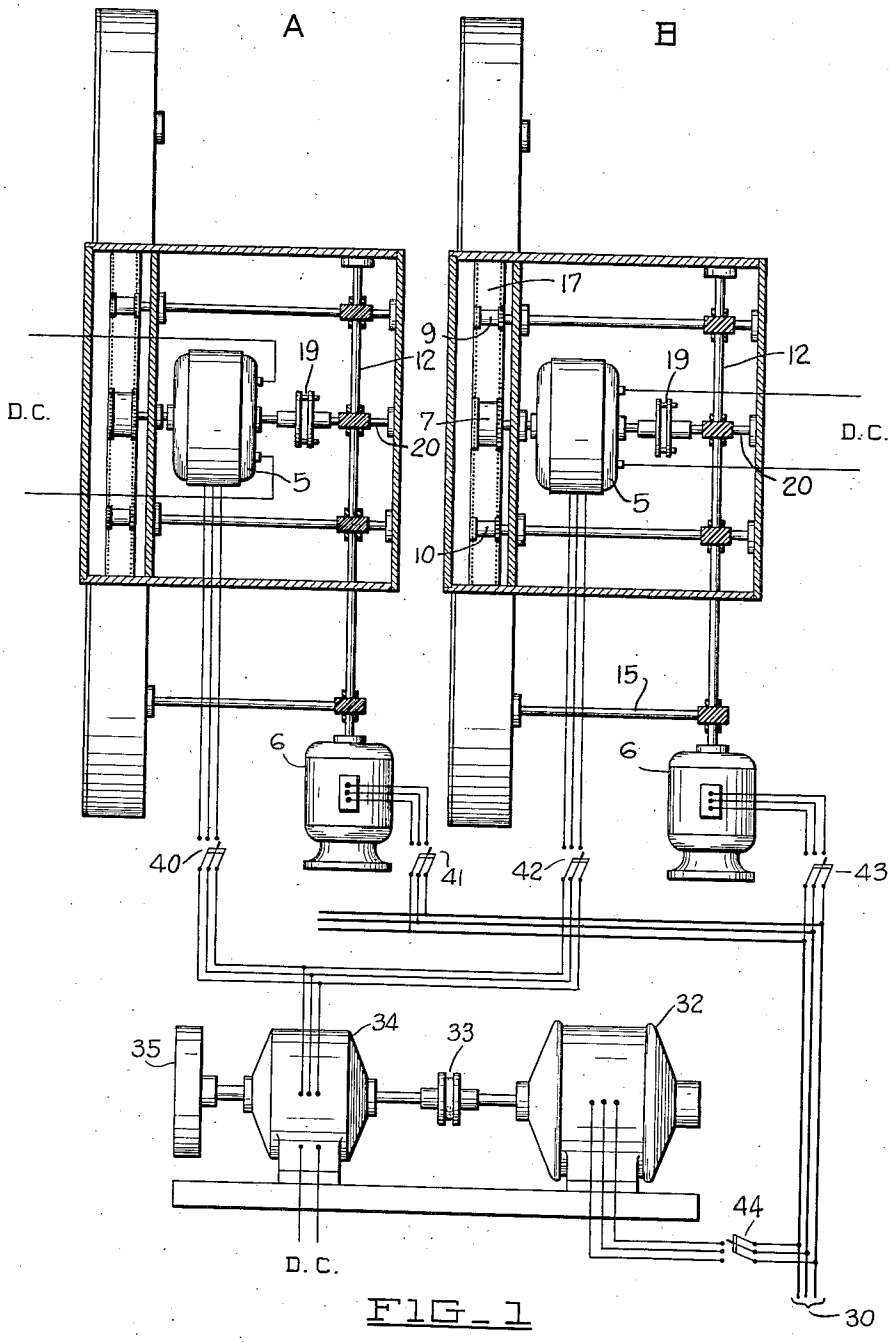


FIG. 1

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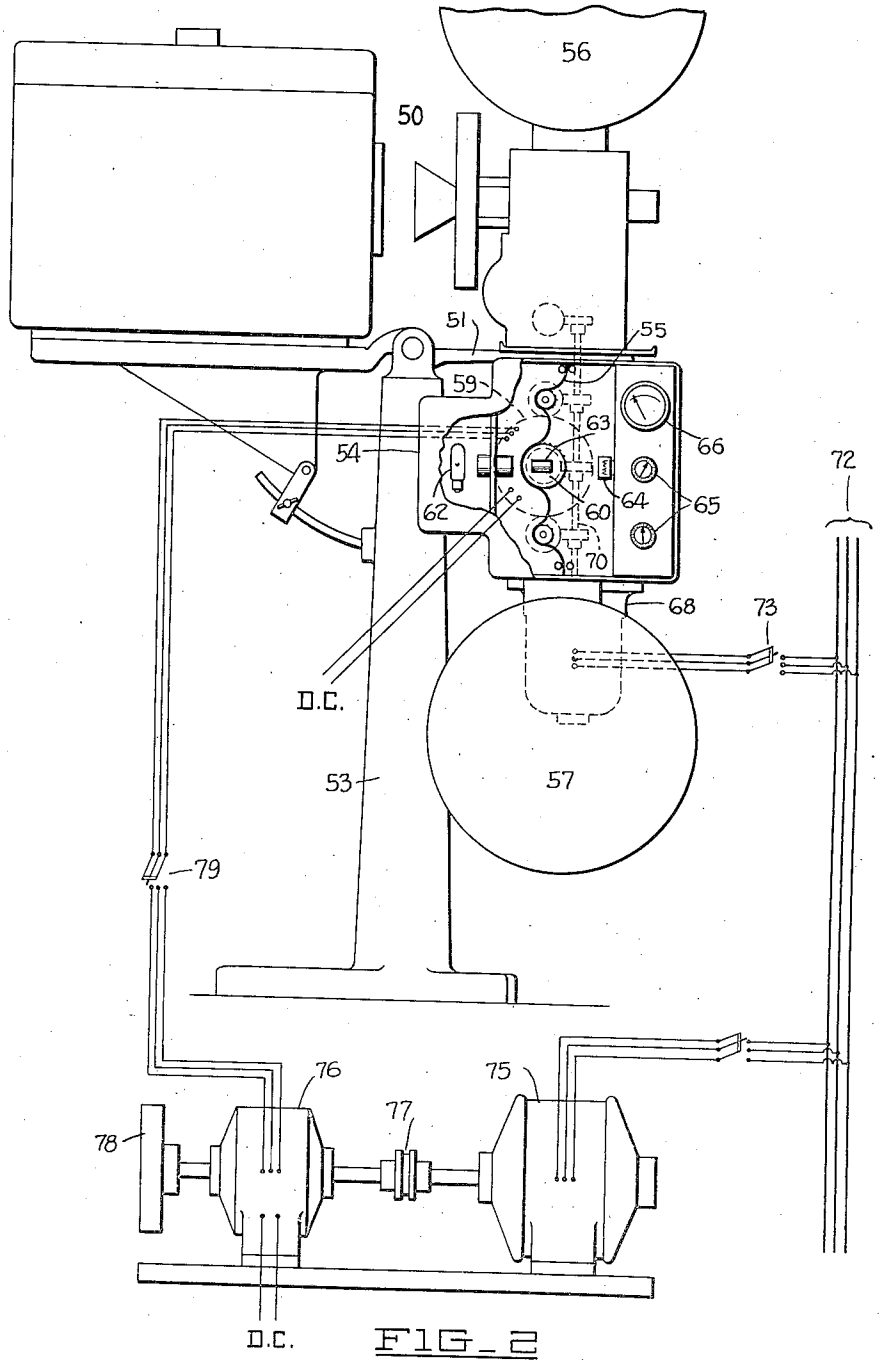


FIG_2

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Filed April 18, 1935 3 Sheets-Sheet 3

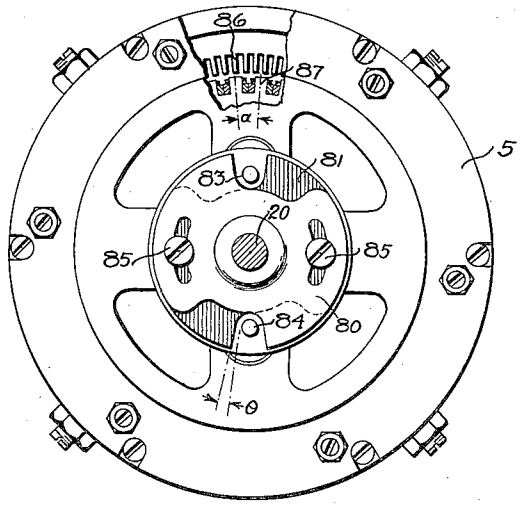


FIG. 3.

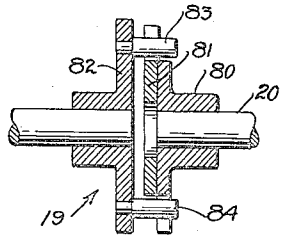


FIG. 4.

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POWER SUPPLY FOR PLURAL MOTOR INTERLOCK SYSTEMS

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Application April 18, 1935, Serial No. 17,099

9 Claims. (Cl. 271—2.3)

This invention relates to constant speed driving systems and particularly to driving systems for progressing linear carriers of photographic sound records. It is well known in the art of recording and reproduction of sound waves that perfect recording and reproduction can only be obtained by maintaining a constant linear velocity for the record carrier since sound is made up of one or more frequencies having a definite wave form and relationship to one another both as to amplitude and phase. Any disturbance of that relationship during the translation from acoustic to electrical energy, or vice versa, produces distortion, one of the chief causes being variation in speed of the driving means. An object of the invention, therefore, is to efficiently progress a linear carrier of sound waves at constant speed.

Where the record carrier is a film, and recording is accomplished by the projection thereon of modulated light, while reproduction is accomplished by the projection thereon of constant intensity light, the apparatus required employs a plurality of driving sprockets, supply and take-up reels. In addition, since it is customary to have on the diapositive, pictures of concomitant sound sources the projection of which is accomplished simultaneously with reproduction of sound, there is associate apparatus being simultaneously driven, this apparatus producing variations in load on the driving means which are generally electrical motors of the synchronous type. A further cause of speed variations where motor power is used is the variation in the motor supply energy. Another object, therefore, of this invention is to drive a talking motion picture film past a sound translation point at a constant speed regardless of variations in speed of other moving parts.

The present invention contemplates the use of separate motors for driving different parts of the system. In brief, a constant speed synchronous motor of special construction is employed for progressing the film past the translation point while the usual type of synchronous motor may be employed for driving the sprockets feeding the film to and from the translation point, the supply and take-up reels, and, when reproducing, the picture projecting mechanism. In accordance with this invention these separate motors, which would if operated separately require different times to reach synchronous speed, are arranged to operate independently when in synchronism within certain predetermined limits, thus permitting one motor to vary in speed without disturbing the other within these limits. This arrangement also permits the motors to start and stop together and thereby retain their synchronous relationship at all times. The special constant speed synchronous motor is directly connected to the drive sprocket which controls the speed of the film past the translation point while the other motor may be coupled by gears, chains, belts, or the like, to the other moving parts. A "back lash" coupling or interlock provides the synchronous independence of the motors but does not permit them to slip an entire pole. The coupling device itself is of the mechanical type which may be adjusted to provide for different pole pitches of different motors.

The invention will be better understood from the following description read in conjunction with the accompanying drawings in which

Fig. 1 is a diagrammatic arrangement of the power supply for sound recording units,

Fig. 2 is a dagrammatic view of a picture projecting and sound reproducing unit supplied with power in accordance with the invention,

Fig. 3 is an end view of one of the motors of Figs. 1 and 2 showing the relationship between the coupling device and the motor, and

Fig. 4 is a cross sectional view of the coupling device.

In Fig. 1 two sound systems A and B are shown for the purpose of illustrating that a plurality of units may be satisfactorily operated from a single energy supply. Units A and B being identical, the same numerals have been given to like elements. The motor 5 is directly connected to a sprocket 7 over which a film 17 is driven past a translation point which may be on the sprocket itself or at a point immediately adjacent thereto in the form of a flat or curved gate. Feed sprockets 9 and 10 progress the film to and from the sprocket 7 in the well known manner. The sprockets 9 and 10 are geared to a drive shaft 12 directly connected to a motor 6 of the usual synchronous type. The shaft 12 is also geared to a shaft 15 which drives a take-up reel for the film 17. A mechanical "back lash" coupling or interlock 19 shown in detail in Figs. 3 and 4

couples a shaft 20, geared to shaft 12, with the shaft of motor 5.

The system just described is claimed and more fully disclosed in my co-pending application Serial No. 17,098 filed April 18th, 1935, while the special type of constant speed motor 5 is disclosed and claimed in my co-pending application Serial No. 17,097 filed April 18th, 1935. The present invention relates specifically to the energy supply for the motors 5 and 6 which will now be described.

As was pointed out in my co-pending application Serial No. 17,098 filed April 18th, 1935, mentioned above, there are several causes of speed variations in the motor 5. One is faulty and unbalanced construction of the motor 5 which has been overcome by the invention in co-pending application Serial No. 17,097 filed April 18th, 1935. The second is that variations in load caused by varying resistance at different points within the system are transferred to the motor and this problem has been solved by the subject matter disclosed and claimed in my co-pending application Serial No. 17,098 filed April 18th, 1935. The third cause is that variations in the commercial power supply occur which vary the speed of the motor and the elimination of this cause forms the subject matter of the present application.

Referring now to the power supply the units A and B, all energy is received over conductors 30 from the usual commercial source which may vary in voltage. This energy is utilized to operate a commercial three-phase motor 32 flexibly connected by a resilient viscously dampened coupling 33 to a large capacity three-phase generator 34 stabilized by a flywheel 35. The coupling 33 and flywheel 35 cooperate to provide the rotor or motor 34 with a substantially constant speed of rotation in spite of the fluctuations in voltage on the commercial line 30. The generator 34 will now provide a much stabler energy output to the motor 5 to which it is connected than would otherwise be obtainable from the lines 30. The field of the motor 5 is supplied from a D. C. source.

The motor 6 may be driven directly from the main supply leads 30 any variations in speed thereof being prevented from affecting the motor 5 by the coupler 19 which permits independent operation of the motors within a pole pitch of motor 5 as disclosed in co-pending application Serial No. 17,098 filed April 18th, 1935. The motor 5, therefore, is isolated not only from variations in speed of the motor 6 caused by variations in the load, but also from variations in the power supplied to the motor 6. This constant energy supply to the motor 5, plus its special construction, its constant load, and its isolation from the driving and driven elements of the remainder of the system, permits the motor 5 to have a constancy of speed which is not obtainable with other driving systems known in the art.

As the generator 34 has a large output capacity relative to the load provided by the motor 5, several units may operate in parallel without disturbing its output characteristics. Switches 40, 41, 42 and 43 are employed for operating any unit desired independently or simultaneously while the switch 44 serves the motor generator sets 32 and 34. The field of the generator 34 may be supplied from a direct current source as shown.

Referring now to Fig. 2, a picture projection unit 50 may be supported on top of a plate 51 mounted on standard 53, a sound reproducing unit 54 being supported below plate 51, the two units being aligned to facilitate the progressing of a sound and picture film record 55 from supply reel 56 to take-up reel 57. The sound head 54 may be the same as the unit shown in my co-pending application Serial No. 17,098 filed April 18th, 1935.

A special constant speed motor represented by the dotted line 59 is directly connected to a sound reproducing sprocket 60 and controls the speed of the film 55 past the sound translation point which in this case is on the sprocket 60. A light source 62, optical units 63, and light sensitive device 64, with their controls 65 and meter 66 are other essential units of the sound unit 54. A synchronous motor 68 directly drives through a shaft 70 the sprockets and pull-down mechanism in the projector 50, the drive sprockets in the sound unit 54, and take-up reel 57.

The general power for the system is obtained over main conductors 72, which are shown as a three wire two or three phase system but which may also be single phase, the motor 68 being connected thereto through a switch 73. The conductors 72 also directly supply a synchronous motor 75 resiliently coupled to a three-phase generator 76 by a resilient viscously damped coupling 77, a heavy flywheel 78 stabilizing the rotational speed of the rotating elements and thus the energy output. The field of the generator 76 is supplied with direct current. As shown, the power energy for the special synchronous motor 59 is supplied from generator 76 through switch 79 and thus this motor has a source of energy considerably more stable than that obtainable from lines 32 since it is not subject to small variations which occur on the lines 72.

The power supply system of Fig. 2, therefore, functions to prevent voltage fluctuations on main line 72 within certain limits from affecting the linear velocity of the film record past the sound translation point in the reproducer 54. The combination of the special constant speed motor 59, the "back lash" coupler 19 interconnecting the motors 59 and 68, and positioned behind the motor 59 as illustrated in Fig. 1, and the motor generator unit 75—76, function to provide a drive for the reproducer 54 and projector 50 which maintains synchronism between the various driven elements while giving the film relatively constant speed past the sound translation point.

Referring now to Figs. 3 and 4 the coupler 19 comprises two concentric plates 80 and 81 on shaft 20 adjustable with respect to one another, and a disc or plate 82 mounted on the shaft of motor 5, the disc 82 having pin extensions 83 and 84 diametrically opposite one another on the disc. The plates 80 and 81 are maintained in their adjusted position by means of screws 85. The desired adjustment between the plates 80 and 81 is such that the variation between the shaft 20 and the shaft of motor 5 is just less than one pole pitch of the motor 5.

As described in the above mentioned co-pending application, the motor 5 has forty (40) poles, as shown at 87, and 120 armature teeth, as shown at 86. In Fig. 3 the pole pitch is represented by the angle alpha and this angle should be greater than twice the angle theta or the angle formed between the pin 84 and plates 80 and 81, assuming pin 84 to be in a central position.

This adjustment of the plates 80 and 81 will prevent any variation in speed between the two motors greater than one pole pitch and consequently prevent the slippage of the motors out of synchronism while permitting relatively independent variations in speed therebetween within these limits. This provides a system wherein the motor 5 is not subjected to speed variations of motors 6 within a pole pitch of motor 5 in Fig. 1 or the motor 59 is not subjected to the same speed variations in motor 68 in Fig. 2. The constant speed sprockets 7 and 60 are thus isolated within limits from motors 6 and 68 respectively.

What is claimed is:

1. In a system for progressing a record carrier past a translation point at a constant speed, a film driving system comprising a motor, a sprocket directly connected to said motor for progressing film past a translation point, sprockets for feeding film to and from said first sprocket, a motor directly connected to said feed sprockets, a power supply for said second motor, a motor-generator set energized from said power supply, means for connecting said first mentioned motor to said motor-generator set, and means for stabilizing the rotation of the generator of said motor-generator set.

2. In a film drive system, the combination of a main power supply having energy fluctuations therein, a motor generator set, a motor for driving certain mechanism of said system, a motor for driving film past a sound translating point, said first motor being supplied with energy directly from said main power system, and said second motor being supplied with energy from said motor-generator set supplied from said main power supply, and means for maintaining a constant energy output from the generator of said motor-generator set during fluctuations of said main power supply.

3. In a system for driving different loads one of which is to have a constant speed, the combination of individual motors for each of said loads, a power source connected to said motor adapted to drive the load which may be permitted to vary in speed, a motor generator set interposed between said power source and said motor adapted to drive said constant speed load, and means for maintaining the generator of said motor generator set at a substantially constant speed during fluctuations in speed of the motor of said set.

4. In a system for operating a portion of a rotating system at a constant speed, the other portion of said system having a permissible variation therein, the combination of a separate motor for each of said portions, a mechanical coupling device between said motors permitting a predetermined slippage therebetween within limits of a pole pitch of one of said motors, a motor-generator set, means for providing the generator of said motor-generator set with a substantially constant output, and means for supplying the motor of said motor-generator set and one of the motors of said system directly from a common power supply.

5. In combination, a plurality of motors for driving different loads, two of said motors being mechanically interconnected and adapted to be disconnected when operating in synchronism, a generator connected to one of said motors and having means for maintaining a constant speed thereof, a motor for driving said generator, and a common alternating current supply means for the other of said first mentioned motors and said last mentioned motor.

6. In a drive system for motion picture film, a translating point, a drive sprocket for progressing said film past said translation point, sprockets for progressing film to and from said drive sprocket, a motor directly connected to said drive sprocket, a second motor directly connected to said feed sprockets, an interlocking device between said motors to permit independent operation within a pole pitch of one of said motors, a power supply, a motor-generator set, means for connecting said second mentioned motor and the motor of said generator set to said power supply and the generator of said motor-generator set to said first mentioned motor, and means for maintaining the energy output of the generato of said motor-generator set substantially constant.

7. A system in accordance with claim 6 in which the motor and generator of said motor-generator set are interconnected by a resilient coupling and the rotating parts of which are under control of a flywheel.

8. In a system for driving portions of an interconnected load at a relative constant speed compared with other portions of said load, a main power supply having energy fluctuations therein, a motor-generator set interconnected by a flexible coupling, a flywheel mounted on the rotating elements of said motor-generator set, a motor for driving the portion of said load having relative constant speed, means for connecting the generator of said motor-generator set to said motor, a second motor for driving the other portion of said load, and means for connecting the power supply to the motor on said motor-generator set and said second motor.

9. A system in accordance with claim 8 in which said loads are mechanically interconnected when the variation in speed between the motors driving said portions of said load is greater than the pole pitch of one of said motors.

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