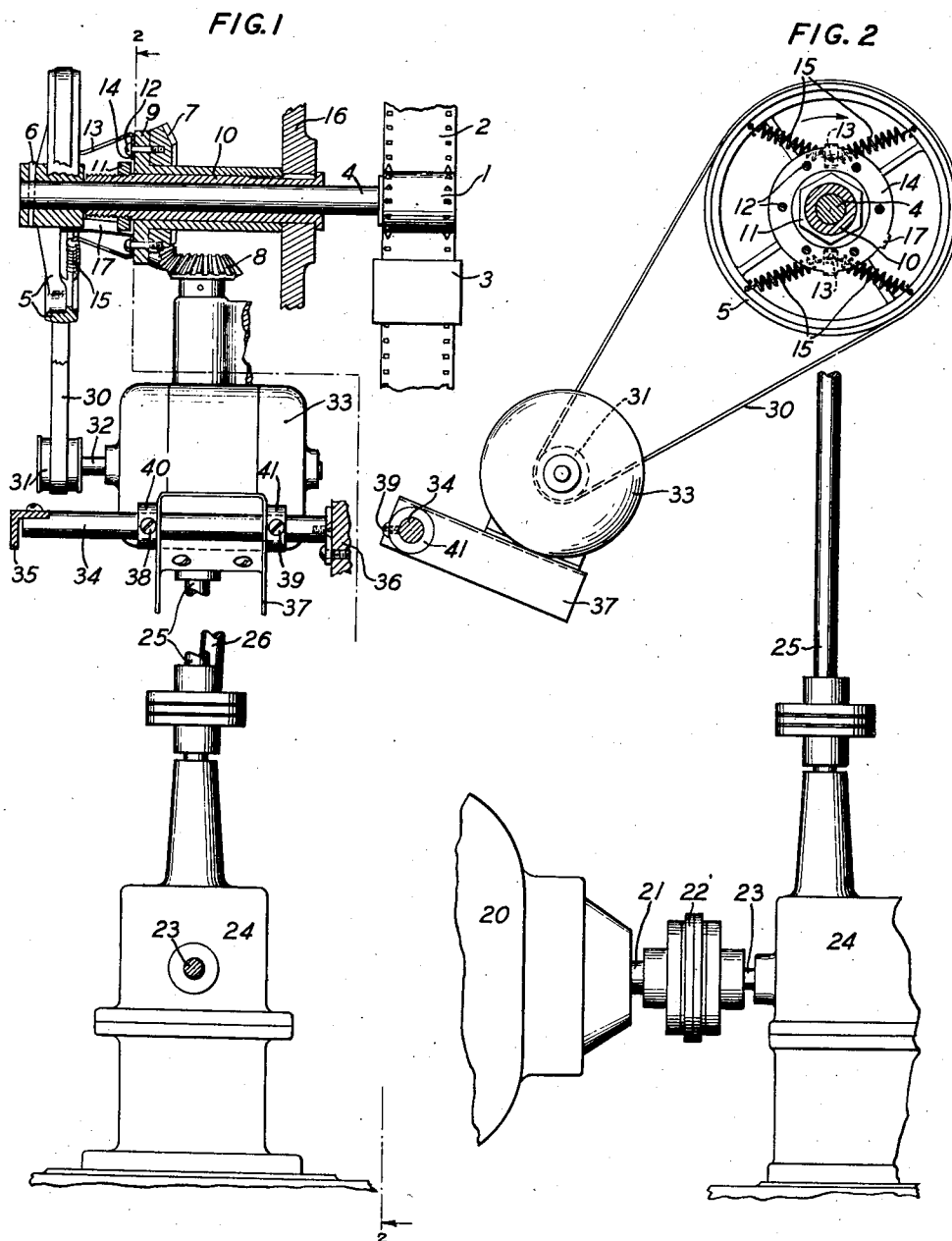


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SOUND PICTURE SYSTEM

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This invention relates to sound picture apparatus, and more particularly to a mechanism for driving the sound reproducing and recording apparatus at uniform velocity.

5 In sound picture apparatus in which the sound and scene are simultaneously translated it is common practice to drive the sound and picture translating apparatus from a common source of power to insure synchronized translation. In apparatus of this general character the picture record is intermittently moved but translated when it is not in motion, while the accompanying sound effects are recorded or reproduced with the record carrying medium in continuous motion. The movement of this record carrying medium must be controlled as to uniformity to an extent which prevents the intrusion of velocity variations which cause noticeable sound pitch variations.

20 According to the present invention the sprocket which feeds the record carrying medium past the point of sound translation, herein known as the sound sprocket, is provided with a secondary driving source in multiple with the common source of power for controlling both a sustained velocity rate and uniformity of velocity at that rate. These sources of power comprise a set of motor-driven gears and a belt and pulley driven by a separate motor connected in multiple to the sound sprocket shaft. The gears are connected to the shaft through an elastic member in the form of springs of small stiffness and the belt pulley is rigidly connected to the shaft. Because of slight irregularities or imperfections in gears and bearings which cause momentary deviations in a sustained velocity, it becomes necessary to differentiate between a sustained velocity rate and uniformity of velocity at this sustained rate. The sustained velocity rate may be defined in this instance as the speed required for moving the film past the point of sound translation in synchronism with the movement of the film past the picture lenses. If there are no variations in this sustained rate, it then becomes uniform velocity. The gears connected to the sound sprocket shaft through an elastic member are driven in synchronism with the gears which control the movement of the film past the picture lenses and consequently these gears control the sustained rate of velocity of the sound sprocket. The belt drive comprises a separate small motor having a pulley on its armature shaft directly connected by a belt to the pulley on the sprocket shaft. An example of a motor for this film drive may be given as a 1/100 horse power three-phase induction motor

having sufficient speed to overdrive the sprocket if not restrained by the gears and springs and with slightly greater driving torque than required by the normal load of the film. The motor thus has sufficient torque to stretch the light springs a given distance during the driving of the film, which completes the load that the motor can drive and regulates its speed. The sprocket is thus driven by the motor under the restraint of the gears at a uniform velocity equal to the average sustained velocity rate of the gears.

It is recognized that the most troublesome periodic low frequency irregularities occur in the gears and bearings of the mechanical transmission system throughout the sound picture apparatus. These irregularities are to some extent transmitted to the gears which drive the sound sprocket shaft and if transmitted from these gears to the sound sprocket cause variations in the film velocity. With the foregoing multiple drive when such irregularities occur at the gears, a momentary deviation in the uniformity of gear velocity is present. However, since the belt pulley is rigidly connected to the sprocket shaft, the belt drive momentarily becomes the controlling factor to hold the sound sprocket to a true uniform velocity and cause the gear velocity variation to be absorbed by the springs between the gears and the sprocket shaft. The duration of the most troublesome low frequency velocity variations amounts to only a fraction of a second. During such periods the light springs may flex and return to their normal driving position, but due to the driving conditions as herein set forth for the small motor, there is no perceptible variation in velocity of the sprocket shaft pulley and consequently there is no perceptible variation transmitted to the film.

Figs. 1 and 2 illustrate two views of the film driving mechanism according to the invention.

In the sound picture apparatus, Figs. 1 and 2, the motor 20 is of comparatively large capacity for driving the mechanical transmission system which synchronously guides the film from the delivery wheel past both the picture and sound translating apparatus to the take-up wheel. The motor 20 is accurately regulated as to a sustained velocity rate by apparatus substantially as shown in Patents 1,662,083 and 1,662,084 issued to H. M. Stoller and myself, March 13, 1928 and Patent 1,662,085 issued to H. M. Stoller, March 13, 1928. This motor is connected by shaft 21, coupling 22 and shaft 23 to reduction gears enclosed in gear box 24. Shaft 26 extends from the reduction gears through couplings to the apparatus of the

picture head which may be of any well-known type. Shaft 25 extends from the reduction gears through couplings to gear 8 for regulating the velocity rate of the sound sprocket. Gear 7, sleeve 9 and spring spider 13-14 are fastened together by machine screws 12 and are arranged to rotate as a unit on the bearing 10. The end portion of bearing 10 is threaded for adjusting nut 11 for holding the gear 7 in the correct meshing relation with gear 8. The belt pulley 5 is rigidly connected to the sprocket shaft 4 by pin 6. The manner of connecting the springs 15 between the spider 13-14 and the belt pulley 5 is best shown in Fig. 2. The spider comprises the angular member 14, spring supports 13 and detent 17. The springs are interconnected between the spring supports 13 and the rim of the belt pulley. Since the pulley 5 is rigidly connected to the sprocket 4, the spring supporting arrangement is the equivalent of an elastic connection between the gear 7 and the sound sprocket shaft 4. Shaft 4 is journaled in bearing 10 which is mounted in frame 16 and keyed in position as shown. Film 2 is fed past the sound translating apparatus diagrammatically shown at 3, by the cylindrical sprocket 1 rigidly connected to shaft 4 as herein-after described.

The small motor 33 as previously stated, is of a limited capacity for driving a particular load. This motor is mounted on the base 37 which is adjustably mounted on shaft 34. The shaft 34 is rigidly fastened to frame members 35 and 36. Pulley 31 is rigidly fastened to the motor armature shaft 32 for driving the sound sprocket shaft 4 and sound sprocket 1 through the agency of belt 30 and pulley 5. The proper lateral adjustment of belt 30 may be obtained by loosening the set screws 38 and 39 in bushings 40 and 41 which permit the movement of motor 33 and base 37 on shaft 34. The set screws 38 and 39 when set, retain the motor and base in the adjusted position. The base 37 is free to rotate on shaft 34 which permits an angular movement of the motor for tensioning the belt.

The operation of the sound picture machine is started by actuating all of the electrical apparatus associated therewith which includes simultaneously energizing motors 20 and 33. As hereinbefore indicated, the velocity of gears 7 and 8 and the spring spider 13-14 are regulated by the speed of motor 20. When the machine has attained normal running speed, the velocity of the belt pulley 5 is made identical with the average sustained velocity rate of gear 7 by the introduction of spring load under the restraint of the gears to balance the driving load with the driving torque of motor 33. This motor is designed to permit slip between the rotating field and the armature in order that its speed may be regulated within desired limits by its driven load. A substantially uniform load is established by the film 1 being fed through the area of sound translation and by the friction of the sprocket shaft in the bearing 10. In order to produce the desired regulation of the sprocket velocity, the torque of the motor 33 is slightly greater than required to carry the normal load. The superfluous torque is for the purpose of extending the springs 15 under restraint of the gears. The upper right spring 15 and lower left spring 15 are thus elongated and the alternate springs of each pair shortened. The added load of the springs, which in the preferred arrangement is a small percentage of the total load, is sufficient to cause the regulation of the motor 33 to drive pul-

ley 5 at exactly the same angular velocity as the average sustained angular velocity rate of gears 7 and 8.

It has been found that an induction motor of the foregoing design provides substantially perfect damping means for the prevention of low frequency hunting. By observation with a stroboscope it was determined that transient disturbances which may be caused by film splices, sudden changes in line voltage or a variation anywhere in the system will be damped out in less than one cycle of oscillation whereas any mechanical damping system usually requires a number of cycles to damp out an oscillation and with no damping at all the hunting phenomena is practically continuous and results in noticeable pitch changes in the record which are very objectionable.

It is apparent that in the above combination the teeth of gear 7 are pressed against the teeth of gear 8 in the non-driving direction of the gears and that a fixed relation is established between the pulley 5, springs 15 and gears 7 and 8 during the running of the film. Momentary angular velocity variations of the gears due to irregularities in the mechanical transmission system changes this relation for a fractional part of a second. This change in relation, however, is limited to relative motion of the gears and a slight linear flexing of the springs. This momentary flexing of the springs does not materially change the load upon the motor 33. In view of the fact that the motor torque is so nearly balanced by the load during such velocity variations and in view of the short duration of such variations, the motor speed does not materially increase or decrease and therefore the belt pulley 5 is maintained at the uniform average velocity rate during gear velocity variations and consequently the sprocket 1 is rotated at all times at a uniform velocity.

What is claimed is:

1. In a strip feeding mechanism, a cylinder for feeding said strip and means for driving said cylinder at uniform velocity comprising two drives for said cylinder driven by separate motors, said drives being connected in multiple through an elastic member independent of the strip fed by the cylinder.

2. In a strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at uniform velocity comprising two drives driven by separate motors, said drives being connected in multiple to said cylinder, and elastic means in each drive independent of the strip fed by the cylinder.

3. In strip feeding mechanism, a cylinder for feeding said strip and means for driving said cylinder at uniform velocity comprising gears driven at a sustained velocity rate and an elastic member rigidly connected between said gears and cylinder, in multiple with a belt and pulley rigidly connected to said cylinder and driven by a separate motor whereby the speed of said motor and associated pulley is regulated by a normal load including the strip load plus a load added through the agency of said elastic member under restraint of said gears.

4. In strip feeding mechanism, a cylinder for feeding said strip and means for driving said cylinder at uniform velocity comprising gears driven at a sustained velocity rate and an elastic member rigidly connected between said gears and cylinder, in multiple with a pulley driven by a motor having sufficient torque to carry the normal

load including the strip load and extend said elastic member under restraint of said gears a distance which adds sufficient auxiliary load to completely absorb any remaining driving torque and cause a uniform angular velocity of the pulley equal to the average sustained angular velocity rate of the gears.

5. In strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at uniform velocity comprising a belt and pulley driven by a motor, means for tensioning said belt by angular rotation of the motor and means in multiple with said motor drive for regulating the speed of said pulley and motor comprising a mechanical transmission system separately driven at a regulated sustained velocity rate and an elastic member connected between the mechanical transmission system and the pulley for creating a load under restraint of said mechanical transmission system.

6. In sound picture apparatus, a strip of inconsiderable mass for picture and sound translation, a mechanical transmission system for moving said film in synchronous relation past the picture and sound translating apparatus at a sustained velocity rate, a cylinder for moving said strip past the point of sound translation, a belt and pulley driven by a separate motor for sustaining uniform velocity at said velocity rate, and means under the restraint of said mechanical transmission system for regulating the speed of said motor and pulley comprising an elastic member rigidly connected between the transmission system and the pulley, having a stiffness varied by the torque of the motor.

7. In a strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at uniform velocity comprising members driven at a sustained velocity rate in multiple with a belt and pulley and a variable load device driven by a separate motor arranged to permit slip between the rotating field and the armature in order to have its speed regulated by said load device under restraint of said members.

8. In a strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at uniform velocity comprising members driven at a sustained velocity rate connected through a variable load member and a pulley to said cylinder, in multiple with an induction motor for driving said pulley arranged to permit slip between the rotating field and the armature in order to have its velocity rate regulated by load created under restraint of said members.

9. In a strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at uniform velocity comprising members driven at a sustained velocity rate connected

through a variable load member and a pulley to said cylinder, and an induction motor for driving said pulley arranged to damp transient disturbances and to permit slip between the rotating field and the armature in order to have its velocity rate regulated by load created under restraint of said members for substantially balancing the motor torque against the driven load.

10. In a strip feeding mechanism, a cylinder for feeding said strip, two motors and two mechanical drives cooperating to drive said cylinder, and means including a variable elastic load member interconnecting the two drives and rotatable therewith under restraint of one motor and the associated mechanical drive and varied by the other motor for regulating the speed of the other motor and associated mechanical drive.

11. In a strip feeding mechanism, a cylinder for feeding said strip, two motors cooperating to drive said cylinder, an elastic member, individual directly connected mechanical drives between said motors and said cylinder, one of said drives terminating at the cylinder in said elastic member for restraining the speed of the other motor.

12. In a strip feeding mechanism, a cylinder for feeding said strip, a drive for said cylinder and a motor for said drive controllable by load variations, a second drive and a motor for said drive operated at a sustained velocity rate, and means for placing the cylinder under the control of both drives to obtain uniform velocity of said cylinder comprising an elastic load member independent of the strip fed by the cylinder connecting said second drive in multiple with said first drive.

13. In strip feeding mechanism, a cylinder for feeding said strip, means for driving said cylinder at a uniform velocity comprising a member driven by a motor at a uniform sustained velocity rate, a second member driven by a second motor, a spring load device connecting said first member with said second member and said cylinder, whereby an elastic load is introduced which varies with the torque of said second motor under restraint of the member driven at a uniform sustained rate, for controlling the velocity of said second motor.

14. In strip feeding mechanism, a cylinder for feeding said strip, two drives for said cylinder, each being driven by separate motors, and means for operating said two drives at the same average sustained velocity rate by having one motor under the restraint of the other and for absorbing momentary velocity variations of either drive comprising a spring load device having opposite ends rigidly connected to alternate drives.

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