

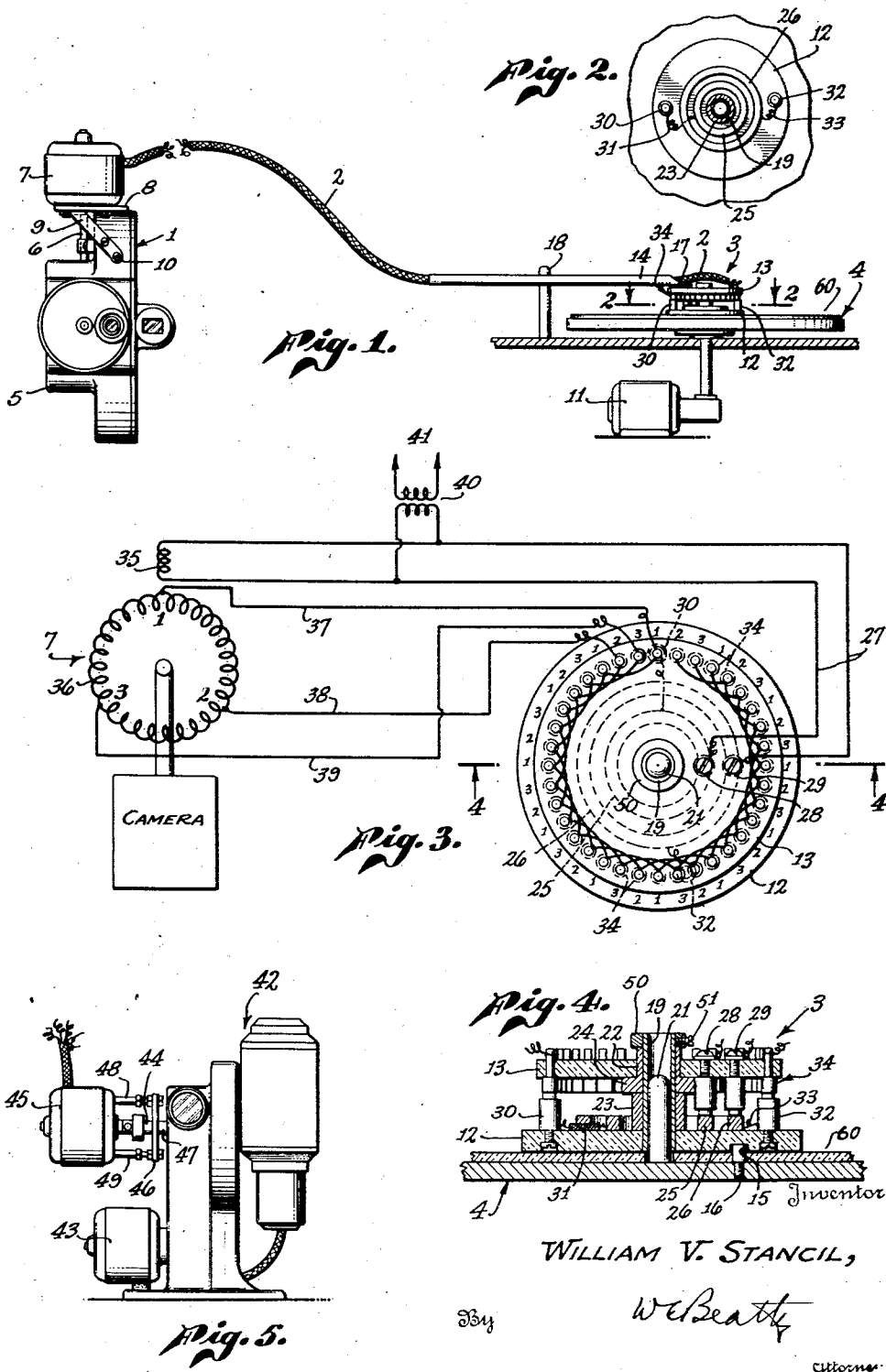
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SYNCHRONIZING SYSTEM

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SYNCHRONIZING SYSTEM

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3 Claims. (Cl. 88—16.2)

The invention relates to a method and apparatus for synchronizing the speed of moving bodies and is particularly directed to obtaining a multiple speed relation between moving bodies.

While the invention in its broadest aspect is not restricted to any particular field of use, in its narrower aspect it is particularly useful in the field of sound pictures i. e., for recording or reproducing sound and motion pictures in synchronism. More particularly the invention relates to the use of a phonograph for the sound recording and reproducing device and to the use of the phonograph to set the speed of the cinematograph i. e., camera or projector.

The standard speed of a phonograph may be taken as 80 R. P. M. and the speed of the shutter shaft of a camera or projector as twelve times that figure or 960 R. P. M. for 16 pictures per second. An object of the invention is to obtain a desired speed ratio such as 12 between the phonograph and the cinematograph, by operating the cinematograph motor with synchronizing impulses generated at the phonograph. In other words, this speed ratio is obtained electrically, not by the use of gears at the camera and projector as heretofore proposed.

For further details of the invention reference may be made to the drawing wherein:

Fig. 1 is a view in elevation of a sound-picture recording system according to the invention.

Fig. 2 is a plan view of the switching device on line 2—2 of Fig. 1.

Fig. 3 is a schematic wiring diagram of the circuit of Fig. 1.

Fig. 4 is a section on line 4—4 of Fig. 3.

Fig. 5 is an elevation of projector which can be used instead of the camera of Figs. 1 and 3.

Referring in detail to the drawing, the motion picture camera 1 in Fig. 1 is electrically connected by the cable 2 to a switching device 3 mounted on the turntable 4 of a phonograph. With a cutter not shown, sound may be recorded on a disk on the turntable 4 in synchronism with the photographing of motion pictures with the camera 1. Camera 1 represents one of the standard makes of 16 m. m. camera although other types may be employed. Camera 1 has a spring motor represented at 5 to operate it. Camera 1 has been modified by connecting to the film operating mechanism thereof a shaft 6 which turns at the same speed as the shutter shaft, that is, one revolution per frame. Shaft 6 forms or is connected to the shaft of the motor 7 which is suitably supported on top of camera 1 by means of a shelf 8 supported by a brace or bracket 9

which is secured to the casing of camera 1 by screws such as 10.

The turntable 4 is provided with the usual motor 11 which operates the turntable 4 at 80 R. P. M., whereas shaft 6 runs at 960 R. P. M.

The switching or synchronizing device 3 which is shown in further detail in Fig. 4, comprises a lower disk 12 which rotates with the turntable 4 and an upper disk 13 which is held against rotation by means of arm 14. As shown in Fig. 4, disk 12 is caused to rotate with the turntable 4 by providing it with a recess 15 to receive the centering screw 16 commonly employed to center disks such as sound record 60 on the turntable 4. The arm 14 is hollow and serves as a cover for a portion of the cable 2. Arm 14 is connected at one end to the disk 13 by a bolt 17 and the phonograph is provided with a post 18 against which the arm 14 bears to prevent its rotation.

As shown in Fig. 4, disks 12 and 13 are provided with a sleeve 19 having a central bore to receive the center pin 21 of the turntable 4. Sleeve 19 is fixed to disk 12 while disk 13 has a sleeve bearing 22 rotatably mounted on the upper portion of sleeve 19. Collar 50 having set screw 51 prevents disk 13 from moving upward on sleeve 19. Surrounding the lower portion of sleeve 19 and resting on the upper surface of disk 12 is a collar 23 which serves as a support for the flange 24 on the sleeve 22.

Disk 12 carries two concentric rings 25 and 26 to which current is led from line 27 (Fig. 3) by brushes 28 and 29 respectively carried by the disk 13. Disk 12 carries a brush 30 which is connected by wire 31 to the inner ring 25, and a brush 32 which is connected by a wire 33 to the outer ring 26. Brushes 30 and 32 as they rotate make contact with different ones of a series of contacts 34 carried on the under side of disk 13.

Brushes 30 and 32 are about 180 electrical degrees apart, that is, when brush 30 is centered under a contact No. 1, as shown in Fig. 3, the center of brush 30 is midway between contacts No. 2 and 3. Also, the brushes 30 and 32 have such a width that when one of them is midway between two of the contacts 34, it straddles those contacts. With brushes 30 and 32 in position as shown in Fig. 3, the full voltage is applied across terminals 1—3, also across terminals 1—2, so that the windings of armature 35 between terminals 1—3, also 1—2 are energized. When disk 13 rotates 60 electrical degrees in a clockwise direction from the position shown in Fig. 3, brush 30 straddles contacts No. 1 and 3 while brush 32 is centered over a terminal No. 2. The full volt-

age is then applied across terminals 2—3, also 2—1, to energize the windings of armature 36 accordingly. The polarity of armature 36 thus rotates as disk 13 rotates. The switching device 3 is in effect a commutator which determines the current distribution to the windings of armature 36.

In the case assumed above, it is desired to operate camera motor 7 at a speed 12 times greater than the speed of the turntable 4. Therefore, I provide that the contacts 34 shall comprise, as shown in Fig. 3, twelve groups of contacts, with 3 contacts in each group. The motor 7 has a field winding 35 and an armature 36 from which I take out the leads 37, 38, and 39 at three equally spaced points marked 1, 2, and 3. The leads 37, 38, and 39 are connected to the corresponding contacts in one of the twelve groups which make up the total array of contacts 34, and the corresponding contacts in each group are connected in multiple as shown. The camera motor 7 makes one revolution each time that the disk 12 rotates 360 electrical degrees and this occurs once for each group of contacts 34 and 12 times for each revolution of turntable 4.

Line 27 and field 35 may be supplied with 24 volts from a transformer 40 connected to a power line 41 supplying 110 volts. Motor 7 may operate on 110 volts or on any other suitable voltage.

Variations in the speed of camera motor 7 cannot react on and change the speed of the turntable 4 as switching device 3 does not produce a torque. Turntable 4 is assumed to have a speed which is sufficiently constant to be used as a factor in setting the speed of the camera. When camera 1 is operated, the spring motor 5 is also operated. If spring motor 5 tends to drive the camera 1 too fast, the motor 7 acts as a brake. If spring motor 5 runs too slow, motor 7 supplies power to shaft 6. In both cases, the desired multiple speed relation is obtained.

If desired, the motor 7 may be too small to operate the camera 1 by itself, that is, unless the spring motor 5 is also operated. On the other hand, the spring motor 5 may be omitted and instead the motor 7 built into the camera 1 and of a sufficient size to operate the camera by itself.

The sound and picture recorded in synchronism with the apparatus of Fig. 1 may be reproduced, while maintaining synchronism, by using a pick-up not shown on the disk on turntable 4, and by substituting the projector 42 in Fig. 5 for the camera 1. Projector 42 illustrates a standard 16 m.m. projector now on the market, having a motor 43 and a shutter shaft 44. I have modified this projector by connecting to the shaft 44 a motor 45 which is like camera motor 7 or which in fact may be the same camera motor 7. The connections for motor 45 are the same as the connections for camera motor 7 as shown in Fig. 3. Motor 45 is suitably supported at the side of projector 42 by a cross piece 46 which is

secured by set screws not shown to the hub 47 on the side of projector 42. Cross piece 46 carries posts 48 and 49 mechanically connected to the casing of motor 45.

As in Fig. 1, both motors 43 and 45 are operated when the projector 42 is operated. Motor 45 acts as a brake, or supplies power, depending upon whether motor 43 tends to run too fast or too slow. I may dispense with motor 45 and modify the windings of the usual projector motor 43 as illustrated in Fig. 3 for the camera motor 7.

It will be apparent that I have provided a very simple manner in which a desired multiple speed relation may be obtained and have also shown how a camera and a projector may be modified to operate in synchronism with a phonograph turntable for sound recording and reproducing purposes. Various modifications may be made in the invention without departing from the spirit of the following claims.

I claim:

1. The combination of a phonograph turntable operable at a certain speed, a kinematograph having a shaft operable at another speed, a motor for said shaft, a plurality of spaced windings for said motor, an A. C. field winding therefor, an A. C. line, and means comprising a commutator unit removably carried by said turntable for distributing alternating current from said line and connections for said commutator for repeating said current distribution a number of times for each revolution of said turntable.

2. In a synchronizing system for operating a kinematograph shaft at a speed which is a multiple of the speed of a phonograph and wherein the kinematograph is provided with an A. C. motor having spaced windings and a field member, means for distributing current from an A. C. line to said windings comprising a commutator unit having a base to rest on a phonograph record and an aperture to receive the phonograph spindle, said commutator comprising one member rotatable with the turntable and another stationary member, a circular array of contacts in one plane for said spaced windings on one of said members, multiple connections for said contacts on the other side of said last mentioned member, and brushes on the other of said members.

3. An adapter unit for synchronizing a kinematograph having a shutter shaft with a phonograph having a spindle, said adapter comprising an auxiliary A. C. motor having a plurality of spaced windings, a field member therefor and a shaft, means for removably supporting said motor on said kinematograph with said motor shaft directly coupled to said shutter shaft, a single synchronizing commutator comprising relatively rotatable parts having a central bore to removably receive the end of the phonograph spindle, synchronizing connections from said commutator to said spaced windings, and means for connecting said commutator and said motor to an A. C. line.

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