

D. HIGHAM.
COMBINATION PHONOGRAPH AND MOVING PICTURE APPARATUS.
APPLICATION FILED NOV. 10, 1908.

1,054,203.

Patented Feb. 25, 1913.

5 SHEETS—SHEET 1.

Fig. 1

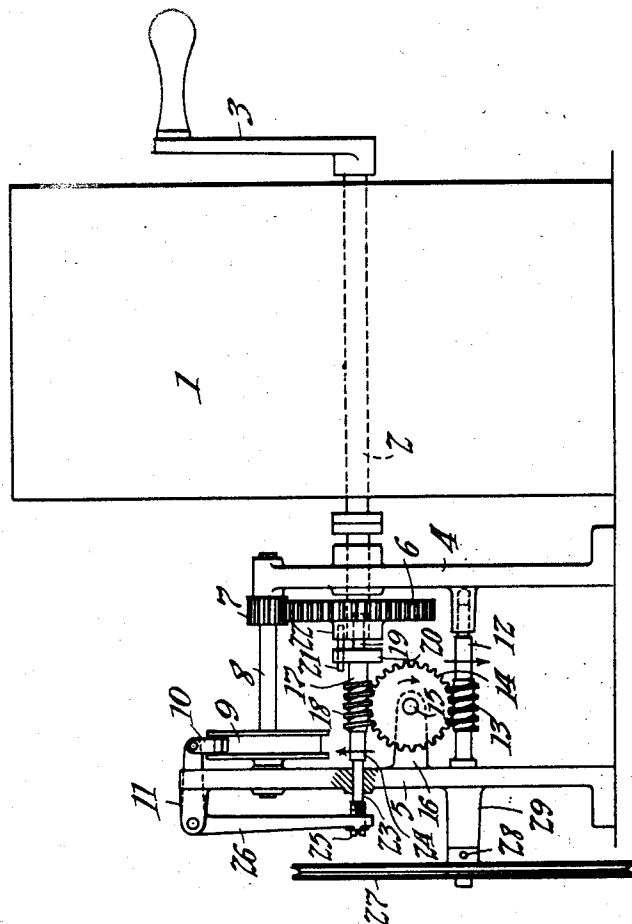
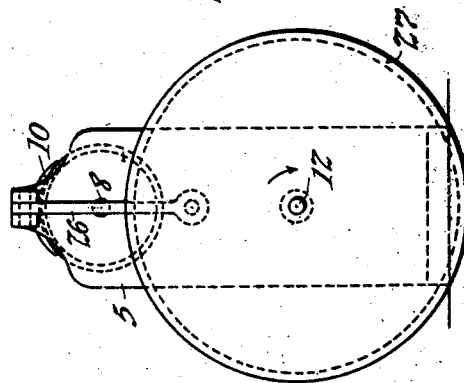


Fig. 2



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5 SHEETS—SHEET 2.

Fig. 3

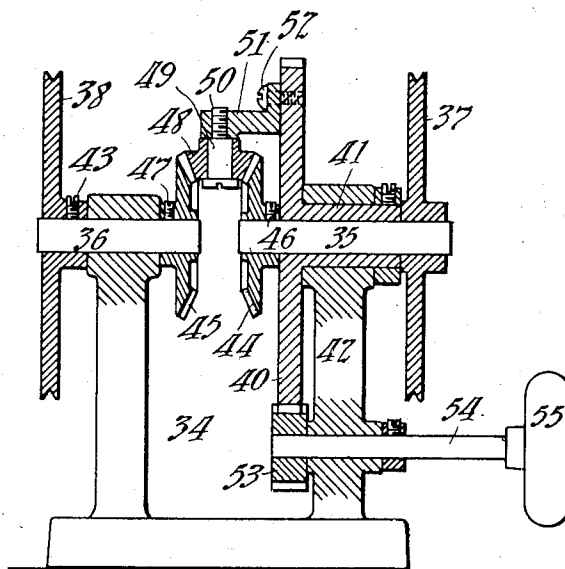
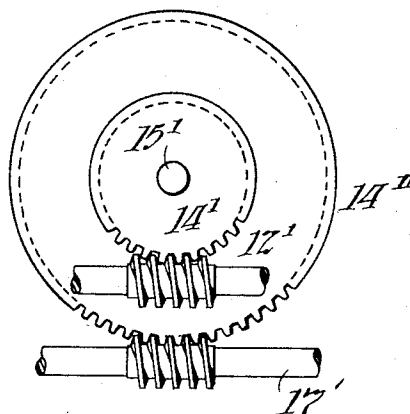


Fig. 4



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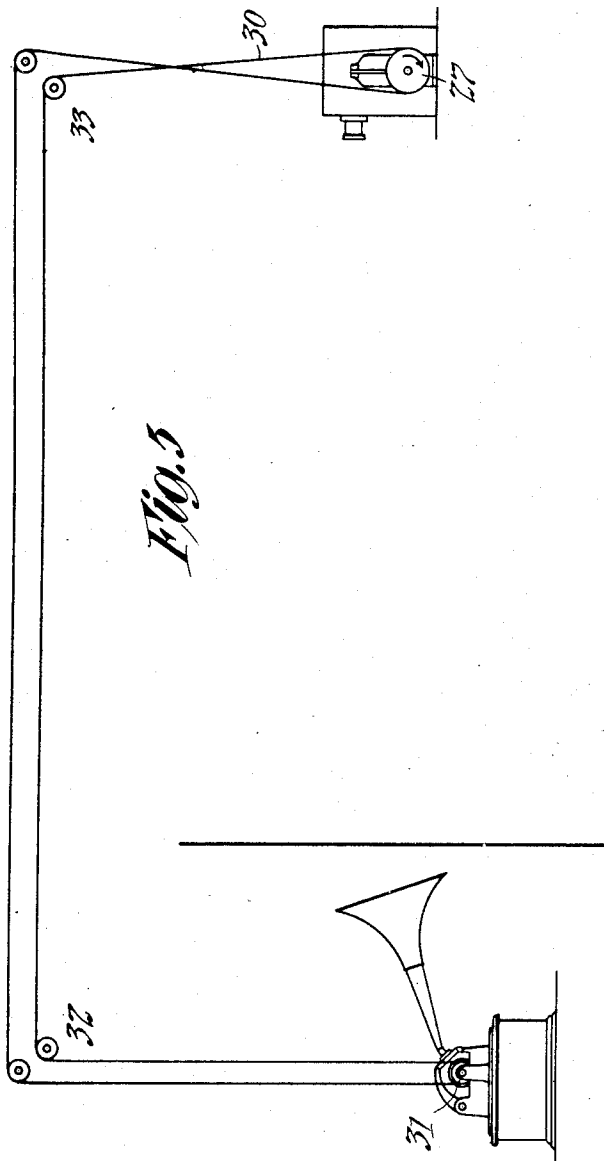
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6 SHEETS—SHEET 3.



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5 SHEETS—SHEET 4.

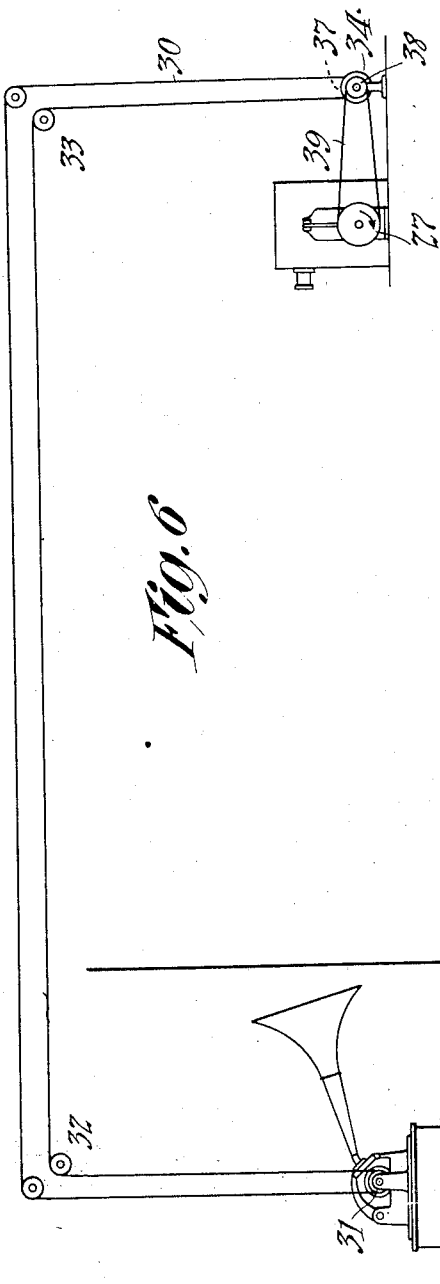


Fig. 6



Fig. 7

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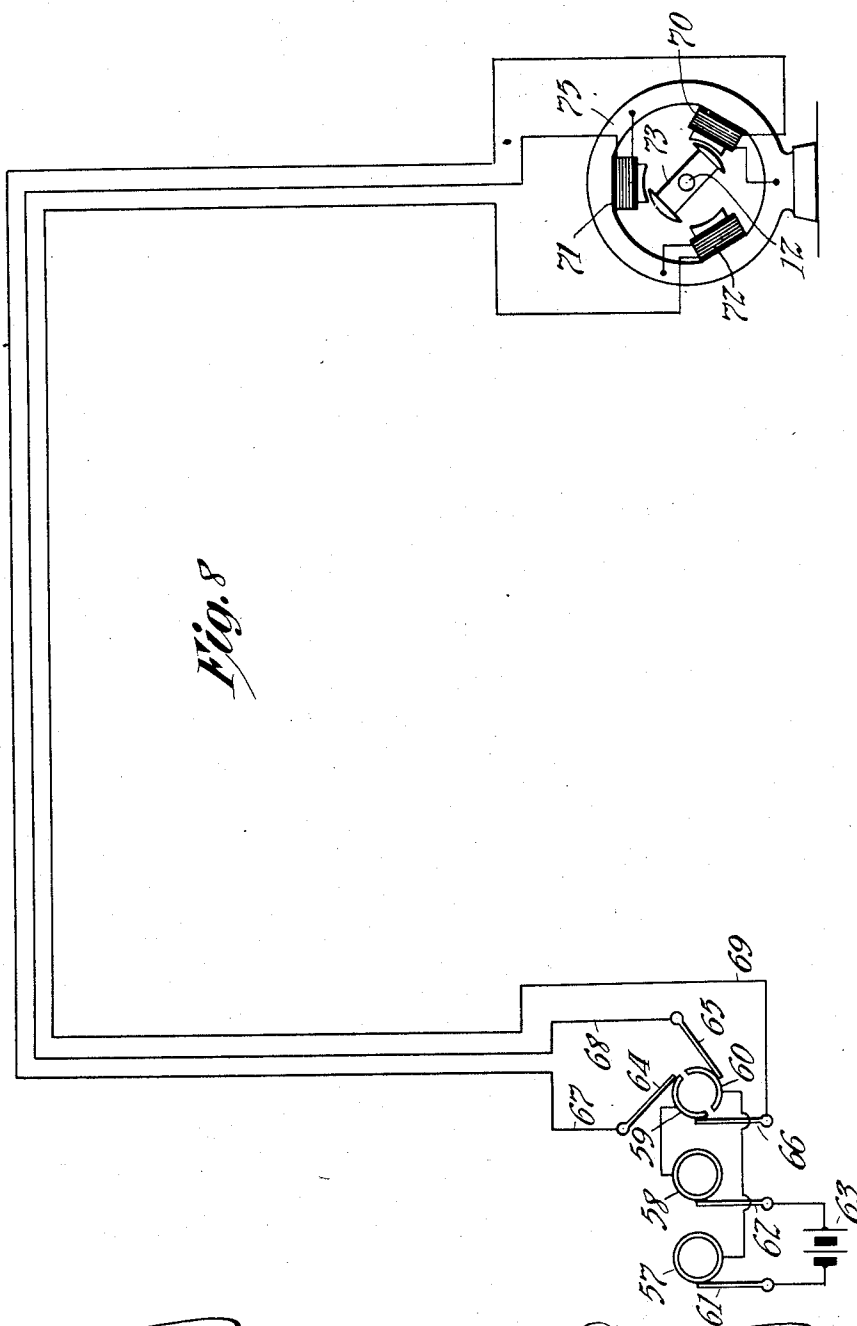
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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

DANIEL HIGHAM, OF NEW YORK, N. Y.

COMBINATION PHONOGRAPH AND MOVING-PICTURE APPARATUS.

1,054,203.

Specification of Letters Patent.

Patented Feb. 25, 1913.

Application filed November 10, 1908. Serial No. 461,869.

To all whom it may concern:

Be it known that I, DANIEL HIGHAM, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Combination Phonographs and Moving-Picture Apparatus, of which the following is a description.

This invention relates to an improved apparatus by means of which moving pictures may be thrown on a screen and the sounds appropriate thereto can be given forth by a talking machine simultaneously with the production of the pictures.

The object of my invention is to provide means by which a phonographic and moving picture apparatus can readily be operated in synchronism, each apparatus being driven by its own independent operating means, and the phonographic apparatus being preferably located behind or near the screen on which the moving pictures are displayed by the moving picture apparatus.

The phonograph, in the preferred form of my invention, is operated at an approximately constant speed, while the moving picture apparatus is regulated into synchronism with the phonograph by automatic means which brake or retard the movement of the moving picture apparatus when the latter exceeds the speed proper for the production of pictures in combination with the reproduction of their appropriate sounds, the force of the retarding means being removed or decreased when the speed of the moving picture apparatus is less than that at which the same should properly be run in connection with the phonographic apparatus to allow the motive means of the moving picture apparatus to increase the speed of the same and bring it into synchronism with the phonograph.

My invention contemplates the provision of means for performing the functions indicated which shall at the same time not interfere with the constant rotation of the phonographic apparatus, and which shall neither take from nor add to the power of the phonographic apparatus.

Another feature of my invention is the provision of means by which the operator can adjust the relative positions of the phonographic and moving picture records, while the latter are reproducing, by either advancing or retarding the moving picture

record to a sufficient extent to cause any scene and its appropriate sound to exactly coincide. This manipulative adjusting means preferably embodies means by which the moving picture driving means is allowed to operate momentarily at a greater speed than that permissible for exact synchronism with the phonographic apparatus when the moving picture record is somewhat behind the appropriate sound, or similarly in preventing the moving picture driving means from attaining a speed of exact synchronism with the phonograph for a brief interval when the moving picture record is somewhat ahead of the appropriate sound record.

My invention also consists in the various details of structure to be hereinafter described and claimed.

While my invention may be embodied in various forms, the preferred form is shown by way of example in the accompanying drawings in which—

Figure 1 is a front elevation of my improved synchronizing means shown in connection with a hand operated moving picture apparatus. Fig. 2 is an end view of the same. Fig. 3 is a vertical longitudinal section through the compensating or adjusting device. Fig. 4 is a detail view showing a modification of the synchronizing means shown in Fig. 1. Fig. 5 is a diagrammatic view showing the arrangement of the phonograph and moving picture apparatus when the compensating or adjusting device is not used, and Fig. 6 shows the same when the compensating device is used. Fig. 7 shows a modified arrangement in which the belt connection between the phonograph, located at or behind the screen and the moving picture apparatus is dispensed with, a second phonograph or phonographic motor governed to run in synchronism with the phonograph at the screen being connected, in this instance, with the moving picture machine by a belt or other means, and Fig. 8 shows a diagrammatic electrical connection between the phonograph and whatever element at the moving picture apparatus would otherwise be connected with the phonograph by other means as in Figs. 5 and 6 by belt.

The moving picture apparatus shown generally at 1 has a crank shaft 2 which is operated by a hand crank 3. An extension of the shaft is supported in frame members 4 and 5, and carries a spur gear 6 which

meshes with pinion 7 on shaft 8, which also carries friction brake wheel 9, adapted to co-act with which is brake shoe 10 pivotally supported from bell crank 11. Also mounted between uprights 4 and 5 is worm shaft 12 carrying worm 13 which is in mesh with worm wheel 14 mounted to rotate at 15 on arm 16 of frame member 5. Worm shaft 17 carrying worm 18 is mounted, in the form of my invention shown in Fig. 1 of the drawings, parallel to shaft 12, worm 17 carried thereby also meshing with worm wheel 14. Worm shaft 12 is rigidly mounted between uprights 4 and 5, whereas worm shaft 17 is so mounted as to allow a certain amount of longitudinal movement. Worm shaft 17 carries a reduced portion 19 at one end thereof, which has a sliding bearing in the end of crank shaft 2. On worm shaft 17 adjacent this reduced portion 19 is a collar 20 which carries a pin 21 which is inserted in a hole in boss 22 on gear 6, connection thus being furnished through boss 22 and pin 21 whereby worm shaft 17 may be driven from crank shaft 2, while at the same time, worm shaft 17 may slide axially, pin 21 being free to move backward and forward in its hole in boss 22. Worm shaft 17 is also provided with a reduced portion 23 which has sliding bearing in upright 5 through which upright it may slide a distance determined by shoulder 24 on shaft 17 on the inner side of upright 5. Screw 25 is adjusted in a threaded opening in the end of arm 26 of bell crank 11, which is so mounted that the end of screw 25 abuts against the end of shaft 17. Connection is thus provided by which the longitudinal movement of worm shaft 17 in one direction applies brake 10 to wheel 9 and in the other direction, allows the same to release.

Belt wheel 27 is mounted on the end of worm shaft 12 and held by pin or set screw 28, arm 29 of upright 5 serving as support for the overhanging end of shaft 12 and the belt wheel 27. A driving belt 30 runs over wheel 27 as shown in Fig. 5 of the drawings, and drives the same from a similar wheel 31 on the rotating shaft of the phonograph. This belt 30 is preferably a very delicate belt such as a fine cord or a thread, the power which must be transmitted thereby being so slight that no heavier form of belt is required. In Fig. 5 belt 30 is shown passing over the screen behind which the phonograph is concealed, and as guided by idler pulleys 32 and 33.

In the operation of my invention, if, when the phonographic and moving picture apparatus have been started in operation, the crank shaft 2 of the moving picture apparatus and with it worm shaft 17 are rotated in exact synchronism with worm shaft 12 which is rotated in synchronism with the

phonograph through the connection of belt 30, worm wheel 14 will turn idly meshing with both worms 13 and 18, worm shaft 17 having no tendency to axial shift and brake 10 remaining in a normal condition of adjustment, which may be either entirely clear from brake wheel 9 or, as preferred, resting thereon with a certain slight friction. If, however, the operator rotates crank shaft 2 of the moving picture apparatus at a speed greater than that proper for synchronous running of the moving picture apparatus and the phonograph, worm 18 on worm shaft 17 will rotate more rapidly than worm wheel 14 whose speed is regulated by that of worm 13 with which it is meshing, the speed of which cannot be greater than that imparted to it by belt 30 traveling at the same speed as the periphery of wheel 31 of the phonograph. The result of this increased speed of worm 18 is that the latter, meshing with the relatively slower worm wheel 14, forces itself by screw action between worm 18 and worm wheel 14 in a longitudinal direction, which with the direction of rotation of the parts shown by the arrows in Fig. 1 would be to the left, applying brake 10 to brake wheel 9 and retarding the rotation of crank shaft 2 of the moving picture apparatus, or causing such resistance to rotation of the moving picture apparatus that the latter will be slowed down to synchronism with the phonographic apparatus. It will be seen that the greater the excess speed of the worm 18 over that of worm 13, the greater will be the braking action of brake shoe 10 on brake wheel 9. In operation, where the moving picture machine is hand operated as shown, the operator always rotates crank 3 as rapidly as the braking apparatus will allow him to do. If the speed of rotation of the moving picture apparatus is less than that of the phonograph, the resistance to the brake is decreased or entirely removed, whereupon the shaft 2 under the force of its operation speeds up again into synchronism. The incline of the worm 13 (and correspondingly, of course, the incline of the worm 18) is so chosen that any longitudinal force which may be imparted to worm 13 by worm wheel 14 (as takes place upon the application of brake 10) has as much tendency to rotate the worm 13 as the friction between the teeth of worm wheel 14 and the convolutions of worm 13, has to oppose the rotation of said worm. The result of this construction is that worm 13 runs lightly without adding to or taking from the power of the phonograph motor (or equivalent apparatus) to any appreciable degree, and permitting the use of a delicate connection between the phonographic and moving picture apparatus, such as a light cord or small electrical mechanism.

Passing to a consideration of the adjusting or compensating device as shown in Fig. 3, such a device is shown as a whole diagrammatically in Fig. 6 by the numeral 34. This device comprises short shafts 35 and 36 on which are mounted respectively belt wheels 37 and 38. Belt wheel 37 is connected with pulley 31 of the phonograph by cord or belt 30 as shown in Fig. 6 of the drawings, while shaft 36 is connected by cord or belt 39 passing over pulley 38 and pulley 27 mounted on the end of worm shaft 12. Shaft 35 has mounted for rotation thereon gear 40 which is formed integral with a boss 41 which finds bearing surface in upright 42. Boss 41 and its gear 40 are mounted to rotate loosely on shaft 35, whereas, pulleys 37 and 38 are fastened to their respective shaft 35 and 36 as in the case of pulley 38 by set screw 43. Also fast to the adjacent ends of shafts 35 and 36 are bevel gears 44 and 45 secured to their respective shafts by set screws 46 and 47. Meshing with both gears 44 and 45 is a planetary gear 48 which is mounted for rotation on a stud 49 which is secured as by screw 50 to an arm 51 which is supported as by screw 52 from the face of gear 40. Meshing with this gear 40 is a pinion 53 which is fastened on the end of a short shaft 54, which carries on its other end hand wheel 55. The result of this construction is the provision of an adjusting means whereby the rotation in one direction or the other of hand wheel 55 results in a forward or back shift of the moving picture record with relation to the phonographic record. Normally, pulley 37 rotates in synchronism with the corresponding pulley on the phonograph, and transmits its rotation through shaft 35, bevel gear 44, pinion 48, bevel gear 45, shaft 36, belt wheel 38 and belt 39, to belt wheel 27, worm shaft 12 thereby receiving the speed appropriate for the operation of the moving picture apparatus and the phonograph in synchronism, as previously explained. If, however, it is desired to retard or advance the moving picture film somewhat in relation to the phonographic record, for the purpose of bringing the two records into exact step, hand wheel 55 is rotated in one direction or the other, resulting in a movement of planetary gear 48 in one direction or the other around shafts 35 and 36 as a center, whereby the speed transmitted from shaft 35 to shaft 36 through the intermeshing of gears 44 and 45 with pinion 48, is either increased or diminished in accordance with whether planetary gear 48 is rotated with gear 40 in a direction with or against the direction of rotation imparted to bevel gear 45 by pinion 48 in its function of connecting means between bevels 44 and 45. The result of this adjustment is either to give

worm shaft 12 a greater or a less speed during the time that hand wheel 55 is being manipulated, than the speed of exact synchronism with the phonograph. When this speed is thus increased, the result is that the operation of the crank 3 of the moving picture machine is permitted to move the moving picture films at a somewhat greater speed than that proper for the exhibition of the pictures in connection with the phonographic record, thereby catching up the pictures with the appropriate sound, whereas, if hand wheel 55 is adjusted in the other direction, and the speed of worm shaft 12 correspondingly diminished, brake 10 will be applied to brake wheel 9 when the moving picture apparatus is run at a speed somewhat less than that of exact synchronism with the phonograph, thus allowing the phonographic record to catch up properly with the picture record.

It is not necessary to mount worm wheel 14 as shown in Fig. 1 with worms 13 and 18 intermeshing therewith on opposite sides. A modification of this arrangement is shown in Fig. 4, in which worm shafts 12' and 17' are shown meshing with worm wheels 14' and 14'', which are rigidly connected to shaft 15' and rotate together. This construction may be used when it is desired that both worms 12' and 17' rotate in the same direction at different rates of speed, it sometimes being necessary to interpose gearing between the phonograph and the moving picture machine. In Fig. 4, as is, of course, obvious, one of the shafts could equally as well have been located at the other end of the diameter of the worm wheel with which it is meshed, thus giving an opposite rotation to that which it would impart through the transmission shown in Fig. 4.

Fig. 7 shows a modification in which the belt or cord 30 connecting the phonograph to the moving picture apparatus is dispensed with. In this embodiment of the invention, a second phonograph 56 is employed, connected in the present instance by means of belt 57 with the pulley 37 of the compensating or adjusting device 34, which in turn, is connected by belt 39 with pulley 27 as in the other embodiments of the invention. Worm shaft 12 is therefore, in this case, given a speed equal to or proportionate to that of phonograph 56, instead of being given a speed equal to or proportionate to that of the phonograph back of the screen as in the other modifications. Phonograph 56 is accordingly regulated so that its motor will run in synchronism with the phonograph back of or at the screen, which is intended to operate in connection with the moving picture apparatus. Phonograph 56 is stripped of its carriage and may,

of course, consist only of the motor and governing parts, or of an equivalent motor and governor.

Fig. 8 is another modification showing means for operating belt wheel 27 in synchronism with the talking machine by electrical means in place of the belt connecting means 30 of Figs. 5 and 6, or in place of the alternate scheme shown in Fig. 7. In this embodiment of the invention, the phonograph mandrel carries rings 57 and 58 electrically connected to the sections of the split rings 59 and 60 as shown. Brushes 61 and 62 bear on rings 57 and 58 and are connected with the opposite poles of a battery or other source of current 63. Brushes 64, 65 and 66 bear on split rings 59 and 60, being adjusted 120 degrees apart as shown. Brushes 64, 65 and 66 are connected as by wires 67, 68 and 69 with electromagnet coils 70, 71 and 72, which magnet coils are mounted upon a field magnet core-frame 75 having rotating armature 73, which is mounted on one end of and connected to worm shaft 12. Coils 70, 71 and 72 are connected together through the magnet core-frame 75 at each of the terminals of the coils other than those to which wires 67, 68 and 69 are connected. The result of this construction shown thus diagrammatically, is to provide motor means for revolving worm shaft 12 in synchronism with the phonograph mandrel since split rings 59 and 60 are connected to opposite poles of the source of current and brushes 64, 65 and 66 bear alternately on one or the other of these split rings, transmitting currents of such polarity to the magnet coils 70, 71 and 72 and consequently setting up such varying magnetisms in the same as to cause armature 73 to rotate in a manner which is well known. Six magnet coils might be used with equal or better results than the three coils 70, 71 and 72 shown connected to six brushes mounted 60 degrees apart, three coils and brushes being shown only for the sake of greater simplicity in the drawings.

It is obvious that it is not essential to this invention that the moving picture apparatus be hand operated. It could be operated equally well by an electric or other motor. In that case, however, it would be necessary to provide a frictional coupling or similar device between the motor and the shaft as will be readily understood. It is also obvious that various other changes might be made in the details of construction without departing from the spirit of the invention, and that my improved mechanism may be connected to any suitable rotating part of the moving picture apparatus.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In a device of the class described, the combination with a phonograph, a moving

picture apparatus, and independent motive means for each, of mechanical braking means and means for causing said braking means to resist operation of said moving picture apparatus at a speed in excess of that synchronizing with the phonograph, and for causing the resistance of said braking means to increase with the excess speed of said moving picture apparatus, substantially as described.

2. In a device for synchronizing a phonographic apparatus and a moving picture apparatus, the combination of means adapted to run in synchronism with the phonographic apparatus, means adapted to run in synchronism with the moving picture apparatus, a friction brake, and means for operating said brake to resist movement of said second named means with a force varying with the difference in speed between said first and second named means, substantially as described.

3. In a device of the class described, the combination with a phonograph and a moving picture apparatus, a rotatable shaft for each, means for driving the phonograph shaft at constant speed and independent means for driving the shaft of the moving picture apparatus, of mechanical means deriving power from said last named means for automatically bringing the shaft of the moving picture apparatus into synchronism with the phonograph shaft, and means for adjusting the relative angular positions of the shafts of the phonograph and the moving picture apparatus, substantially as described.

4. In a device of the class described, the combination with a phonograph and a moving picture apparatus, each having rotatable shafts, and independent means for driving the same, of mechanical means deriving power from the driving means for the moving picture apparatus for bringing the shaft of the moving picture apparatus into synchronism with the phonograph shaft, and manual means operable at will during the operation of the two machines for shifting the relative angular positions of the respective shafts of the same, substantially as described.

5. In a device of the class described, the combination with a phonograph and a moving picture apparatus, of means for driving the phonograph at an approximately constant speed, independent means for driving the moving picture apparatus, mechanical braking means for retarding the action of said last named driving means, means normally running in synchronism with the phonograph, and means coacting with said last named means to increase or decrease the braking action of the retarding means with the increase or decrease respectively of the speed of the moving picture apparatus with

respect to that of the phonograph, substantially as described.

6. In a device for synchronizing a phonograph and a moving picture apparatus, the combination of means adapted to be operated from the phonograph to run in synchronism therewith, means adapted to be operated from the moving picture apparatus to run in synchronism therewith, mechanical
braking means and means controlled by said first and second named means for causing the braking means to automatically resist movement of said second named means at a speed in excess of that synchronizing with said first named means, and for causing the resistance of said braking means to increase with the excess speed of said second named means, substantially as described.

7. In a device of the class described, the combination with a phonograph and a moving picture apparatus, of an axially immovable worm rotating in synchronism with the phonograph, a worm wheel meshing therewith, a worm mounted for a limited axial shift, and rotating in synchronism with the moving picture apparatus, said worm being in meshing connection with said worm wheel, a brake for the moving picture apparatus, and means for applying said brake connected for operation by the shifting of said shiftable worm, substantially as described.

8. In a device of the class described, the combination with a phonograph and a moving picture apparatus of two worm shafts operated in synchronism, one with said phonograph and the other with said moving picture apparatus, intermediate gearing between said worm shafts engaging the same, to shift the same longitudinally relatively to each other when not running in synchronism with each other, and means operated by such shifting to bring the phonograph and the moving picture apparatus into synchronism, substantially as described.

9. In a device of the class described, the combination with a phonograph and a moving picture apparatus, their shafts and separate driving means for each, of means operated from the phonograph to run in synchronism therewith, mechanical means coacting with said last named means to bring the moving picture apparatus into synchronism therewith, and means to adjust the angular position of said phonograph operated means with relation to the phonograph shaft, backward or forward, at will, substantially as described.

10. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of mechanical means controlled by the motive means of both of said apparatus for automatically retarding the speed of said moving picture ap-

paratus when such speed becomes greater than that for synchronism between the two apparatus, and manually operable means for momentarily and at will permitting said moving picture apparatus to exceed said last named speed or to prevent the same from attaining said speed, substantially as described.

11. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of mechanical braking means and means controlled by the motive means of both of said apparatus for causing the braking means to automatically resist operation of said moving picture apparatus at a speed in excess of that synchronizing with said phonographic apparatus, and for causing the resistance of said braking means to increase with the excess speed of said moving picture apparatus, substantially as described.

12. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of a worm rotated in synchronism with said phonographic apparatus, a gear meshing therewith and braking means coacting with said gear for automatically maintaining said apparatus in synchronism with each other, substantially as described.

13. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of mechanical braking means for resisting operation of said moving picture apparatus, movable means controlled by both of said apparatus and caused to move by a departure thereof from synchronism, and a mechanical connection between said braking means and said movable means for operating said braking means, substantially as described.

14. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of means controlled by the motive means for both of said apparatus for automatically maintaining said apparatus in synchronism, said means comprising two worms operated in synchronism, one with said phonographic apparatus and the other with said moving picture apparatus and intermediate gearing between and engaging said worms, substantially as described.

15. In a device of the class described, the combination with a phonographic apparatus, motive means therefor, a moving picture apparatus, and manual means for operating the latter, of interconnecting mechanism between said phonographic and moving picture apparatus for preventing said moving picture apparatus from exceeding a speed

synchronizing with that of said phonographic apparatus, and manually operable means for momentarily and at will permitting said moving picture apparatus to exceed said speed, substantially as described.

16. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of interconnecting mechanism between said phonographic and moving picture apparatus for preventing said moving picture apparatus from exceeding a speed synchronizing with that of said phonographic apparatus, and manually operable means for momentarily and at will permitting said moving picture apparatus to exceed said speed a desired amount, substantially as described.

17. In a device for synchronizing a phonographic apparatus and a moving picture apparatus, the combination of means adapted to run in synchronism with the phonographic apparatus, means adapted to run in synchronism with the moving picture apparatus, mechanical braking means, and means for operating said braking means to resist movement of said second named means with a force varying with the difference in speed between said first and second named means, substantially as described.

18. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of means controlled by both of said motive means for automatically maintaining said apparatus in synchronism with each other, said means comprising a worm rotated in synchronism with one of said apparatus and having a differential connection with the other apparatus, substantially as described.

19. In a device for synchronizing a phonographic apparatus and a moving picture apparatus, the combination with a brake, of means for applying said brake comprising a worm adapted to be rotated in synchronism with said phonographic apparatus, a worm adapted to be rotated in synchronism with said moving picture apparatus, and intermediate gearing engaging said worms, substantially as described.

20. In a device of the class described, the combination with a phonographic apparatus,

a moving picture apparatus and independent motive means for each, of a shaft operated to run with substantially constant speed in synchronism with said phonographic apparatus, a shaft operated to run with substantially constant speed in synchronism with said moving picture apparatus, said two shafts being connected by a device comprising a movable member which is caused to move by a departure from synchronism of said two shafts, mechanical braking means for retarding the speed of one of said apparatus, and a mechanical connection for communicating the movement of said movable member to the braking means to automatically bring said two apparatus into synchronism with each other, substantially as described.

21. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of mechanical braking means for resisting operation of said moving picture apparatus, and means controlled by both of said apparatus for automatically operating said braking means to maintain said apparatus in synchronism with each other, said controlled means being entirely mechanical and having provision for preventing the operation of the braking means from causing a substantial variation of the load upon the phonographic motive means, substantially as described.

22. In a device of the class described, the combination with a phonographic apparatus, a moving picture apparatus, and independent motive means for each, of mechanical braking means for resisting operation of said moving picture apparatus, said braking means deriving its power from the moving picture apparatus motive means, movable means controlled by both of said apparatus and caused to move by a departure thereof from synchronism, and a mechanical connection between said braking means and said movable means for operating said braking means, substantially as described.

This specification signed and witnessed this 9 day of Nov. 1908.

DANIEL HIGHAM.

Witnesses:

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ANNA R. KLEHM.