O. E. KELLUM.

CONTINUOUS PHONOGRAPH, KINETOGRAPH, OR THE LIKE.

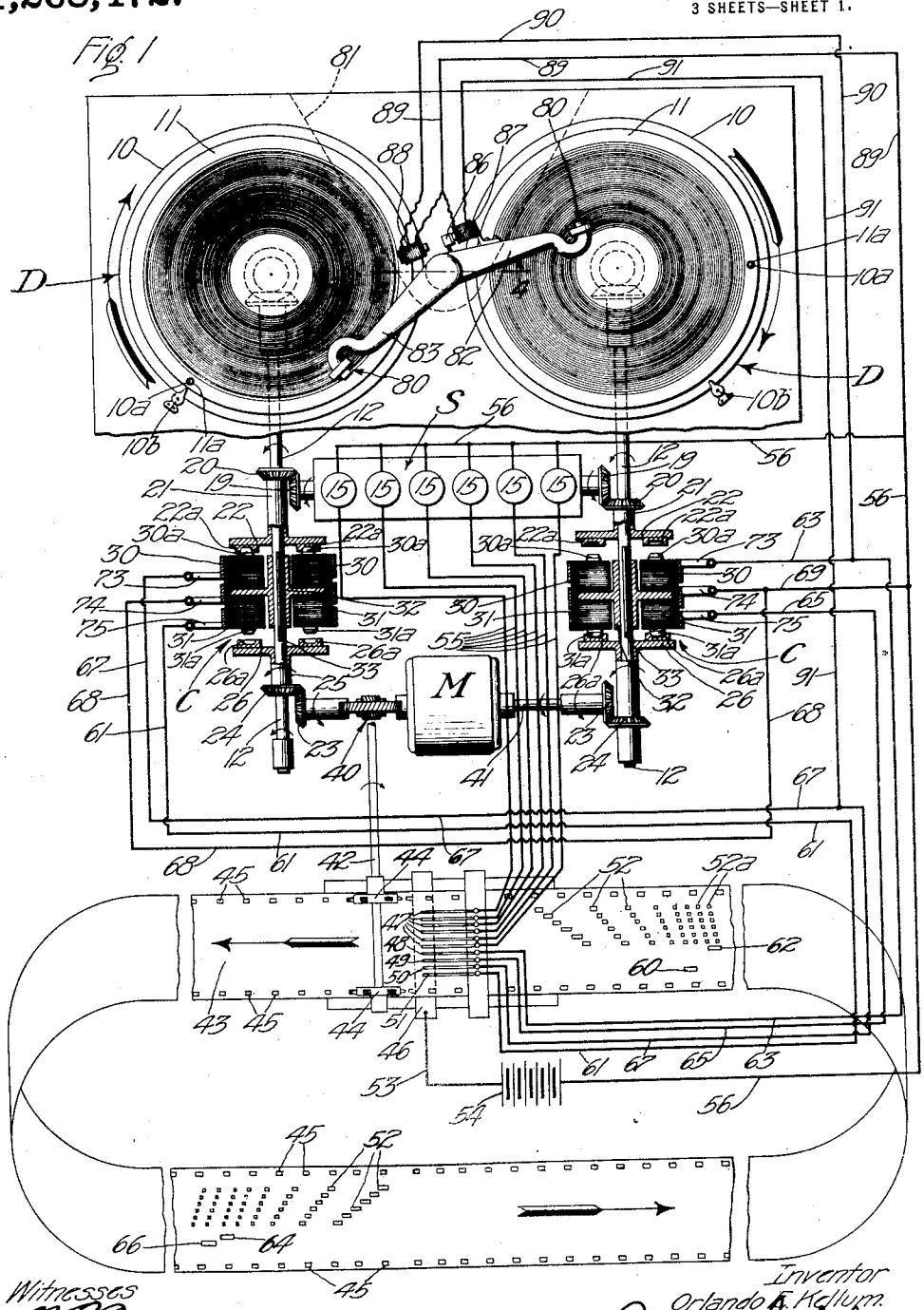
APPLICATION FILED MAR. 16, 1914. RENEWED NOV. 1, 1917.

1,268,472.

Patented June 4, 1918.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses

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3 SHEETS—SHEET 2.

Fig 2

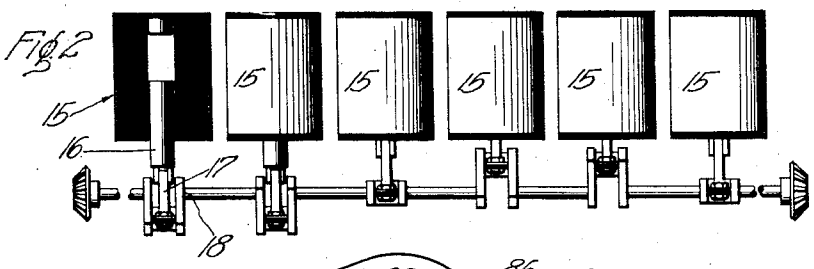


Fig 4

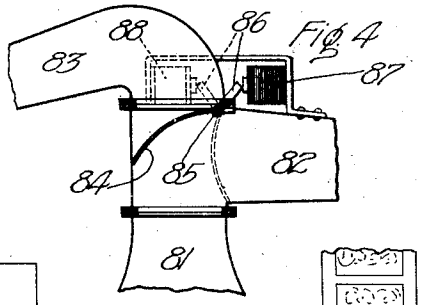


Fig 3

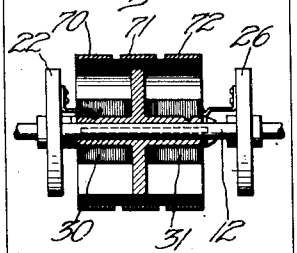


Fig 6.

Witnesses

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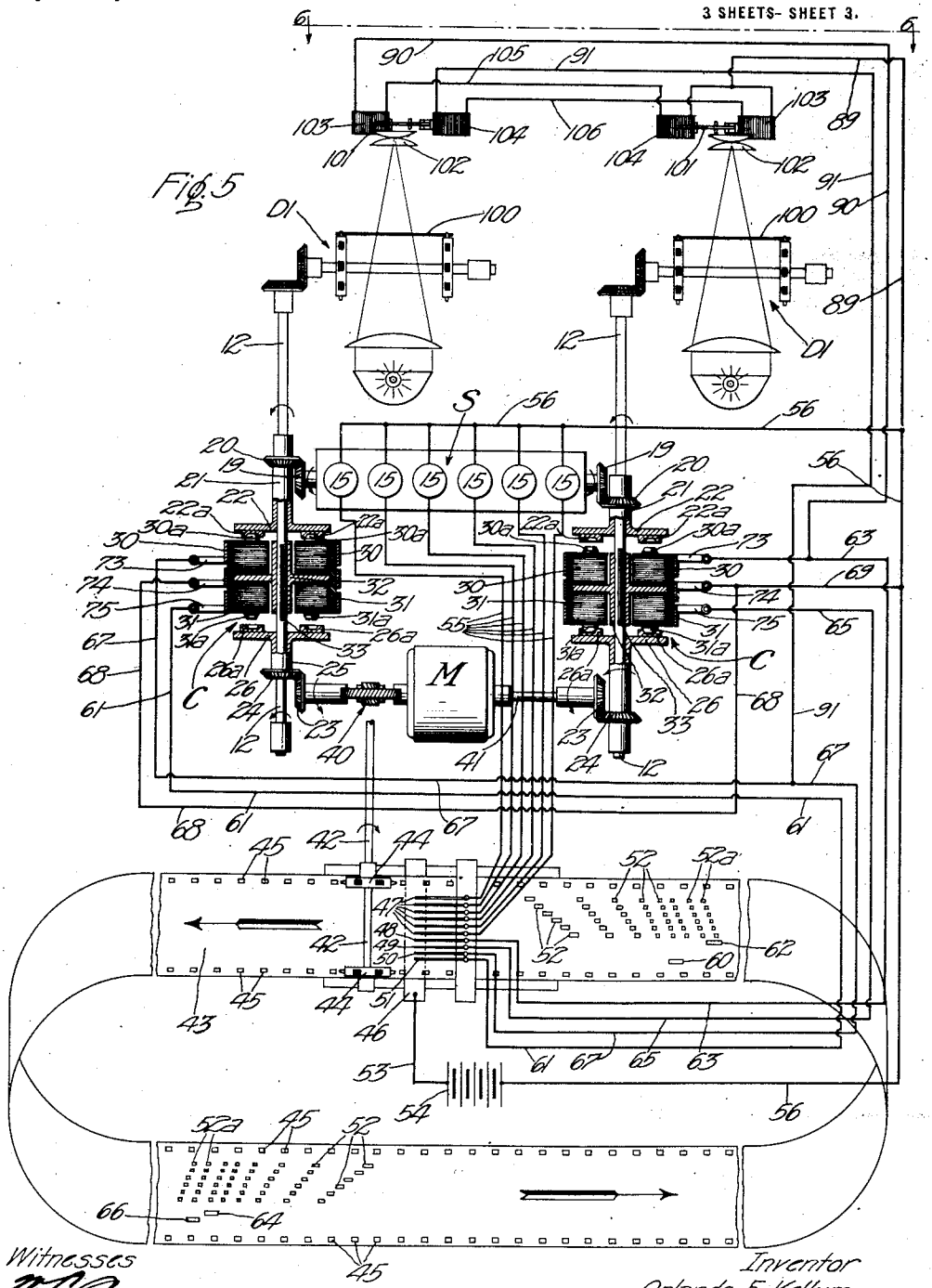
APPLICATION FILED MAR. 16, 1914. RENEWED NOV. 1, 1917.

1,268,472.

Patented June 4, 1918.

3 SHEETS- SHEET 3.

Fig. 5



Witnesses

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UNITED STATES PATENT OFFICE.

ORLANDO E. KELLUM, OF LOS ANGELES, CALIFORNIA.

CONTINUOUS PHONOGRAPH, KINETOGRAPH, OR THE LIKE.

1,268,472. Specification of Letters Patent. Patented June 4, 1918.

Application filed March 16, 1914, Serial No. 824,909. Renewed November 1, 1917. Serial No. 199,773.

To all whom it may concern:

Be it known that I, ORLANDO E. KELLUM, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Continuous Phonographs, Kinetographs, or the like, of which the following is a specification.

This invention relates to the original making and reproduction of records, such as phonograph and kinetograph records, or any sound or visual or other like records; and the main object of this invention is the provision of means to make and reproduce a continuous record of indefinite length.

As is well known, the continuous performance of a kinetograph, phonograph or similar recording or reproducing machine, is limited by certain physical conditions inherent in the records themselves. Thus, the length of continuous performance of a phonograph is limited by the length of the phonograph record; and a kinetograph performance is necessarily limited by the length of one continuous film. My invention provides means for an indefinitely continuous performance by providing means for unbroken continuance from one record to a subsequent one, the end of the preceding record and the beginning of the succeeding one being so matched and so synchronized that the final effect is just as if there were only one continuous record of indefinite length.

As hereinbefore stated, my invention may be applied to any machine or device for making or for reproducing records. I herein explain my device in connection with a phonograph and with a kinetograph, but I do not limit my invention to these particular machines. I most particularly explain my invention in connection with a phonograph; this application of my invention typifying its application to other record taking and record reproducing machines.

As applied to a phonograph, my invention embodies the following described typical elements; I provide two distinct record driving devices adapted to drive separate records; and I provide a constantly running motor (of any desired character) for normally driving either one or the other of the record drivers. There is a special device for initially starting either one or the other of the record drivers and for starting the corresponding record; and this starting device (preferably in the form of a motor adapted to be synchronously energized or controlled) is controlled so that it will bring the next record up to even speed with the record being driven by the constantly running motor at a time when the preceding record is about finished. When the starting motor has brought the succeeding record up to normal speed, then the succeeding record is connected directly with the constantly running motor and may be driven synchronously with the preceding record for a short interval. The connection between the preceding record and the constantly running motor is then broken, and the succeeding record is then driven to its end. In the meantime the attendant takes the first record off the record driver and substitutes for it another record which will succeed the second record. The third record is brought into play in the same manner that the second one was brought into play. This procedure may go on indefinitely.

When the records are originally made, they are made on a machine which is, in all essentials a duplicate of the machine on which the records are finally reproduced. The starting of the new records, in either case, is controlled by the same control mechanism. Thus, whether the records are being made or reproduced, the preceding record will be given just so many revolutions before the succeeding record is started up and is thrown into driving relation with the constantly running motor; and the arrangements are such, that once the records have been taken under the control of my device, they will always in future match and synchronize with each other under the control of my device. In fact, the only essential difference between a record making machine and a record reproducing machine, according to my invention, is the substitution of means for acting upon the record instead of means adapted to be operated by the record. When I speak of record, I speak broadly and without limitation. I do not herein limit myself to a phonographic or sound record; but by the term record I mean to designate any form of visual, auditory or other record which is made at one time of events or conditions and is reproduced at another time.

I have illustrated preferred embodiments of my invention in the accompanying drawings, in which,

Figure 1 is a diagram showing my invention as applied to a phonograph,

Fig. 2 shows a preferred form of record starting motor,

Fig. 3 shows a preferred form of connection means between the motor and the record drivers,

Fig. 4 is a section taken on line 4—4 of Fig. 1,

Fig. 5 is a diagram similar to that of Fig. 1, showing my invention applied to a kinetograph,

Fig. 6 is an elevation taken as indicated by line 6—6 of Fig. 5.

Referring now to the drawings and particularly to Figs. 1 to 4, the letter "D" may indicate a pair of independent record drivers, in this particular instance having the form of rotatable tables 10 upon which flat disk records 11 may be placed. The tables 10 may be driven from shafts 12 which are provided with certain connective or clutch mechanisms by which either of them may be connected to the constantly running motor "M" or to the starting mechanism "S". The starting mechanism "S" is preferably in the form of an electromagnetic motor capable of controlled operation; that is, capable of controlled operation by energization by successive impulses, so that the speed of operation of the motor may be accurately controlled. This starting motor "S" may be of any preferred design; I have shown a typical form in Fig. 2, being the form of motor which I use in my synchronizing apparatus shown in my Patent No. 1,027,658 dated May 28th, 1912. In essentials, this motor comprises a plurality of solenoids 15 each with a plunger 16 and connecting rod 17 connected to crank shaft 18. The cranks are arranged so that the plungers and solenoids must act successively in order to uniformly rotate the shaft 18. Successive electrical impulses to the solenoids will cause the controlled rotation of the crank shaft 18 and cause operation of the motor at any desired speed.

At each end of the crank shaft 18 there may be gears 19 meshing with gears 20 mounted on sleeves 21 which carry clutch disks 22. These sleeves 21 and clutch disks 22 are loose on the shafts 12 and are adapted to be rotatively connected with the shafts through the medium of the clutch mechanisms "C". The constantly running motor "M" (which may be of any desired character) has gears 23 meshing with gears 24 on sleeves 25 loose on the shafts 12, the sleeves 25 carrying clutch disks 26 similar to and opposing the clutch disks 22. The movable part of the clutch mechanism "C" is placed between these two clutch disks. The clutch disks may be of magnetic material; and the movable part of the clutch mechanism carries electromagnets 30 and 21 mounted upon sliding sleeve 32. The energization of magnets 30 will move the sleeve 32 toward the disk 22 and will cause the engagement of the pole pieces 30^a in the cups 22^a, so as to make a driving engagement between the disk 22 and the shaft 12 through the sleeve 32 which is slidably keyed to the shaft 12 at 33. Energization of the magnet 31 will cause engagement of the pole pieces 31^a with the cups 26^a and make driving connection from the motor "M" through the clutch disk 26 to the shaft 12. Normally, the motor "M" is connected to and driving one of the shafts 12 and one of the record drivers "D", while the starting motor "S" is connected to the other shaft 12 ready to drive the corresponding record driver "D". The starting motor "S" is so controlled that it is started in operation at precisely the correct instant and brings up the speed of one of the records equal to the speed of the other of the records driven by the constantly running motor "M"; and when this has taken place the clutches "C" are then shifted and the new record is connected to the motor "M" and the old record is dropped.

I provide means for energizing the starting mechanism, which energizing means is operated or controlled in synchronism with the record being driven by the constantly running motor "M". I prefer to drive this energizing or control means directly from the motor "M". In the drawings, I have shown a suitable gear arrangement 40 between the motor shaft 41 and the control shaft 42. This control shaft 42 preferably runs at a speed much lower than that of the motor, and it drives a commutator or other electrical contact mechanism which I preferably provide in the form of a perforated endless film 43 coöperating with certain brushes, as herein explained. This endless film 43 is uniformly and accurately driven in the direction indicated by the usual expedient of toothed wheels 44 on the shaft 42 engaging in perforations 45 at the edges of the film. At any given point there is a contact plate 46 arranged beneath the endless film, and a plurality of brushes 47, 48, 49, 50 and 51 above the film opposite the contact plates 46. A series of perforations 52 are adapted to pass under the contact brushes 47 and to momentarily allow these contact brushes to engage the plate 46 to complete an electrical circuit between the respective brushes and the plate. A wire 53 connects the plate 46 with one side of an electrical source 54. The brushes 47 are individually connected by wires 55 to the solenoids 15 of the starting motor, while the other sides of the solenoids are connected by wire 56 to the other side of the electrical source 54. Suppose the machine to now be operating with the parts in the positions shown and that the motor "M" is driving the right hand record 11, which is nearly finished. The left hand record 11 has been placed upon the

table 10 with a pin 10^a through an aperture 11^a in the record, so as to register the record on the table, and with both pin and aperture opposite a pointer 10^b. The arrangement is such that, when the table 10 is in this position, the starting motor "S" is in such position, that, say the left hand solenoid 15 is ready for action, its core 16 being in position to be drawn up. That is, the starting motor "S" is ready for action when the solenoids are successively energized beginning with the left hand solenoid 15. As the film 43 moves toward the left the foremost aperture 52 comes beneath that brush 47 which is connected by wire 55 to the left hand solenoid 15; and immediately thereafter, in succession, the other apertures 52 come beneath the corresponding brushes 47 so that successive impulses are sent through the wires 55 to the corresponding solenoids 15. Immediately one series of the apertures 52 has passed the brushes, the next series passes beneath them; and so on until all but the last few series, say the last two series of apertures 52, have passed beneath the brushes 47. It will be noted that these series of apertures are cut in the film so that the apertures follow each other at progressively decreasing intervals; and this means that electrical impulses are sent to the solenoids 15 at progressively decreasing intervals and that the starting motor "S" is therefore gradually brought up to normal speed. By the time all but, say, the last three series of apertures have passed the brushes 47, the starting motor "S" has been brought up to normal speed and the left hand record 11 is being driven at a speed equal to that of the right hand record 11 driven directly from the constantly running motor "M". The last two series of apertures $52^{a'}$ are placed so that the starting motor "S" will be operated for a short time at its normal uniform speed after that uniform speed has once been attained. As soon as the starting motor has attained the normal speed (as soon as all but the last series of apertures 52^a have passed under the brushes 47) an aperture 60 passes beneath the brush 51 and allows the brush 51 to engage the contact plate 46, sending a current through the wire 61 to the electro-magnets 31 of the left hand clutch mechanism "C", causing the clutch mechanism to immediately throw to position to connect the shaft 12 with the constantly running motor "M". This action taken place at such a time that the pole pieces 31^a are exactly opposite the cups 26^a on the clutch disk 26. The clutch disk and the cups are constantly revolving in the direction indicated; and the commutator mechanism, including the film 43 with its perforations, etc., is so coöperated with the motor "M", and therefore with the disk 26, that the shaft 12 and the pole pieces 31^a will be revolving in the same direction at the same speed as the clutch disk 26 and the cups 26^a and the pole pieces will be exactly opposite the cups when the perforation 60 comes under the brush 51 and the electro-magnets 31 act to throw the clutch mechanism to connect the left hand record with the constantly running motor "M". When this has been done, the left hand record is driven by the constantly running motor, as is also the right hand record; and the starting motor "S" is also being driven at a speed which drives the clutch disks 22 at even speed with the shafts 12. While the starting motor is still in operation, another perforation 62 in the film 43 passes under the brush 48 and current is sent through wire 63 to the magnets 30 of the right hand clutch mechanism, causing that clutch to throw to position to disconnect the shaft 12 from the motor "M" and to connect it to the starting motor "S". The same control arrangement which provides that the clutch mechanism shall match accurately when throwing in the side connecting to the motor "M" provides for accurate matching when the clutch mechanism throws in the side connecting with the starting motor "S". That is, the starting motor "S" being in action, the cups 22^a of the right hand clutch are exactly opposite the pole pieces 30^a when the magnets 30 are energized and when the clutch shifts position. Immediately after this action has taken place, the starting motor comes to a stop, the shaft 12, at the right hand, also coming to a stop. The clutches are then in positions opposite to that illustrated in Fig. 1. The attendant then removes the right hand record 11 and replaces it with a record which is to succeed the left hand record 11, registering the pin 10^a with the pointer 10^b as before. This act of registration also moves the starting motor to its proper position for making its next start under control of the commutator mechanism. The record 11 at the left hand then rotates until it has been entirely used, when the other sets of perforations 52, 52^a, etc., come under the brushes 47. The starting motor is again operated to start the right hand record 11; and as soon as the starting motor attains its normal speed, the perforation 64 passes under the brush 49 and a current is sent through wire 65 to the magnet 31 of the right hand clutch "C", causing that clutch to return to the position shown in Fig. 1 and causing the right hand record to be directly connected to the motor "M". During the brief succeeding interval, the two records are driven together in unison by the motor "M". This is for the purpose of allowing the record which is being started to steady down to uniform and vibrationless motion before it is actually thrown into use. At the end of this short interval another perforation 66 passes be-

neath the brush 50 and a current is sent out over the wire 67 to the magnets 30 of the left hand clutch, returning that clutch to the position shown in Fig. 1. This operation of starting successive records may be kept up indefinitely. The various magnets 30 and 31 are connected by common wires 68 and 69 to the battery 54. The clutch mechanism is provided with three collector rings 70, 71 and 72 engaged by brushes 73, 74 and 75 respectively to which the wires 67, 68 and 61 connect for the left hand clutch mechanism, and to which the wires 63, 69 and 65 connect for the right hand clutch mechanism. The rings 70 are connected to one side of the magnets 30 and the rings 72 to one side of the magnets 31, while the rings 71 are connected to the opposite sides of all the magnets, forming the common connection through which all the magnets are connected to the battery 54.

I have shown, in coöperation with the records 11, suitable mechanisms 80, which mechanisms may be either for the purpose of originally making the records or for reproducing them. These mechanisms may connect to a suitable horn 81, or other sound transmitter, through the medium of two tubes or sound arms 82 and 83. I have provided means by which either one or the other of mechanisms 80 may be cut off from connection with the horn 81. A shutter or valve 84 is mounted upon a pivot 85 carrying an armature 86, and this armature may be of sufficient weight to over-balance the valve 84 and to hold it either in the position shown in full lines or the position shown in dotted lines in Fig. 4. A pair of magnets 87 and 88 operate upon the armature 86 to throw it and the valve from one position to another. Energization of the magnets 87 will cause the sound arm 83 to be shut off from connection with the horn 81, while energization of the magnet 88 will cause the sound arm 82 to be shut off from connection with the horn 81. One side of each of the magnets is connected to a common wire 89 leading to the battery wire 56; the other sides of the magnets are connected to wires 90 and 91 connecting to wires 63 and 67 respectively. The wires 63 and 67 are the ones which form a part of the circuit for energizing the magnets 30 of the two clutches "C." Whenever the magnets 30 are energized to disconnect either of the record drivers from the motor "M," then the corresponding magnet 87 or 88 is energized to throw the valve 84 to disconnect the corresponding arm 82 or 83 from the horn 81, and to thus disconnect the corresponding mechanism 80 from the horn. At the same time, the mechanism 80 for the other record (the record which has just been started in operation) will be simultaneously thrown into action.

Suppose now that a record is being made on my machine and suppose that the original sound of, say, an opera, is being produced in front of the horn 81, or is being produced in any manner in connection with the horn or equivalent. Suppose also that the mechanism is in the position shown in Fig. 1, and that the right hand record has been placed upon the right hand driver and registered, as stated, and the right hand mechanism 80 has been placed in proper cooperation with the record. As the right hand record is rotated, the mechanism 80 will record upon it the sound being originally produced through the horn. As the right hand record reaches its end, the control mechanism, including the film 43, reaches the position shown in Fig. 1 and the new record which has been placed upon the left hand driver is started in operation. The starting motor brings the new record up to speed and the left hand clutch is then thrown to connect the new record to the motor "M." Immediately thereafter, the first record is disconnected from the motor "M" and simultaneously the valve 84 is shifted so as to throw the sound into the left hand mechanism 80 which immediately begins recording it. It will be noted that recording does not begin upon the succeeding record until that record has been fully connected to the motor "M" and has had a short interval to steady down to uniform and vibrationless rotation. The attendant removes the first record and places on the right hand driver another blank record. The left hand record rotates through a certain pre-determined number of revolutions when the control mechanism starts the third record and shifts the operation to that record at the instant of finishing the second record. This may take place indefinitely.

In reproducing a series of records, made as above described, there is no difference whatever in the mechanism of my invention, except that the mechanism 80 becomes a reproducer instead of a recorder. The attendant places the first record upon either one or the other of the record drivers and registers it, as hereinbefore stated, and places the needle of the reproducer in the outermost groove of the record. The machine then acts to rotate the record and to change to the succeeding record in exactly the same manner as it before acted in making the original records; so that, upon reproduction, the records must necessarily match and there can be no break or discrepancy between them. In practice, I propose to make a standard control mechanism; that is, I propose to make the film, or equivalent, of standard design and dimensions and to make and reproduce all of the records under the control of this one standard control mechanism. With this arrangement, I am

enabled to take continuous records at any place and to send those records to other places where they may be reproduced under the control of my machine with its standard control mechanism. Hence, records taken under the control of my mechanism can always be reproduced accurately and without interruption on any of my machines at any time and place.

In Figs. 5 and 6 I show my invention as applied to a kinteograph. I show two driving mechanisms D^1 taking the place of the two drivers "D" of the form shown in Fig. 1. The driving mechanisms D^1 are driven from the shafts 12 and may include any suitable means for driving a motion picture film 100. In the drawings, I have shown a simple arrangement; any of the arrangements now in vogue for intermittently moving the film may be used. I have shown a shutter 101 adapted to cut off the light rays to or from the objective lenses 102, these shutters being operated by magnets 103 and 104. Energization of either of the magnets 104 will cause the corresponding shutter to assume the position before the objective 102; while energization of either of the magnets 103 will cause the shutter to be retracted from this position. The wire 90, hereinbefore described, connects to the magnet 103 of the left hand mechanism in Fig. 5, while the wire 91 connects to the magnet 104 of the same mechanism, while the magnet 103 of the left hand mechanism is connected by wire 105 with magnet 104 of the right hand mechanism, and magnet 104 of the left hand mechanism is connected by wire 106 with magnet 103 of the right hand mechanism. The other sides of both magnets 103 and 104 of the right hand mechanism are connected to the common wire 89. Current sent through the wire 90 (which occurs when the right hand film 100 is being finished and when the left hand film is brought into play) will energize the left hand magnet 103 and right hand magnet 104 (in Fig. 5) which will throw the shutters to the position shown in Fig. 6. Current sent through the wire 91 will cause movement of the shutters oppositely. To all intents and purposes, this shutter mechanism operates similarly to the valve mechanism shown in Fig. 4, the effect of this shutter mechanism being to throw the shutter over the lens of the film just being finished and to open the shutter over the lens of the film just being started.

When my device is put in action in connection with a kinetograph, the film 100 is placed with a certain mark 110 opposite a suitable mark 111 on the apparatus which drives the film and both marks are placed opposite a pointer 112 mounted on some stationary part of the apparatus. The control mechanism causes the first film to be fed through a machine; and after a certain definite length of film has been passed through the machine the control mechanism will then start the operation of the starting motor to start the next film. Thus, as shown in Fig. 6, the left hand film is nearing its end and the right hand film is just ready to start (in Fig. 5 it is the right and left films that are finishing and starting, respectively). The starting motor will start the right hand film and the corresponding driver mechanism will be thrown into driving relation with the constantly running motor "M" and the connection of the motor "M" to the left hand film will then be broken. Just as this action takes place, the last picture on the left hand film (in Fig. 6) will be passing the lens and the first picture on the right hand film will be just ready to pass. The first picture on the right hand film will be a continuation of the last picture on the left hand, just as closely as two pictures on the same film are continuations of each other. When the left hand film is finished, the attendant places the third film, as hereinbefore described, and it is thrown into action as soon as the second film has been finished.

It will be seen that the gist of my invention is contained in the provision of a pair of record drivers, and a constantly running motor, and means for connecting the motor with either of the drivers, and a means operated synchronously with, or in control by, the record being driven by the motor or the motor itself, for throwing a new record into action. The particular modes of action and the specific constructions of the various parts do not enter into the broad conception of my invention; they may be varied to suit conditions.

Having described my invention, I claim—

1. In combination, a pair of independent record driving means, a constantly running motor, a record starting motor, means operated in synchronism with a record being driven by the constantly running motor to energize the starting motor, and means for connecting the starting motor with either record driving means and for connecting the constantly running motor with either record driving means.

2. In combination, a pair of independent record driving means, a constantly running motor, means for connecting the motor to either driving means, a record starting device and means for energizing the same in synchronism with a record being driven by the constantly running motor, and means to connect the record starting device to either of the record driving means.

3. In combination, a pair of independent record driving means, a constantly running motor adapted to drive either record driving means, a record starting device, means

for energizing the starting device to bring one of the record drivers up to normal speed even with the other record driver driven by the constantly running motor, and means for connecting the constantly running motor to said record driver after it has attained normal speed.

4. In combination, a pair of independent record driving means, a constantly running motor adapted to drive either record driving means, a record starting device, means for energizing the starting device to bring one of the record drivers up to normal speed even with the other record driver driven by the constantly running motor, means for connecting the constantly running motor to said record driver after it has attained normal speed and for disconnecting the starting device from said record driver, and means for immediately thereafter connecting the starting device with the other record driver while the starting device is energized.

5. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, and energizing means for the starting mechanism controlled by the constantly running motor.

6. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism including an electro-magnetic motor, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, and energizing means for the starting mechanism controlled by the constantly running motor.

7. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, and means controlled by the constantly running motor to energize the starting mechanism and to operate said connecting means.

8. In combination, a pair of independent record drivers, a constantly running motor, a record starting electro-magnetic motor, means for connecting either the constantly running motor or the starting motor with either of the record drivers, and electrical means controlled by the constantly running motor to energize the record starting motor and to operate said connecting means.

9. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism including an electric-magnetic motor, means for connecting either the constantly running motor or the starting motor with either of the record drivers, and energizing means for the starting mechanism controlled by the constantly running motor, said energizing means including means operated by the constantly running motor for intermittently supplying current to said starting motor.

10. In combination, a pair of independent record driving means, a constantly running motor, a record starting motor, means for connecting either the starting motor or the constantly running motor with either of the record drivers, and an energizing means for the starting motor adapted to give impulses to the starting motor at progressively decreasing intervals to gradually bring the speed of the starting motor up to the speed of a record being driven by the constantly running motor.

11. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, and energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor.

12. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, and energizing means for the starting motor including commutator means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor.

13. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, and electro-magnetic means for operating said connection means

for making and breaking driving connection between the two motors and the two record drivers.

14. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, electro-magnetic means for operating said connection means for making and breaking driving connection between the two motors and the two record drivers, and means coöperating with said starting motor energizing means for controlling said electro-magnetic means.

15. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including commutator means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, electro-magnetic means for operating said connecting means for the purpose of making and breaking driving connection between the two motors and the two record drivers, and commutator means coöperating with the commutator means of said starting motor control for controlling the operation of said electro-magnetic means.

16. In combination, a pair of independent record driving means, a constantly running motor, a record starting motor, means operated in synchronism with a record being driven by the constantly running motor to energize the starting motor, and means for connecting the starting motor with either record driving means and for connecting the constantly running motor with either record driving means, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

17. In combination, a pair of independent record driving means, a constantly running motor, means for connecting the motor to either driving means, a record starting device and means for energizing the same in synchronism with a record being driven by the constantly running motor, means to connect the record starting device to either of the record driving means, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

18. In combination, a pair of independent record drivers, a constantly running motor adapted to drive either a record driver, a record starting device, means for energizing the starting device to bring one of the record drivers up to normal speed even with the other record driver being driven by the constantly running motor, means for connecting the constantly runing motor to said record driver after it has attained normal speed, mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

19. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, energizing means for the starting mechanism controlled by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

20. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism including an electro-magnetic motor, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, an energizing means for the starting mechanism controlled by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

21. In combination, a pair of independent record drivers, a constantly running motor, a record starting mechanism including an electro-magnetic motor, means for connecting either the constantly running motor or the starting mechanism with either of the record drivers, an energizing means for the starting mechanism controlled by the constantly running motor, said ener-

gizing means including means operated by the constantly running motor for intermittently supplying current to said starting motor, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

22. In combination, a pair of independent record driving means, a constantly running motor, a record starting motor, means for connecting either the starting motor or the constantly running motor with either of the record drivers, an energizing means for the starting motor adapted to give impulses to the starting motor at progressively decreasing intervals to gradually bring the speed of the starting motor up to the speed of the record being driven by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

23. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

24. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including commutator means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

25. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, electro-magnetic means coöperating with said energizing means for operating said connection means for making and breaking driving connection between the two motors and the two record drivers, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means coöperating with said electro-magnetic connection operating means for making said mechanism effective or ineffective with respect to either record.

26. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, electro-magnetic means for operating said connection means for making and breaking driving connection between the two motors and the two record drivers, and means coöperating with said starting motor energizing means for controlling said electro-magnetic connection operating means, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means cooperating with said electro-magnetic connection operating means for making said mechanism effective or ineffective with respect to either record.

27. In combination, a pair of independent record driving means, a constantly running

motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including commutator means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, electro-magnetic means for operating said connecting means for the purpose of making and breaking driving connection between the two motors and the two record drivers, commutator means coöperating with said starting motor energizing commutator means for controlling the operation of said electro-magnetic means, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means coöperating with said electro-magnetic connection operating means for making said mechanism effective or ineffective with respect to either record.

28. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to speed equal to that of a record being driven by the constantly running motor, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

29. In combination, a pair of independent record driving means, a constantly running motor, an electro-magnetic record starting motor capable of being controllably operated by successive electrical impulses, means for connecting either the starting motor or the constantly running motor with either of the record drivers, energizing means for the starting motor including means for intermittently and at progressively decreasing intervals supplying current to said starting motor so as to gradually increase its speed so that a record driven by the starting motor will be brought up to the speed equal to that of a record being driven by the constantly running motor, electro-magnetic means for operating said connection means for making and breaking driving connection between the two motors and the two record drivers, a mechanism adapted to coöperate with a record on each of the driving means, and electro-magnetic means coöperating with said electro-magnetic connection operating means for making said mechanism effective or ineffective with respect to either record.

30. In combination, a pair of record driving means, a constantly running motor, a record starting motor, means operated in synchronism with a record being driven to energize the starting motor, and means for connecting the starting motor with either record driving means and for connecting the constantly running motor with either record driving means, a mechanism adapted to coöperate with a record on each of the driving means, and means coöperating with the starting motor energizing means for making said mechanism effective or ineffective with respect to either record.

31. In combination, a pair of record drivers, a constantly running motor, a starting motor, two two-position clutches in connection one with each record driver and each adapted in one position to connect the corresponding record driver to the constantly running motor and in the other position to connect the corresponding record driver to the starting motor, said clutches being normally one in one of said positions and the other in the other of said positions, means for energizing said starting motor to start one of the record drivers, and means for throwing both clutches, after the starting operation of said starting motor.

32. In combination, a pair of record drivers, a constantly running motor, releasable driving connections between the motor and each of the record drivers, a starting motor, releasable driving connections between the starting motor and each of the record drivers, means for energizing the starting motor in synchronism with a record driver driven by the constantly running motor, and means coöperating with said energizing means to throw said driving connections to connect to the constantly running motor the record driver started by the starting motor and to disconnect the other record driver from the constantly running motor.

33. In combination, a pair of record drivers, a constantly running motor, driving connections between the motor and each of the record drivers, a starting mechanism, driving connections between the starting mechanism and each of the record drivers, means for energizing the starting mecha-

nism, and means for throwing the said driving connections to connect to the motor the record driver started by the starting mechanism and to disconnect the other record driver from the motor.

34. In combination, a pair of record drivers, a constantly running motor, an electro-magnetic starting motor, means to connect either the constantly running motor or the starting motor to either of the record drivers, electro-magnetic means for operating said connecting means, a commutator mechanism driven by the constantly running motor, and electrical circuits coöperating the commutator mechanism with the starting motor and the electro-magnetic operating means.

35. In combination, a plurality of independent record drivers, a driving motor connected to one of the record drivers, a starting driving mechanism connected to another of the record drivers, and means whereby said starting mechanism is energized to drive said last mentioned record driver in synchronism with the record driver connected to the driving motor.

36. In combination, a plurality of independent record drivers, a driving motor adapted to drive any one of the record drivers, a starting driving mechanism adapted to drive another of the record drivers, and means whereby said starting mechanism is energized to drive said last mentioned record driver in synchronism with the record driver driven by said driving motor.

37. In combination, a plurality of independent record drivers, motor means for driving any one of said drivers, motor means for starting another of said record drivers, and means controlled by said first mentioned motor means for causing operation of said second mentioned motor means in synchronism therewith.

38. In combination, a plurality of record drivers, a constantly running motor, means whereby said motor may cause the operation of any one of said record drivers, and means controlled by said constantly running motor for causing the starting of another of said record drivers and for then causing its operation synchronously with the first mentioned record driver independently of the constantly running motor.

39. In combination, a plurality of record drivers, a constantly running motor, means whereby said motor may drive any one of said record drivers, and means operated by said constantly running motor for positively starting another of said record drivers and for then driving it synchronously with the first mentioned record driver independently of the constantly running motor.

40. In combination, a pair of record drivers, a constantly running motor, means whereby said motor may drive either of said record drivers, and means operated by said constantly running motor for positively starting the other of said record drivers and for then driving it synchronously with the first mentioned record driver independently of the constantly running motor.

In witness that I claim the foregoing I have hereunto subscribed my name this 5th day of March, 1914.

ORLANDO E. KELLUM.

Witnesses:
JAMES T. BARKELEW,
DRUE L. HOFFMAN.