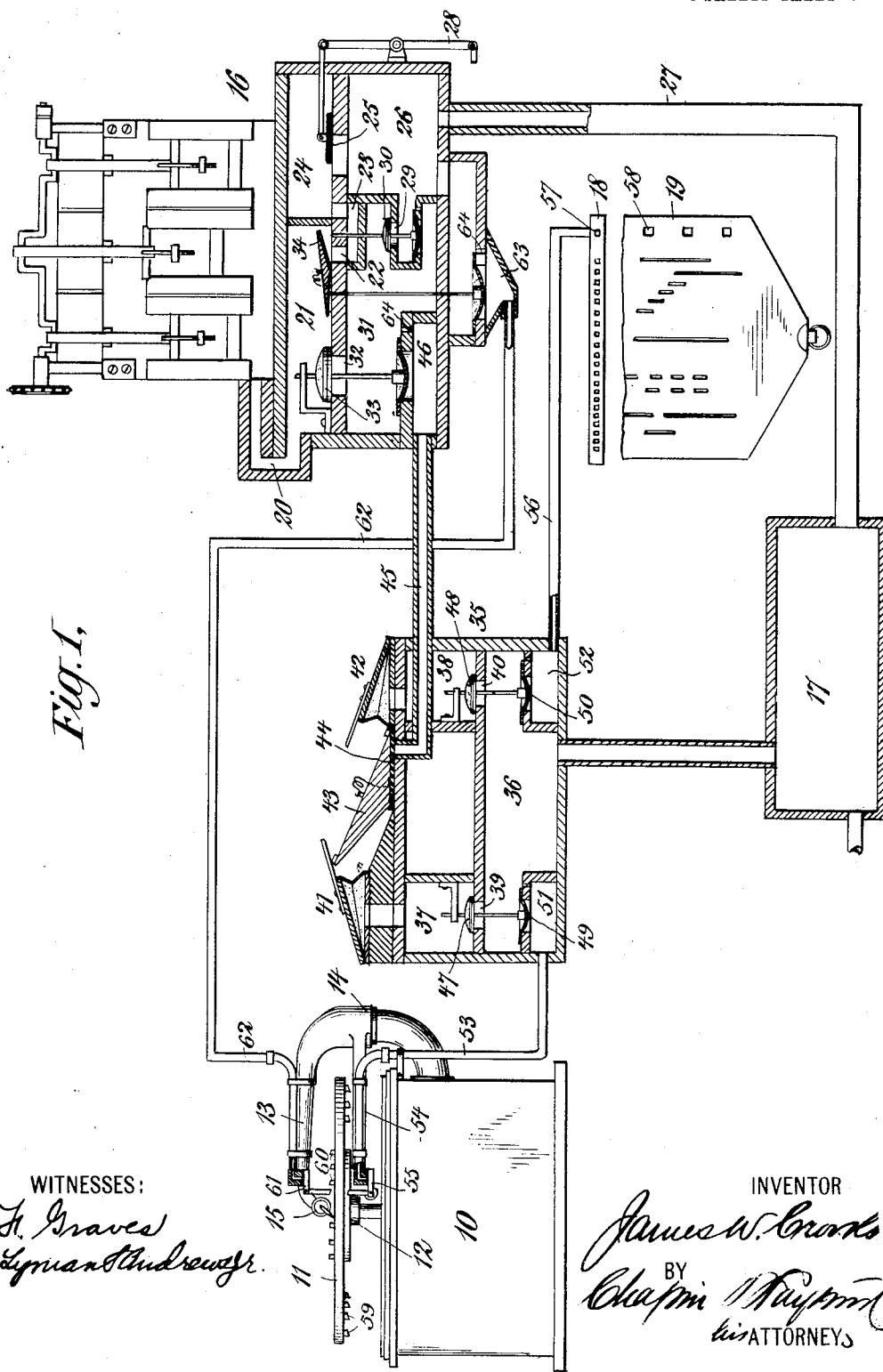


J. W. CROOKS.
 MEANS FOR REGULATING THE RELATIVE SPEED OF OPERATION OF REPRODUCING MACHINES.
 APPLICATION FILED JUNE 14, 1910.

1,057,332.

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3 SHEETS—SHEET 1.



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Fig. 3.

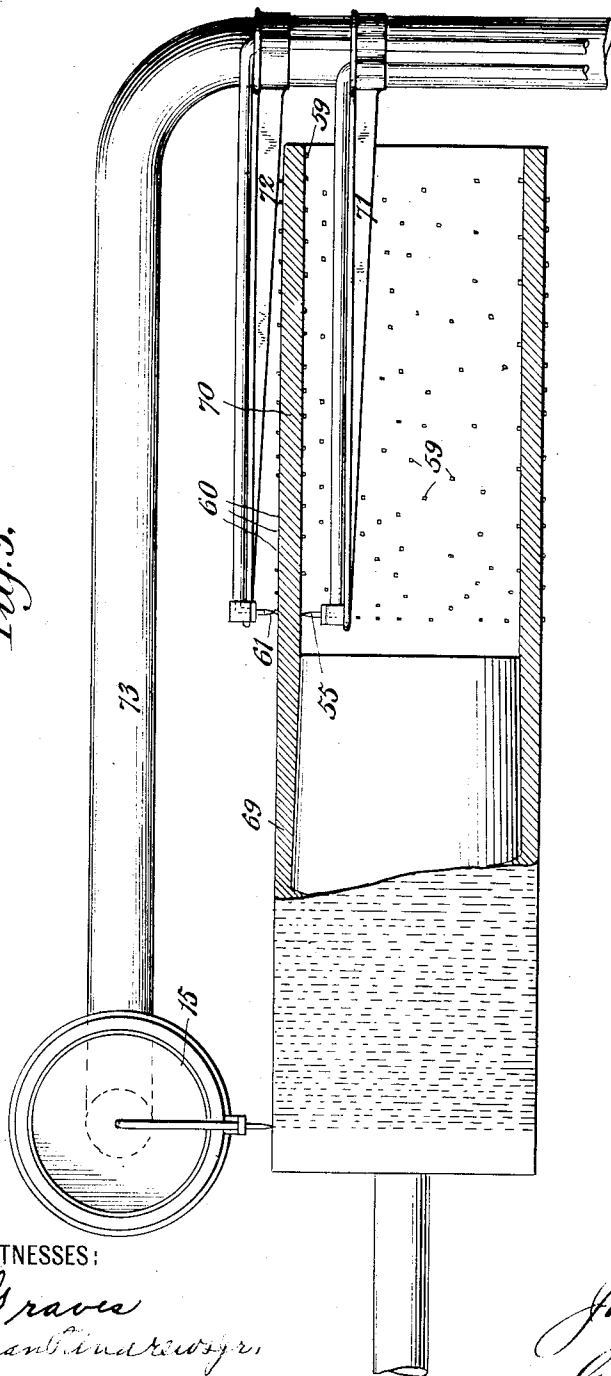
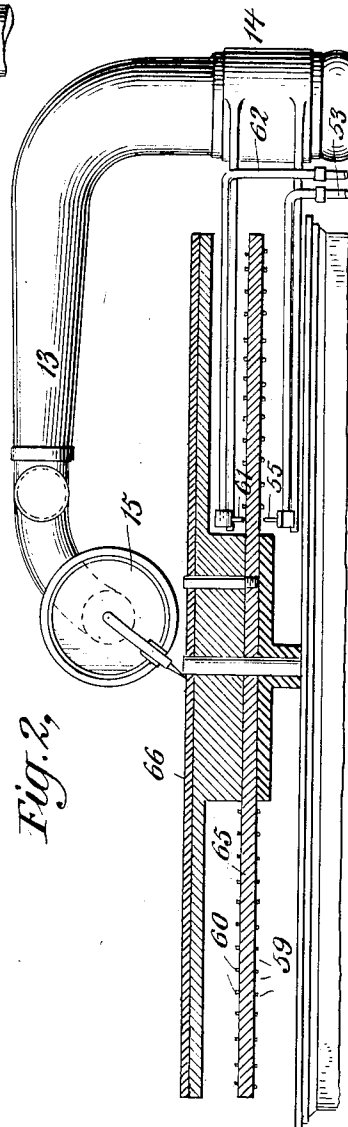


Fig. 2.



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Fig. 4,

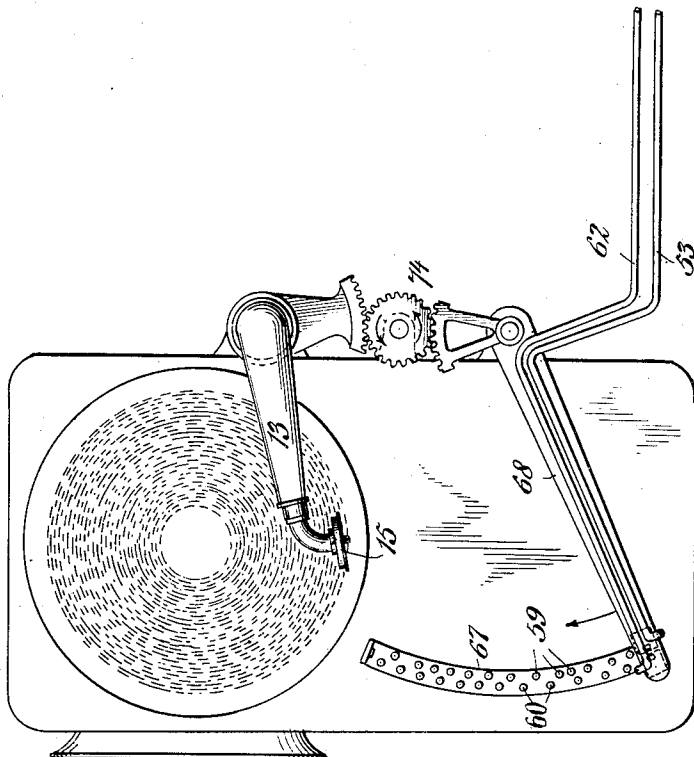
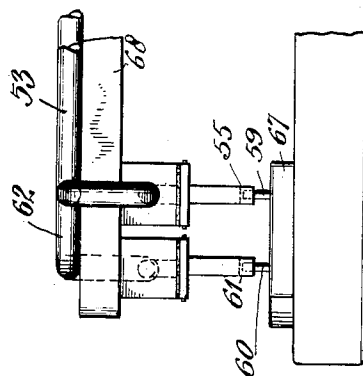


Fig. 5,



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UNITED STATES PATENT OFFICE.

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MEANS FOR REGULATING THE RELATIVE SPEED OF OPERATION OF REPRODUCING-
MACHINES.

1,057,332.

Specification of Letters Patent.

Patented Mar. 25, 1913.

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To all whom it may concern:

Be it known that I, JAMES W. CROOKS, a citizen of the United States of America, and a resident of Mount Vernon, county of Westchester, and State of New York, have invented certain new and useful Improvements in Means for Regulating the Relative Speed of Operation of Reproducing-Machines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in means for regulating the relative speed of operation of reproducing machines, and particularly to means for regulating the operation of a piano playing mechanism or the like in conjunction with the operation of sound reproducing instruments, whereby an accompaniment may be caused to properly follow the rendition of a song or the like.

Heretofore it has been attempted to couple sound reproducing machines and piano playing mechanism and the like whereby the two are operated simultaneously and from the same motive power, but exceeding difficulty has been found in the past in maintaining a proper registry between the accompaniment and the song or the like, due, of course, to the individual expression involving variations in tempo introduced by the individual performer when the original records are being made.

My invention consists in a means automatically controlled by a moving part of the sound reproducing mechanism for bringing about a temporary acceleration of the motor for the accompaniment mechanism, or for temporary retarding or stopping the motor, together with means for again bringing about the normal operation of the motor after the two mechanism have again been brought into register.

My invention also consists in many novel details of construction and combinations of parts, such as will fully appear in the following specification, and in order that my invention may be thoroughly understood, I will now proceed to describe certain structures constituting embodiments thereof, having reference to the accompanying drawings illustrating the same, and will then point out the novel features in claims.

In the drawings: Figure 1 is a view somewhat in diagrammatic form of an appara-

tus constructed in accordance with my invention, certain of the parts being shown in side elevation and others being shown in vertical section. Fig. 2 is a detail view upon an enlarged scale of a part of a sound reproducing machine in which a supplemental disk is employed as a controlling element in lieu of the ordinary record disk being employed for this purpose as in the form shown in Fig. 1. Fig. 3 is a detail view showing my invention as applied to a sound reproducing machine of the cylinder record type instead of to a machine of the flat record disk type as in Figs. 1 and 2. Fig. 4 is a detail view of a modification in which the controlling element is made as a separate stationary strip entirely independent of the sound reproducing machine records but adapted to be engaged by an arm which moves with the tone arm of the machine. Fig. 5 is a detail view upon an enlarged scale of certain valve means carried by the said moving arm.

Referring first of all to Fig. 1 the apparatus therein disclosed comprises a sound reproducing machine 10 of the ordinary well-known type in which a record disk 11 is mounted upon, and rotatable with, a carrier 12 suitably rotated by a motor (not shown), and a tone arm 13 pivotally mounted at 14, and carrying a sound box 15 having a stylus which engages the sound groove of the record. The tone arm swings over the record as the stylus gradually moves toward the center thereof in conformance to the path of the helical sound groove being either propelled by and in accordance with the said sound groove, or being fed positively by suitable feeding mechanism, all as is well known and will be readily understood by those skilled in this art.

The accompanying instrument, which, for purpose of simplicity of description I will herein term "piano player" with the understanding however that such term is in no sense to be construed as a limitation, comprises a motor 16, a main exhaust chamber 17, and a tracker board 18 arranged for co-action with a traveling perforated record strip 19. The record strip or sheet is arranged to be drawn over the tracker board at a suitable rate of speed by means operated from the motor 16, as will be well understood. It will follow from the fore-

going that the speed of the motor determines the speed of movement of the record strip, and that hence by a proper regulating of the motor synchronization may be obtained
5 between the musical sounds produced by the two instruments.

The motor 16 which is a well known type of air motor used in piano players, is operated by atmospheric pressure made effective by the exhaustion of air from the motor through a conduit 20 to the chamber 21, thence through a valve controlled opening 22 and through a channel 23 into a chamber 24, thence past the ordinary tempo regulating valve 25 into another chamber 26, and thence through a conduit 27 to the said exhaust chamber 17. The opening and closing of the tempo valve 25 by manipulation of the lever 28, regulates the tempo or speed of the motor for ordinary purposes, under the will of the operator, as will be well understood. Because of the restricted passage past the valve 25, it will follow that the air in the chamber 26 will be at a lower pressure than that in the chamber 24. It will also follow, therefore, that if an additional passage be opened between the motor chamber 21 and the chamber 26 a greater amount of air will be allowed to flow to the chamber 26 in a given time and the movement of the motor will be accelerated. For the purpose of accomplishing this at the required time I provide a by-pass from the chamber 26 to the chamber 21 including a passage 29 controlled by a valve 30 between the chamber 26 and a chamber 31, and a passage 32 controlled by a valve 33 between the said chamber 31 and the chamber 21. When these two valves are opened air will flow from the channel 20 through the passage 32 to the chamber 31 and thence through the passage 29 to the chamber 26 in addition to flowing through the channels 22—23 to the chamber 24 and past the valve 25 to the chamber 26.

In addition to the foregoing I have provided a valve 34 for closing at will the passage 22 whereby communication can be entirely cut off between the chamber 26 and the chamber 21, the operation of the said valve serving also to positively close the valve 30 whereby all communication is then closed between the chambers 21 and 26 and the motor thereby caused to stop. These various valves are operated by the following means and in the following manner: Intermediate the sound reproducing machine 10 and the motor 16 is a pneumatic device designated, as a whole, by the reference character 35. This device includes a low pressure chamber 36 in open communication with the exhaust chamber 17, two chambers 37 and 38 leading thereto through valve controlled openings 39—40 respectively, a pneumatic
65 operating member 41 in communication with

the chamber 37, a pneumatic operating member 42 in communication with the chamber 38, a rocker 43 between the two said pneumatic operating members, and a valve 44 carried by the said rocker and arranged to control admission of atmospheric air into a conduit 45 leading to an operating chamber 46 for the said valve 33. The openings 39 and 40 to the chamber 36 in the pneumatic device 35 are provided with valves 47 and 48 respectively, each provided with an operating element 49—50 respectively, the latter forming a movable wall for a chamber 51, and the latter a movable wall for a chamber 52. The chamber 51 is provided with a conduit 53, the opposite end of which is carried by a part 54 supported upon, and movable with, the tone arm 13 of the sound reproducing machine, the extremity thereof being provided with a valve 55 normally closing the same against the admission of atmospheric air, while the chamber 52 is provided with a conduit 56 which leads to an opening 57 in the tracker board 18 and arranged to register at the proper times with suitable openings 58 in the traveling record strip 19 of the piano player.

The valve 55 for the conduit 53 has a finger adapted for co-action with controlling elements in the form of pins or projections 59 which, in the example of my invention shown in Fig. 1, are carried by the record disk 11 of the sound reproducing machine, being arranged to project downward from the under side thereof. The upper side of the disk 11 is also, in the example of my invention shown in Fig. 1, provided with controlling elements in the form of upwardly projecting pins or projections 60, conveniently located upon the central portion of the disk in the part thereof not ordinarily occupied by the sound groove, the said pins or projections 60 being arranged for engagement with the operating arm of a valve 61 carried by the tone arm, the said valve being arranged to normally close an opening in the extremity of a conduit 62 which leads to an operating chamber 63 of the motor 16. This operating chamber has a movable wall constituting an operating member for the part carrying the valve 34 of the motor, as will be well understood by reference to Fig. 1 of the drawings.

The operation is as follows: The motors of the sound reproducing machine and of the piano player being set into motion, the performance of the sound reproducing machine and of the accompaniment, commences. The tempo of the motor is regulated by hand, as is usual, by manipulation of the lever 28 or in any other manner desired, to cause the traveling strip 19 to travel at approximately the proper rate of speed with respect to the rate of movement of the record disk 11. Preferably the motor 16 is

regulated so that it will tend to run slightly slower than that required so that the accompaniment will tend to follow the rendition of the melody. At predetermined points, which are determined when the record 11 is being originally produced, the pins 59, properly disposed upon the disk, engage the finger of the valve 55. Directly a pin so engages the valve atmospheric air is vented into the chamber 51, the valve 47 is thereupon operated by reason of the increased pressure of air in the chamber 51, and the pneumatic device 41 being open to the low pressure chamber 36, atmospheric air will operate to quickly depress the device and thereby to reverse the position of the rocker 43. This will open the valve 44 and vent air through the conduit 45 into the operating chamber 46 whereupon the valve 33 will be opened, thus opening the connection between the chambers 21 and 31. The momentary increase of pressure in the chamber 31 will cause the valve 30 to be opened, thereby establishing the branch passage from the motor through the chambers 21 and 31 to the chamber 26, augmenting the amount of air which can be drawn through the motor via the chamber 21, the passages 22—23 and the chamber 24. The motor will immediately increase considerably in speed thereby causing the strip to catch up to the disk, bringing it again into registry therewith. Directly it is in register an opening 58 in the record strip, properly positioned upon the said strip with respect to a predetermined position in the sound groove of the disk 11, will come into register with the opening 57 in the tracker board 18 to thereby vent air through the conduit 56 into the chamber 52. This will effect the operation of the valve 48 thereby venting air from the chamber 38 to the chamber 36 and causing the operation of the pneumatic device 42, the effect of which will be to return the rocker 43 to its normal position, closing the valve 44, the result of which will be that the valves 33 and 30 will again return to their seats and the motor will resume its normal speed of operation as before. From the foregoing it will be seen that by so arranging that the record strip shall tend to lag behind, it may be again brought into synchronism with the sound producer at predetermined points all along the strip, such, for instance, as at the beginning of each phrase of the melody produced in the sound reproducing machine. Now supposing a retardation is required, due to a pause or the like in the melody reproduction—in such case one of the upper pins 60, properly positioned upon the disk, will engage the valve 61 to vent air through the conduit 62 into the chamber 63. The effect of this will be to instantly close the valve 34, thereby closing the passage 22 and stop-

ping the motor. Should the valve 30 be open at the moment this valve 34 is closed, the said valve 30 will also be closed, the same being effected by the engagement of the arm which carries the valve 34 with an upwardly extending stem of the valve 30. The motor will be stopped for so long a time as the valve 61 is open and hence the pins or pegs 60 may be made of sufficient length to keep the motor closed for the desired length of time, or a succession of pins, one immediately behind the other, may be employed, such as will open the valve 61 a number of times in quick succession. This may be done so quickly that the valve 34 will hardly have time to respond due to the fact that it will take an appreciable length of time for the air which has been vented into the conduit 62 and the chamber 63 from being exhausted therefrom, it being understood that the usual venting or bleed passages 64 are employed around the several pneumatic operating means for equalizing the pressure after an operation thereof. By placing a succession of the pegs 60 a little farther apart the motor may be allowed to progress a little at a time, thereby producing a perfect retardation so that by the joint operation of the upper and lower pegs or projections upon the disk 11, a perfect control of the motor may be obtained so as to keep the accompaniment in its proper relation at all points with the production of the melody.

It will, of course, be understood that the foregoing is but one example of the specific mechanism which I may employ, and it will also be understood that it is by no means necessary that the pins or pegs 59—60 or other controlling elements be carried directly by the record disk but may be otherwise disposed. In Fig. 2 I have shown the pins or pegs disposed upon an independent disk 65 mounted to rotate with the record disk which in this figure is designated by the reference character 66. Again, in Figs. 4 and 5 I have shown the pins or projections 59—60 as mounted upon a stationary strip 67, the valves being carried by an arm 68 which is connected by suitable gearing 74 with the tone arm 13. Conveniently the arm 68 may be longer than the tone arm 13, and the gearing may be such as to increase the rate of speed of the arm 68 with respect to that of the tone arm 13, whereby the desired movement may be obtained.

In Fig. 3 I have shown a sound reproducing record 69 of cylindrical form, the same being provided with an extension 70, the interior and exterior walls thereof carrying the pins or projections 59—60, as will be well understood. In this case the valves 55—61 are carried by arms 71—72 arranged to move longitudinally with the arm 73 which carries the sound box 15. It will, of

course, be understood that the conduits which connect with the moving portions, will have flexible portions or other means by which the desired relative movements will be permitted.

What I claim is:

1. The combination with two non-synchronized independently operating reproducing machines, of regulating means for increasing and decreasing the speed of operation of one of the machines with relation to the other, the other said machine having controlling means for controlling the operation of the said regulating means.

2. The combination with two reproducing machines each including a movable record, of regulating means for arbitrarily increasing and decreasing the speed of movement of the record of one of the said reproducing machines, without any necessary corresponding increase or decrease of speed of movement of the record of the other said reproducing machine, the other said machine having controlling means including elements located at predetermined points, at arbitrarily varying distances apart therein, and operated by the latter said machine in the movement of its record, for controlling the said regulating means.

3. The combination with two reproducing machines each including a movable record, of regulating means for arbitrarily increasing and decreasing the speed of movement of the record of the second reproducing machine, without any necessary corresponding increase or decrease of speed of movement of the record of the first reproducing machine, the first said reproducing machine having controlling means including elements located at predetermined points, at arbitrarily varying distances apart therein, and operated by the said first reproducing machine in the movement of its record, for operating the said regulating means to increase the speed of movement of the record of the second reproducing machine, and other controlling means thereafter controlled in its operation by the record of the second reproducing machine, at predetermined points in its operation, for operating the said regulating means to decrease the speed of operation of the said second reproducing machine record.

4. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, another reproducing machine, and means controlled by the said elements for varying the speed of operation of the latter said reproducing machine.

5. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements

arbitrarily positioned in the sound reproducing machine for the particular record employed therein, the said sound reproducing machine having a movable part for coaction with the said individual controlling elements in the operation of the said machine, another reproducing machine, and means controlled by the coaction of the said movable part with the said elements for varying the speed of operation of the latter said reproducing machine.

6. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, another reproducing machine, governing means for regulating the speed of operation of the latter said reproducing machine, and means operated by the said controlling elements for controlling the said governing means.

7. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, a member movable with the tone arm for coaction with said elements, another reproducing machine, and means operated by the successive coaction of the said member with the said controlling elements for regulating the speed of operation of the latter said reproducing machine.

8. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, the said sound reproducing machine being provided with a moving member for successive engagement with the said controlling elements, another reproducing machine, means controlled by the said member in its engagement with the said elements for accelerating the speed of operation of the second said reproducing machine, and means operating at predetermined intervals after each such engagement for again reducing the speed of operation of the second said reproducing machine.

9. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, another reproducing machine, a record therefor, means controlled in its operation by the said controlling elements to increase the speed of operation of the second said reproducing machine, and means controlled in its operation by the sec-

ond said reproducing machine record for again reducing the speed of operation of the said second reproducing machine.

10. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, a member movable with the tone arm for coaction therewith, another reproducing machine, a record therefor, means operated at each successive coaction of the said sound reproducing machine member with the said controlling elements for accelerating the speed of operation of the second said reproducing machine, and means controlled in its operation by the second said reproducing machine record for again reducing the speed of operation of the second said reproducing machine, to normal.

11. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, the said sound reproducing machine being provided with a moving part for coaction with the said controlling elements, another reproducing machine, a record therefor, and governing means for regulating the speed of operation of the second said reproducing machine, the said governing means being controlled in part by the coaction of the said moving member of the sound reproducing machine with the controlling elements, and in part by the record of the second said reproducing machine in its movement.

12. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of two sets of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, two members movable with the tone arm for coaction therewith, another reproducing machine, means operated by one of the said members in its coaction with the said controlling elements of one of the sets thereof for accelerating the speed of operation of the second said reproducing machine, and means operated by the other of the said members in its coaction with the controlling elements of the other said set for retarding the operation of the second said reproducing machine.

13. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of two sets of individual controlling

elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, two members movable with the tone arm for coaction therewith, another reproducing machine, a record therefor, means operated by one of the said members in its coaction with the said controlling elements of one of the sets thereof for accelerating the speed of operation of the second said reproducing machine, means operated by the other of the said members in its coaction with the controlling elements of the other said set for retarding the operation of the second said reproducing machine, and means controlled by the record of the second said reproducing machine for again causing the second said reproducing machine to operate at normal speed.

14. The combination with a sound reproducing machine including a sound box and a moving tone arm carrying the same, of accompaniment playing means, means for varying the speed of operation of the said accompaniment playing means, and means including an element moving with the tone arm, for controlling the same.

15. The combination with a sound reproducing machine including a sound box and a moving tone arm carrying the same, of accompaniment playing means including a motor therefor, means for varying the speed of operation of the said accompaniment playing means motor, and means including an element moving with the tone arm, for controlling the same.

16. The combination with a sound reproducing machine including a sound box and a moving tone arm carrying the same, of accompaniment playing means including a record and a motor, and regulating means for varying the speed of operation of the said accompaniment playing means motor, the said regulating means being controlled in part by the said tone arm in its movement, and in part by the accompaniment playing means record in its movement.

17. The combination with a sound reproducing machine and a record therefor, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, an accompaniment playing machine including a fluid pressure motor, and means controlled by the said elements for varying the amount of fluid supplied to the said motor.

18. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, a member movable with the tone arm for coaction there-

with, an accompaniment playing machine including a fluid pressure motor, and means operated by the said member in its coaction with the said elements for varying the amount of fluid supplied to the said motor.

19. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, a member movable with the tone arm for coaction therewith, an accompaniment playing machine including a fluid pressure motor and a record operated thereby, means operated by the said member in its engagement with the said controlling elements for increasing the amount of fluid supplied to the said motor, and means operated by said accompaniment playing machine record at predetermined points in its movement for reducing to normal the amount of fluid so supplied.

20. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the sound reproducing machine for the particular record employed therein, valve means movable with the said tone arm for coaction with the said controlling elements, an accompaniment playing means including a fluid pressure motor, and pneumatic controlling means for the said motor, governed in its operation by the said valve means.

21. The combination with a sound reproducing machine including a rotatable record carrier, a record carried thereby, a sound box, and a movable tone arm carrying the same, of a plurality of individual controlling elements arbitrarily positioned in the

sound reproducing machine for the particular record employed therein, valve means movable with the said tone arm for coaction with the said controlling elements, an accompaniment playing means including a fluid pressure motor and a record operated thereby, pneumatic controlling means for the said motor, operated by the said valve means in its coaction with the said controlling elements, and means operated by the said accompaniment playing machine record for likewise operating the said pneumatic controlling means.

22. The combination with a sound reproducing machine including a record, and an accompaniment playing machine including an air operated motor, of a low pressure chamber, a passage therefrom to the motor through which motive fluid from the motor normally passes, a second passage from the motor to the said low pressure chamber, and means operated by the sound reproducing machine for opening the second said passage at predetermined points in the movement of its record.

23. The combination with a sound reproducing machine including a record, and an accompaniment playing machine including an air operated motor and a record operated thereby, of a low pressure chamber, a passage therefrom to the motor through which motive fluid from the motor normally passes, a second passage from the motor to the said low pressure chamber, means operated by the sound reproducing machine for opening the second said passage at predetermined points in the movement of its record, and means controlled by the accompaniment playing machine record at predetermined points in its movement, for again closing the second said passage.

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