May 16, 1933. L. L. JONES 1,909,768

PHONOGRAPH

Filed April 23, 1929 2 Sheets-Sheet 1

Fig. 1.

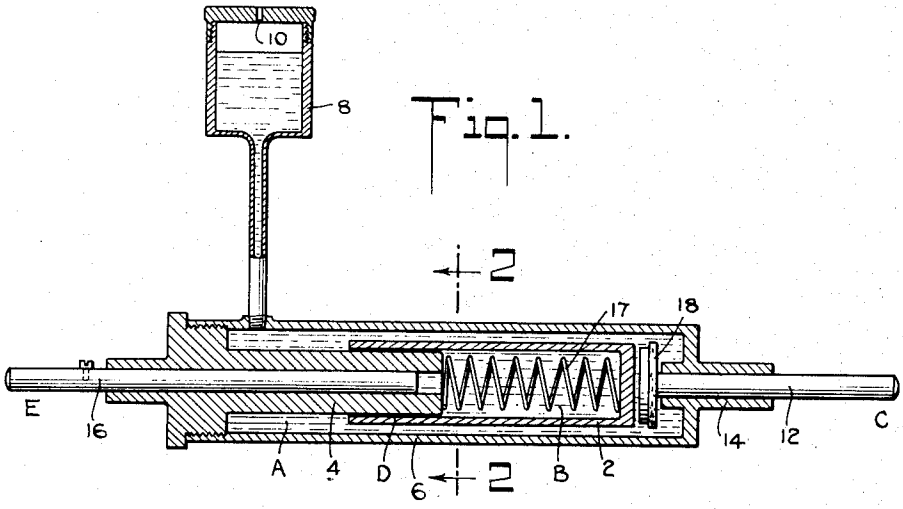


Fig. 2.

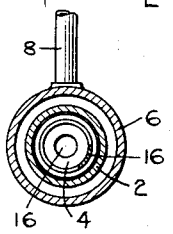


Fig. 3.

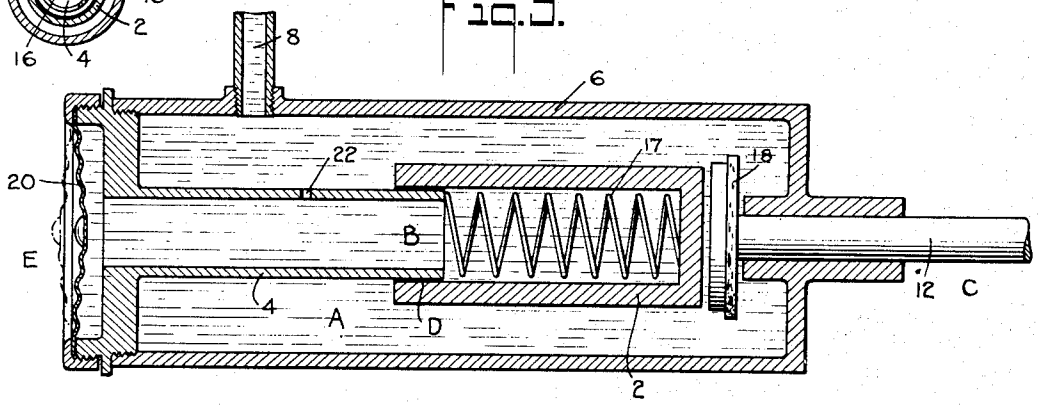
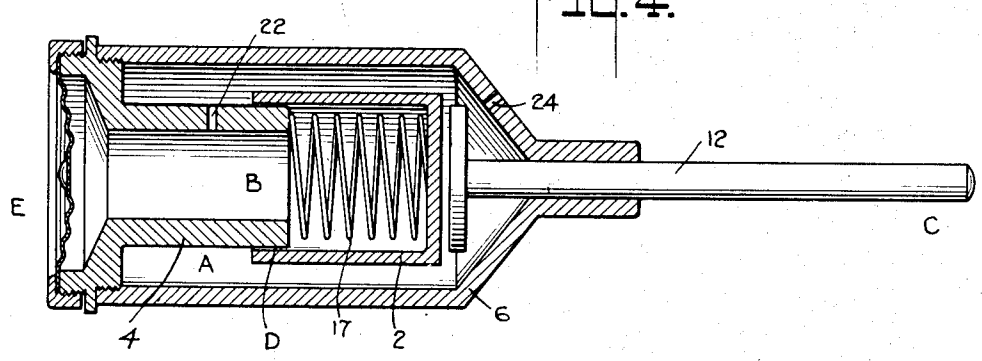


Fig. 4.



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Fig. 5.

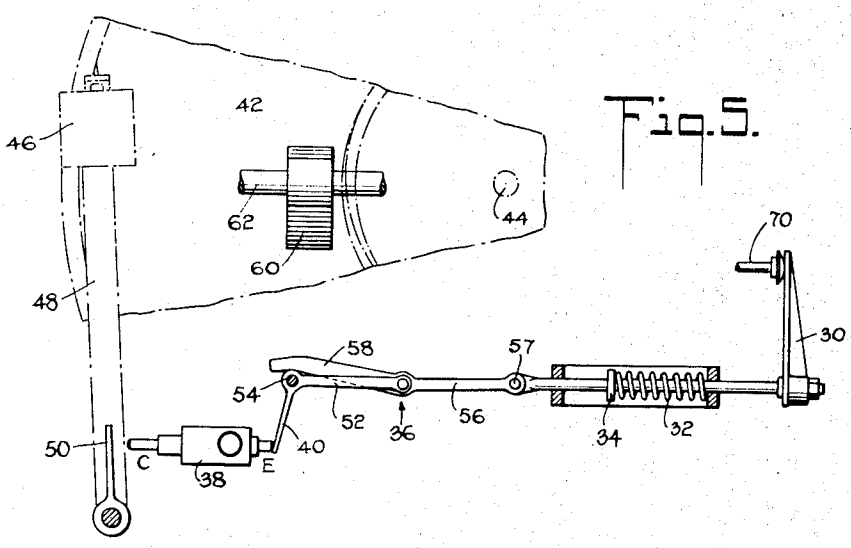


Fig. 6.

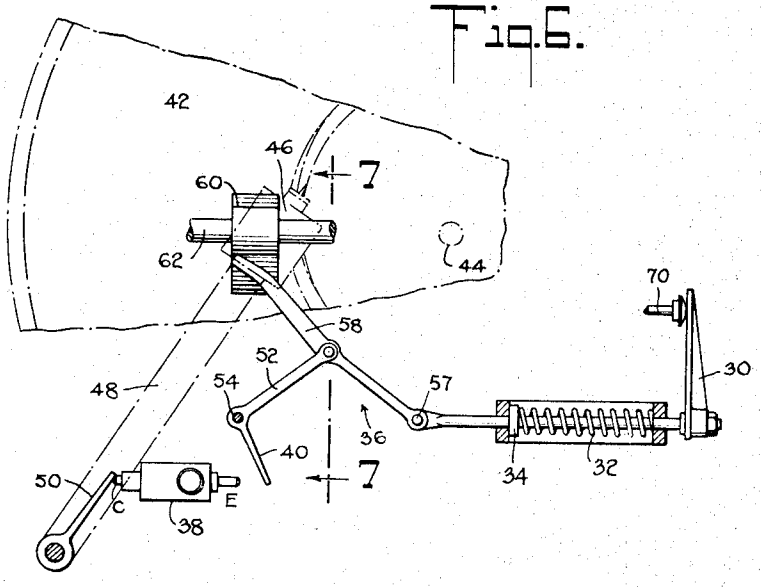
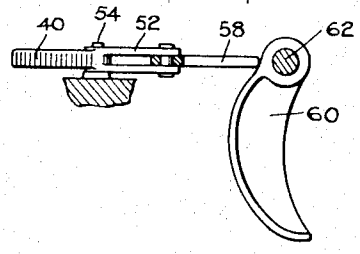


Fig. 7.



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PHONOGRAPH

Application filed April 23, 1929. Serial No. 357,444.

This invention relates to phonographs and more particularly to an automatic trip for stopping or for initiating the record changing or record repeating operations in a phonograph.

The primary object of the present invention is to provide an automatic trip mechanism for phonographs, the action of which will be smooth, silent, and reliable, and which will not require a preliminary setting to determine the stopping point. Practically all records are now made to terminate with an end groove which is displaced from the last sound producing grooves in the record, but some of these records have eccentric and others have concentric terminating grooves. It is an object of the present invention to provide an automatic trip the operation of which will be equally responsive to either type of record.

The movement of the reproducer over the surface of the record during reproduction is relatively slow, while the movement in an eccentric groove, or in a spiral groove leading to a concentric terminating groove, is relatively rapid. I take advantage of the consequent acceleration of the movement of the reproducer to obtain the desired tripping action, and one object of my invention, therefore, may be broadly stated as being the discrimination between relatively slow and relatively fast motions in order to obtain a response to a relatively fast motion. This object I fulfill by utilizing the said motion to change the pressure of a fluid, simultaneously relieving the change in pressure but only gradually, that is to say, at a rate commensurate with the relatively slow motion, and obtaining the desired response from the change in fluid pressure resulting from a relatively fast motion.

Other objects of my invention are to permit of rapid retraction of the reproducer when the record has been played, and to permit of free manipulation of the reproducer over the first portion of the record, as is desirable, for example, when locating the reproducer at the beginning of the next record to be played, all without danger of prematurely actuating the trip mechanism.

Of course, only a small amount of energy is available from the movement of the reproducer in the terminating groove of the record. This energy is ordinarily sufficient to operate a simple stop mechanism for a phonograph, but in the case of automatic phonographs where the trip mechanism must additionally initiate a record change operation, it is desirable that a more powerful tripping impulse be available. Accordingly, a further object of my invention is to provide tripping impulse amplifying means which make it possible to obtain a trigger action of considerable force.

A more specific object of my invention is to provide such a mechanism which will be capable of actuating the clutch pin of a single revolution clutch such as is used in the automatic phonograph described in my copending applications Serial Nos. 341,076, 341,077, and 341,078, all filed February 19, 1929. To this end I provide in combination with an automatic trip of any suitable kind, and more particularly of the kind already briefly described in this application, a reciprocable trigger, a spring for actuating the trigger, a toggle joint arranged to keep the trigger spring under tension when in alinement, and means responsive to the automatic trip for breaking the toggle in order to spring the trigger. Another object of my invention is the provision of means for automatically placing the trigger spring under tension in order to store up the amplified trigger energy.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the trip elements and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a section through a slow and fast motion discriminating means;

Fig. 2 is a section taken in the plane of the line 2—2 in Fig. 1;

Fig. 3 is a modification of the arrangement shown in Fig. 1 employing a flexible diaphragm;

Fig. 4 illustrates a modification of the ar-

rangement shown in Fig. 3 utilizing air as the fluid medium;

Fig. 5 is a partially schematic layout of a complete trigger mechanism shown in plan;

Fig. 6 shows the arrangement of the trigger mechanism elements immediately after the trigger has been sprung; and

Fig. 7 is a vertical section taken in the plane of the line 7—7 in Fig. 6.

To discriminate between a relatively slow and a relatively fast motion I have found that the motion may be utilized to tend to change the pressure of a fluid, the change in pressure of which may be relieved at a rate commensurate with the slow motion, while the sudden change in pressure resulting from the fast motion, the relieving means being insufficient to accommodate such a change, may be employed to obtain the desired response, a response which is not obtained during slow motion, and which, therefore, makes the desired discrimination. I prefer to make the change in pressure an increase, but by suitably reversing the direction of movement of the parts to be illustrated the change may be a decrease, so that the response will be to evacuation instead of to pressure.

Referring to Figs. 1 thru 4 of the drawings, there is a fluid system A, the volume of a portion or chamber B of which may be varied in response to an input motion applied to a plunger C. There is means, here exemplified by the clearance D, for permitting passage or discharge of fluid from the chamber B at a rate commensurate with a relatively slow input motion applied to the plunger C. There is a further means E in communication with the chamber B responsive to the increased fluid pressure resulting from a relatively fast motion of the plunger C.

Referring more specifically to the modification of the invention illustrated in Figs. 1 and 2, there is a movable cylinder 2 with which cooperates a stationary piston 4. The remainder of the fluid system includes a housing 6 and an elevated standpipe and reservoir 8, which is open to the atmosphere by reason of an opening 10 in the top of the reservoir. The fluid system is filled with oil, preferably a thin mineral oil which does not oxidize or dry out, and which has a fairly constant viscosity over the usual range of room temperature, say from 60 degrees to 90 degrees Fahrenheit. Input motion is applied to a plunger 12 which reciprocates within a bushing 14 at one end of the housing 6, the motion of the plunger in one direction being applied to the cylinder 2, and thus serving to diminish the volume of the chamber B. The clearance D between the cylinder 2 and the piston 4 is so adjusted that the oil may gradually leak out of the cylinder as a slow movement is imparted to the input plunger 12. The oil displaced by the plunger 12 rises in the reservoir 8.

When the movement of the plunger 12 is suddenly accelerated the oil within the cylinder 2 is unable to escape and its pressure is suddenly increased and moves the output plunger 16 outwardly, and this movement may be used in any desired manner, as in the present instance, for example, to stop a phonograph, or to initiate a record changing operation.

It should be noticed that the unidirectional operative relation between input plunger 12 and the cylinder 2 is such that the plunger 12 may be retracted quickly without necessitating that the cylinder 2 do likewise, the latter being gradually retracted by a light reset spring 17 located between the piston and the head of the cylinder. In this manner the reproducer may be moved back to begin the playing of another record while the cylinder is reset and refilled with oil from the reservoir at leisure. It may be pointed out that the oil is not under pressure in the housing 6 and, therefore, there is but little tendency for it to leak out through the bushing 14. This leakage is further prevented by a packing washer 18, made of cork or other suitable substance, which when the input plunger 12 is retracted, serves to seal the bushing 14 from the oil in the housing 6. Furthermore, any slight leakage of oil is replaced by the excess oil contained in the reservoir 8.

Attention is now directed to the modification shown in Fig. 3, which differs from that shown in Fig. 1 in employing a flexible diaphragm 20 for response to increased pressure, instead of the reciprocable plunger 16, used in the form shown in Fig. 1. It was previously mentioned that the oil leakage around the input plunger 12 is negligible owing to the fact that the oil thereat is not under pressure. The same is true for the oil around the output plunger 16 for a good portion of the time, but during the period of fast movement this plunger is subjected to a greatly increased pressure, and therefore is more apt to leak. By using the leakproof diaphragm 20, which is a disc of resilient material formed with annular ridges or corrugations, the enclosed chamber B is effectively sealed against such leakage.

The modification shown in Fig. 3 is further improved by the addition of a perforation 22 in the wall of the piston cylinder 4. This opening permits free discharge of the fluid in the chamber B during the first portion of the motion of the cylinder 2. However, when the cylinder 2 has been moved in far enough to cover the discharge opening 22, the operation then proceeds as before, the clearance D determining the rate of discharge of fluid, and this rate is made slow and com-

mensurate with the slow input motion applied to the input plunger 12.

The modification shown in Fig. 4 differs from those previously described principally in the use of air for the confined fluid, instead of a liquid such as oil. The arrangement is obviously structurally similar to that shown in Fig. 3, except that in place of a riser and reservoir there is merely a perforation 24, giving the housing 6 access to the outside atmosphere, which then acts as a practically infinite reservoir. With this arrangement leakage need not be at all considered, for the necessary air for the operation of the device is constantly being replenished so fast as may be necessary from the outside atmosphere.

As so far described the invention is applicable in any situation where it is desired to discriminate between a relatively slow and a relatively fast motion. If used in a phonograph the input motion is obtained from the movement of the reproducer across the record, and the output impulse is sufficient in energy to actuate the usual type of stop means for stopping the phonograph at the termination of the record being played. However, for some stop means, and more particularly for initiating the record changing or repeating operation in automatic phonographs, it is desirable to have available a more powerful trigger impulse.

With this in view I have devised a trip impulse amplifying means one form of which is illustrated as applied to a phonograph, in Figs. 5, 6, and 7. Referring to these figures, the trip impulse amplifying means comprise a trigger 30, resilient means here shown as a compression spring 32 tending to actuate the trigger by reason of its pressure on a collar 34, and means for keeping the resilient means under tension, here illustrated by a toggle trigger barrier 36. The trip impulse may come from any suitable source, exemplified by a trip unit 38 which may take the form of any of those illustrated in Figs. 1 through 4 of the drawings. The trip impulse from the unit 38 is applied to an arm 40 which moves the toggle arms out of alinement and so serves to break the toggle, and spring the trigger, as is illustrated in Fig. 6.

Considered more in detail, a record 42 is carried on a turntable which rotates about a vertical shaft 44. A reproducer 46 rides in the grooves of the record, being carried at the end of a tone arm 48. These elements have all been shown in broken lines because they really are located above the trigger mechanism to which the drawing is more particularly directed.

The tone arm carries with it a suitable actuating finger 50. This may be so positioned relative to the trip unit 38 that it does not contact with the input plunger C of the trip unit until the reproducer 46 is positioned at the radius of the smallest record ever used, and preferably does not so contact until after a portion of the record has been played, say a third or a half of the record, in order that the reproducer may be moved freely about without springing the trigger mechanism. It will also be observed that the contact between the finger 50 and the input plunger C is a pushing contact, and therefore only unidirectional, so that the reproducer and arm may be retracted rapidly, while the parts of the trip unit 38 may become reset during a relatively long period of time. These precautions may all be taken either instead of or in addition to the precautions set forth in connection with the trip units described in Figs. 1 through 4 of the drawings, for there the same objects may be attained by reason of the pushing contact between the input plunger C and the cylinder 2, and by reason further of the rapid relief perforation 22.

The trigger barrier 36 comprises a toggle arm 52 which is pivoted about a fixed pivot 54, and a toggle arm 56 which is pivoted to the trigger at 57. When the toggle arms 52 and 56 are in alinement they serve to keep the trigger spring 32 under tension ready to actuate the trigger 30. The toggle arm 56 is provided with an extension 58 which, when the toggle has been moved downwardly a little bit past alinement or dead center, engages the pivot 54, and so serves to keep the toggle located in position. The arm 40 is rigidly connected to the arm 52, and, when a trip impulse is applied to the arm 40 by the trip unit 38, the toggle arms are moved upwardly slightly beyond alinement, thereby breaking the toggle and permitting the trigger to spring sharply to the left. The movement of the toggle near dead center does not appreciably move the collar 34, and therefore offers but little resistance to the trip unit 38, so that the trigger action, while certain, is sensitive.

The extension 58 serves also as part of a reset mechanism for compressing the spring 32 and resetting the toggle 36. This is done by the aid of a cam 60 mounted on a shaft 62. After the trigger 30 has been sprung it initiates a record changing operation which involves mechanical motion of a number of parts in order to discard the used record and to replace it with a new one. One of these movements, or an additional added one, may be employed to rotate the shaft 62 and the cam 60, the cam surface being so designed that by its pressure against the extension 58 the latter is moved toward the fixed pivot 54, and finally carries the toggle past dead center and into locked position. This constitutes means for automatically placing the trigger spring under tension in order to store up the trigger energy which is to amplify the trip impulse.

I have designed the particular trigger mechanism here set forth with a special view to utilizing it in an automatic phonograph such as I have disclosed in my copending applications, Serial Nos. 341,076, 341,077, 341,078, all filed February 19, 1929. In the phonograph there described the record changing operation is produced by tilting the record turntable about a horizontal axis through approximately a quarter of a revolution in order to aid in the discharge of the used record. The tilting is obtained by means of a crank mechanism actuated through a single revolution clutch which is engaged by reciprocating a clutch pin. In the arrangement here set forth the shaft 62 is the horizontal axis about which the turntable oscillates, so that after the trigger 30 by its movement has actuated the clutch pin 70 of the single revolution clutch, the oscillation of the turntable carries the cam through the necessary rotation for resetting the trigger barrier 36.

It will be aparent that while I have shown and described my invention in the preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims. By the terms "trip" and "trigger" in the claims directed to phonographs I intend to include phonograph stop means, record changer means, record repeat means, or other responses to the termination of a record.

I claim:

1. The method of discriminating between relatively slow and relatively fast motions in order to obtain a response to a relatively fast motion which includes utilizing the motion to tend to change the pressure of a fluid, relieving the change in fluid pressure at a rate commensurate with a relatively slow motion, and obtaining the desired response from the change in fluid pressure resulting from a relatively fast motion.

2. In a phonograph comprising a reproducer and an automatic trip, the method of determining the termination of a phonograph record in order to operate the trip which includes utilizing the movement of the reproducer across the record to compress a fluid, relieving the fluid presure at a rate commensurate with the normal reproducing movement of the reproducer, and utilizing the increase in presure caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record for operating the automatic trip.

3. In a phonograph comprising a reproducer and an automatic trip, the method of determining the termination of a phonograph record in order to operate the trip which includes utilizing the movement of the reproducer across the record to compress a fluid, freely relieving the fluid pressure during the movement of the reproducer across a portion of the record, only gradually relieving the fluid pressure during the movement of the reproducer across another portion of the record, and utilizing the increase in pressure produced by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record to operate the automatic trip.

4. Means for discriminating between relatively slow and relatively fast input motions comprising a fluid system, means for varying the volume of a portion of said system in response to the input motion, means permitting passage of the fluid between said portion and the system at a rate commensurate with a relatively slow input motion, and means in communication with the said portion responsive to the change in fluid pressure resulting from a relatively fast input motion.

5. Means for discriminating between relatively slow and relatively fast input motions comprising a chamber containing a fluid, means for varying the volume of the chamber in response to the input motion, means permitting gradual discharge of the fluid from said chamber at a rate commensurate with a relatively slow input motion, and means in communication with said chamber repsonsive to the increased fluid pressure resulting from a relatively fast input motion.

6. Means for discriminating between relatively slow and relatively fast input motions comprising a chamber containing a fluid, means for varying the volume of the chamber in repsonse to the input motion, means permitting free discharge of the fluid in the chamber during a portion of the input motion, means permitting only a gradual discharge of the fluid from said chamber during another portion of the input motion, and means in communication with said chamber responsive to the increased fluid pressure resulting from a relatively fast input motion taking place during the latter portion of the input motion.

7. Means for discriminating between relatively slow and relatively fast input motions comprising a cylinder containing a fluid, a relatively reciprocable piston for varying the volume of said cylinder in response to the input motion, said cylinder and piston having sufficient clearance to permit of a gradual discharge of the fluid from the cylinder at a rate commensurate with a relatively slow input motion, and a flexible diaphragm in communication with the cylinder for response to the increased fluid pressure resulting from a relatively fast input motion.

8. An automatic trip for a phonograph comprising a fluid system, means for varying the volume of a portion of said system, a reproducer, means so interconnecting the volume varying means and the reproducer that movement of the reproducer across the record

varies the volume of the said portion of the system, means permitting passage of the fluid between said portion and the system at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, and trip means responsive to a change in the pressure of the fluid in said portion of the system, such as is caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record.

9. An automatic trip for a phonograph comprising a chamber containing a fluid, means for varying the volume of the chamber, a reproducer, means so interconnecting the volume varying means and the reproducer that movement of the reproducer across the record varies the volume of the chamber, means permitting gradual discharge of the fluid from the chamber at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, and trip means responsive to an increase in the pressure of the fluid in the chamber such as is caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record.

10. An automatic trip for a phonograph comprising a chamber containing a fluid, means for varying the volume of the chamber, a reproducer, means so inter-connecting the volume varying means and the reproducer that movement of the reproducer across the record varies the volume of the chamber, means permitting free discharge of the fluid in the chamber during movement of the reproducer across the first portion of a record, means permitting only a gradual discharge of the fluid from said chamber during movement of the reproducer across the last portion of the record, and trip means responsive to an increase in the pressure of the fluid in the chamber such as is caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record.

11. An automatic trip for a phonograph comprising a cylinder containing a fluid, a relatively reciprocable piston for varying the volume of the cylinder, a reproducer, means so interconnecting the relatively reciprocable parts and the reproducer that movement of the reproducer across the record varies the volume of the cylinder, the piston clearance being sufficient to permit of a gradual discharge of the fluid from the cylinder at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, a flexible diaphragm in communication with the cylinder for response to an increase in the pressure of the fluid in the chamber such as is caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record, and trip means actuated by movement of the diaphragm.

12. An automatic trip for a phonograph comprising a chamber containing a fluid, means for varying the volume of the chamber, a reproducer, means so interconnecting the volume varying means and the reproducer that only movement of the reproducer across the record in the playing direction serves to vary the volume of the chamber, reset means to restore the volume of the chamber when the reproducer is retracted, means permitting gradual discharge of the fluid from the chamber at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, and trip means responsive to an increase in the pressure of the fluid in the chamber such as is caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record.

13. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a trigger, resilient means for actuating the trigger, a toggle-like barrier for said resilient means bendable either side of dead center, means to prevent motion of said barrier more than slightly past dead center on one side, so as to align and lock the barrier in substantial dead center for keeping the resilient means under tension during the playing of a record, and means responsive to the automatic trip for moving the toggle-like barrier toward the opposite side slightly past dead center, thereby breaking the toggle and releasing the resilient means for actuation of the trigger, at the end of the record.

14. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a trigger, resilient means for actuating the trigger, means for automatically placing the resilient means under tension, and means responsive to the automatic trip for springing the trigger at the end of the record.

15. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a trigger, resilient means for actuating the trigger, means for automatically placing the resilient means under tension, a toggle trigger barrier for locking the resilient means under tension, and means responsive to the automatic trip for breaking the toggle and thereby springing the trigger.

16. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a reciprocable trigger, a spring for actuating the trigger, a toggle-like barrier arranged to keep the

trigger spring under tension when the toggle-like barrier is in alinement, and means responsive to the automatic trip for breaking the toggle-like barrier in order to spring the trigger.

17. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a reciprocable trigger, a spring for actuating the trigger, a toggle joint arranged to keep the trigger spring under tension when the toggle arms are in alinement, means tending to lock the toggle in alinement, and means responsive to the automatic trip for breaking the toggle in order to spring the trigger.

18. The combination with an automatic trip for a phonograph, of trip impulse amplifying means comprising a reciprocable trigger, a spring for actuating the trigger, a toggle joint including a fixed toggle pivot, a movable toggle pivot on the trigger, and pivoted toggle arms arranged to keep the trigger spring under tension when in alinement, an extension on one of the toggle arms engaging the remote toggle pivot when the arms are moved slightly past alinement in order to lock the toggle, and an arm responsive to the automatic trip for rotating the fixed pivot in the opposite direction in order to break the toggle, and spring the trigger.

19. Automatic trip mechanism for a phonograph comprising a reciprocable trigger, resilient means for actuating the trigger, means to keep the trigger actuating means under tension, a chamber containing a fluid, means for varying the volume of the chamber, a reproducer, means so interconnecting the volume varying means and the reproducer that movement of the reproducer across the record varies the volume of the chamber, means permitting gradual discharge of the fluid from the chamber at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, and means responsive to an increase in the pressure of the fluid in the chamber caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record for springing the trigger.

20. Automatic trip mechanism for a phonograph comprising a reciprocable trigger, a spring for actuating the trigger, a toggle joint arranged to keep the trigger spring under tension when the toggle arms are in alinement, means tending to lock the toggle in alinement, a chamber containing a fluid, means for varying the volume of the chamber, a reproducer, means so interconnecting the volume varying means and the reproducer that movement of the reproducer across the record varies the volume of the chamber, means permitting gradual discharge of the fluid from the chamber at a rate commensurate with the rate of change in volume produced by the normal reproducing movement of the reproducer across the record, and means responsive to an increase in the pressure of the fluid in the chamber caused by the relatively rapid movement of the reproducer when it reaches the terminating groove or spiral of the record for breaking the toggle in order to spring the trigger.

Signed at New York in the county of New York and State of New York this 22nd day of April, A. D. 1929.

LESTER L. JONES.