June 30, 1970 R. LUBOW 3,518,354

VIBRATO SYSTEM WITH VARIABLE SPEED SIGNAL STORAGE DISC

Filed March 18, 1968 2 Sheets-Sheet 1

Fig. 1

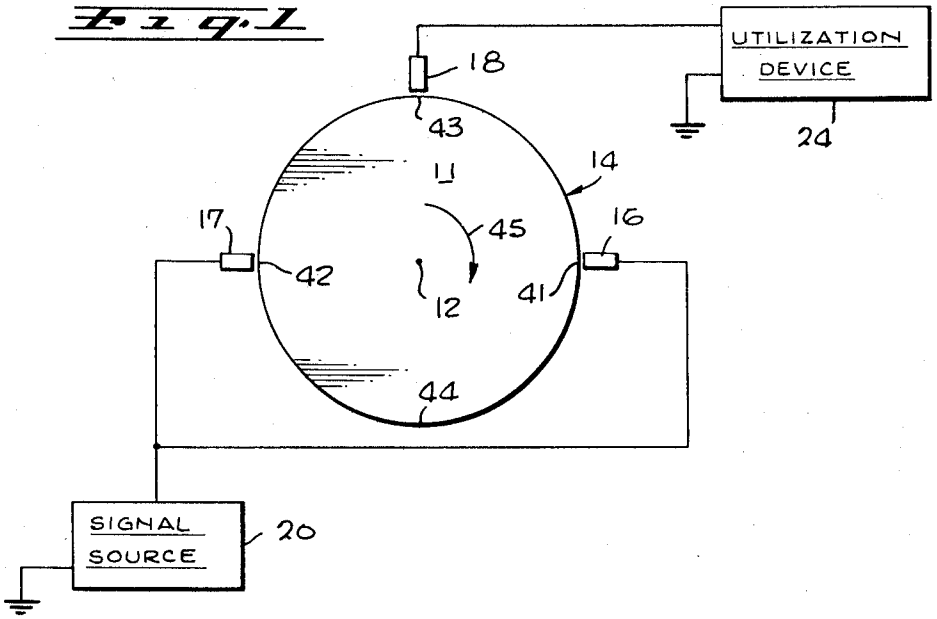


Fig. 2

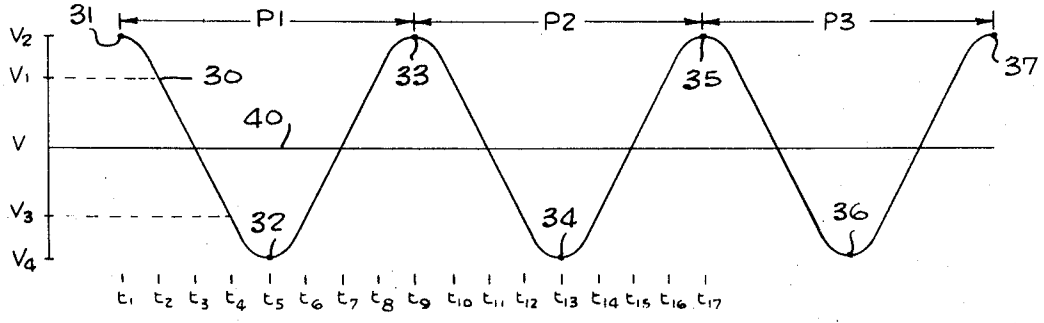
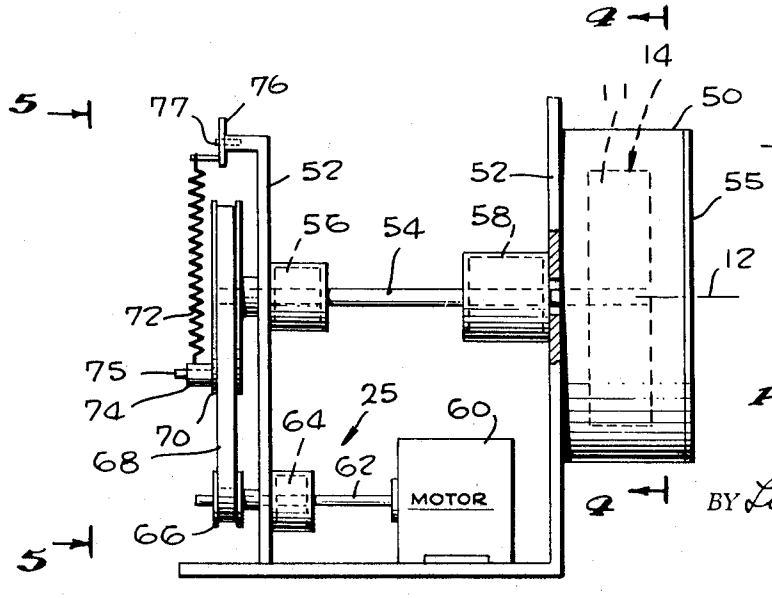


Fig. 3



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Fig. 4

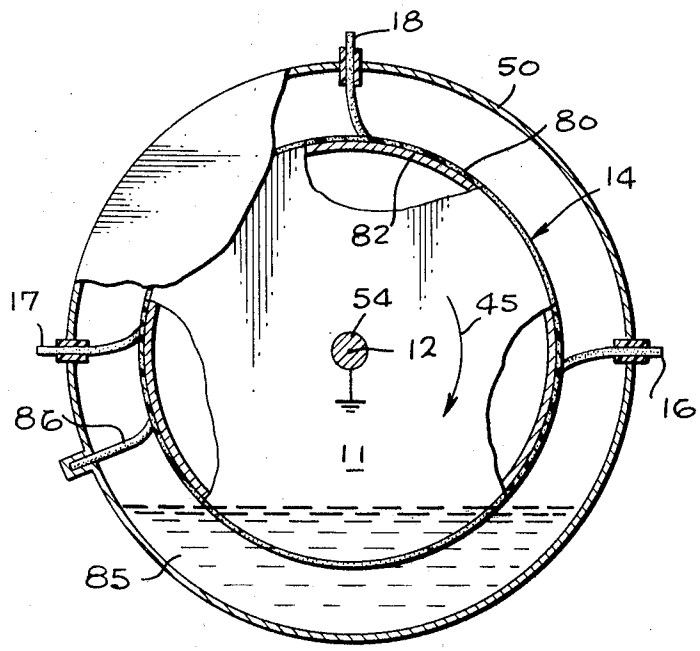


Fig. 5

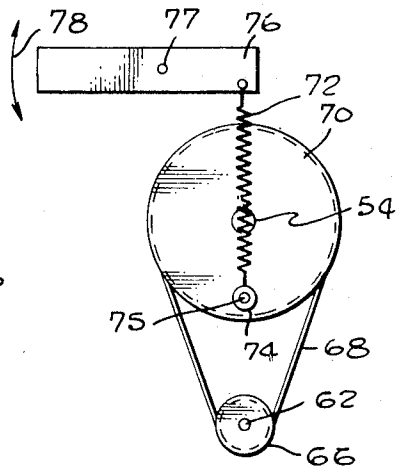
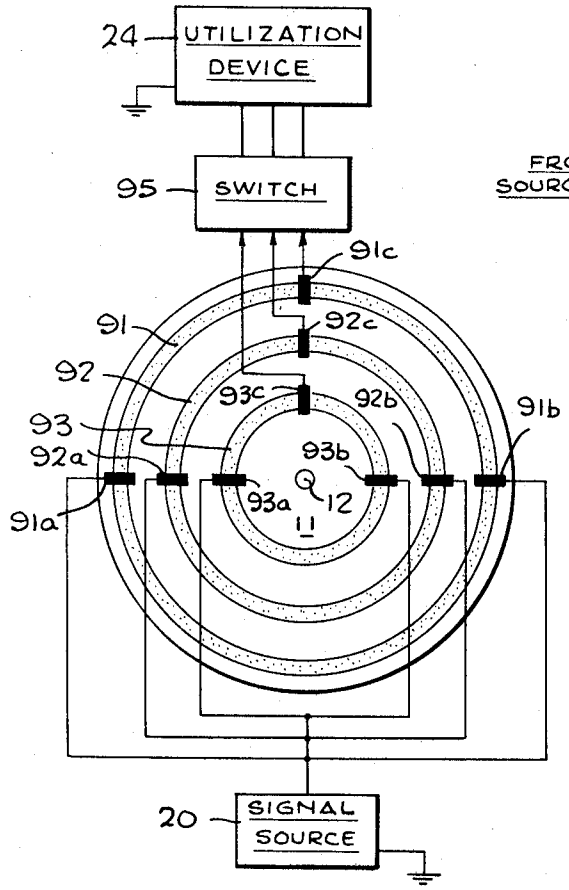


Fig. 7



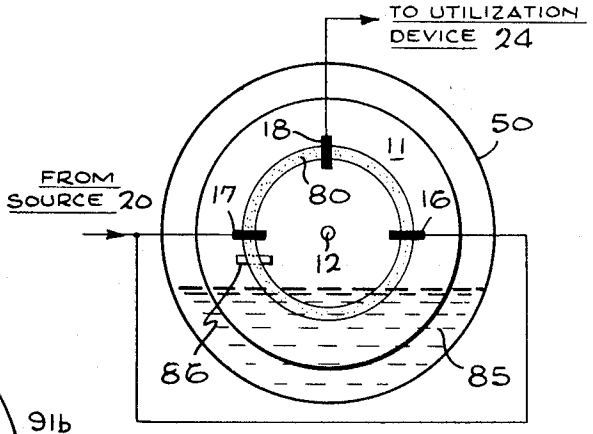


Fig. 6

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VIBRATO SYSTEM WITH VARIABLE SPEED SIGNAL STORAGE DISC

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Int. Cl. G10h 1/02
U.S. Cl. 84—1.25 12 Claims

ABSTRACT OF THE DISCLOSURE

A vibrato-producing apparatus which includes a conductive cylindrical body which is coated with dielectric material. The body is rotatable about its longitudinal axis at a rate which varies above and below an average rate during each revolution. A pair of record electrodes are positioned on opposite sides of the body. Signals, which are simultaneously applied to the two record electrodes, are stored simultaneously in opposite surface elements of the dielectric material. Thus, each element stores signals which have been frequency modulated above and below the input signal frequency. A read electrode is used to read the signals stored at each surface element.

BACKGROUND OF THE INVENTION

Field of the invention

This invention generally relates to signal-storing and reproducing devices and, more particularly, to a vibrato-producing apparatus.

Description of the prior art

In music, the term vibrato generally refers to cyclic vibrations in frequency of a signal in the audio frequency range, hereafter referred to as an audio signal or tone. The cyclic rate of variations is typically 4 to 8 cycles per second. The magnitude of the frequency variations above and below a mean frequency value, which is also referred to as the width of the frequency excursion, represents the vibrato range. A wide vibrato range is generally desirable since a wider vibrato range produces richer musical tones and greater orchestral effects.

In some musical instruments, vibrato is produced by generating the desired frequency variations at the source, as is the case with instruments such as the slide trombone or a string instrument. In the slide trombone the vibrato is produced by selectively positioning the slide while in a string instrument a similar effect is produced by the selective positioning of the player's finger on the string. In other instruments, such as electrical organs and pianos which contain little or no natural vibrato, vibrato may be produced by the addition of special devices.

Many such devices have been designed and are available commercially. Some devices employ signal phase shift and/or signal time delay techniques in order to produce the vibrato effect. In other devices electromechanical and mechanical principles are employed to produce the desired signal frequency variations. Although some of these devices operate with relative degrees of success, they have certain performance limitations which are quite undesirable. For example, devices based on signal phase shift techniques are capable of producing a very limited and narrow vibrato range, while others with sufficiently wide vibrato range are likely to produce flat and sharp tones which may be most disturbing to a listener.

The flat or sharp tones occur if at the instant of cessation of one note, the vibrato device produces a frequency at one end of its vibrato range, and the start of a succeeding note occurs when the produced frequency is at the other end of the vibrato range. Such disturbing tones

are particularly present in devices with a wide vibrato range. Another disadvantage, characteristic of prior art devices, is the absence of means for sustaining a vibratoed signal in order to prevent sudden disruption of an audible note.

OBJECTS AND SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide a new improved vibrato-producing apparatus.

Another object of the invention is to provide an apparatus capable of producing a wide vibrato range.

A further object of the present invention is to provide a relatively simple and inexpensive apparatus which is capable of producing a wide vibrato effect of a relatively wide range without attendant flat or sharp tones.

Still a further object of this invention is to produce a vibrato-producing apparatus with vibratoed-tone-sustaining characteristics.

These and other objects of the invention are achieved by providing a rotatable signal-storing device, such as a disc which has a portion of its surface, located about a center, coated with a signal-storing medium, a pair of record electrodes and a read electrode. The pair of record electrodes are positioned on opposite sides of the disc center about which the disc is rotated by a drive unit. Any incremental surface area of the signal-storing medium which passes by one record electrode passes, one half revolution later, by the other record electrode. The disc is rotated so that during each revolution, it is accelerated and decelerated. Alternately stated, the disc is rotated so that during each revolution, the velocity of the signal-storing medium, with respect to the record electrodes, varies above and below an average or mean velocity, with the maximum and minimum velocities occurring one half revolution period apart.

The audio signal to be vibratoed is applied to both record electrodes simultaneously, as the disc is being rotated. Consequently, after one complete revolution, at each incremental surface area of the medium, signals are stored whose relative wavelengths deviate from the wavelength of the input signal by equal lengths above an below it. That is, the frequencies of the signals stored at each incremental surface area of the medium are above and below the input signal frequency by equal values. Consequently, when these signals are sensed or read out by the read electrode and are supplied to a speaker, the resulting vibratoed tones which are both sharp and flat simultaneously tend to merge in the listener's ear. Thus, the undesired effect of flat or sharp tones is eliminated.

In order to provide a capability of sustaining the vibratoed signal, a conductive surface, coated with a dielectric material, is used. Signals are stored therein by electrostatic charging. The material is partially discharged each time it passes by the read electrode. Consequently, even after a note is no longer applied to the record electrodes, it is sustained in the signal-storing medium for several revolutions or read out cycles until it is completely discharged.

The novel features of the invention are set forth with particularity in the appended claims. The invention will best be understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTIONS OF THE DRAWINGS

FIG. 1 is a diagram useful in explaining the invention;

FIG. 2 is a velocity vs. time diagram;

FIG. 3 is a side view of one embodiment of the invention;

FIG. 4 is a diagram along lines 4—4 of FIG. 3;

FIG. 5 is a diagram along lines 5—5 of FIG. 3;

FIG. 6 is a front cross-sectional view of another embodiment of the invention; and

FIG. 7 is a front cross-sectional view of yet another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Attention is now directed to FIG. 1 which is a diagram of the basic parts of the apparatus of the invention. Therein, numeral **11** represents a disc-like member which is rotatable about a center **12**. The peripheral surface **14** of the disc is assumed to be coated with a material capable of storing signals applied thereto by record electrodes **16** and **17**. The two record electrodes are positioned adjacent surface **14** on opposite sides of center **12**, so that any incremental portion or area of surface **14** which passes adjacent one electrode, such as **16**, appears and passes near the other record electrode one half revolution period later.

The two record electrodes **16** and **17** are connected to a signal suorce **20**, so that the signal received therefrom is applied simultaneously by the two electrodes to opposite incremental surface areas, hereafter referred to as signal-storing elements, of the circular signal-storing surface **14**. The apparatus also includes a read electrode **18** which senses the signals stored in each signal-storing element passing thereby, and supplies signals related thereto to a utilization device **24**. The latter may be an audio amplifier which drives a loudspeaker of an audio system. In FIG. 1 read electrode **18** is shown 90° apart from either of the record electrodes **16** and **17**.

In addition, the apparatus of the invention includes a drive unit which is designated in FIG. 3 by numeral **25**. Unit **25** will be described hereafter in detail in conjunction with FIG. 3. Basically, the function of drive unit **25** is to rotate surface **14** about center **12** at a varying rate, so that during each revolution period, the surface **14** accelerates and decelerates. Alternately stated, the disc **11** is rotated so that during each revolution, the velocity of surface **14** with respect to the electrodes **16**, **17** and **18**, which are stationary, varies continuously, reaching maximum and minimum values with respect to a mean or average velocity one half revolution period apart.

Reference is now made to FIG. 2 wherein the velocity of surface **14** versus time, during three successive revolutions P1, P2 and P3 is diagrammed, and is designated by line **30**. Points **31**, **33**, **35** and **37** represent a maximum velocity, points **32**, **34** and **36**, a minimum velocity and the points of intersection of line **30** with a line **40** represent a nominal velocity value.

The principles of operation of the apparatus of the invention will now be described in conjunction with FIGS. 1 and 2. Let it be assumed that source **20** provides record electrodes **16** and **17** with signals at a constant frequency f, which are stored on surface **14** as it passes by each of the electrodes **16** and **17**. Furthermore, let it be assumed that at a time t_1 (see FIG. 2) when the velocity of surface **14** is a maximum, designated V_2, elements **41** and **42** of surface **14** are adjacent record electrodes **16** and **17** respectively, and that the member **11** is rotated clockwise as represented by arrow **45**. Consequently, the input signals at frequency f are stored at elements **41** and **42** at a maximum surface velocity V_2. Half a revolution later, at time t_5, the two elements **41** and **42** appear near electrodes **17** and **16** respectively. However, at time t_5, the surface velocity is a minimum, designated V_4.

Thus, it is seen that the input signals at frequency f are stored twice at each of elements **41** and **42**, once at a surface velocity V_2 and once at a surface velocity V_4, where V_2 and V_4 deviate from a nominal velocity V by equal magnitudes or amounts. Consequently, the effective wavelength of the signals stored at velocity V_2 is shortened with respect to the wavelength of the input signals. Alternately stated, signals at frequency f stored at minimium velocity V_4 are frequency modulated to be of a frequency f_4 above f, and those signals stored at

the maximum velocity V_2 are frequency modulated to a frequency f_2 below f, where $f_4-f=f-f_2$.

After one complete revolution, each signal-storing element of surface **14** stores signals with effective frequencies above and below the nominal frequency f, with the frequency deviations being equal. The magnitude of frequency deviations of the signal stored at each element depend on the instantaneous velocity of the element with respect to the nominal velocity at the time of recording or signal-storing.

Each element may be thought of as storing two frequency modulated tones, one above and the other an equal amount below the frequency which is being vibrated. Since the two tones would always be read out simultaneously, the vibrato which they would produce would be both sharp and flat at the same time. Such a tone combination would not be disturbing to a listener, since his ear would tend to average the tones. Thus, the undesired effect due to the presence of sharp and flat tones, which is characteristic of prior art vibrato devices, is eliminated in the apparatus of the present invention.

The vibrato effect is actually produced by the varying frequency shift of the two vibratoed tones stored as signals at each surface element. The varying frequency shift is produced by the varying velocities of surface elements as they pass by read electrode **18**. For example, element **41** which at time t_1 is near electrode **16** stores a modulated signal f_2 and at time t_5 when it is near electrode **17**, it stores a modulated signal f_4. Then a quarter of a revolution later, at time t_7, element **41** is at electrode **18**. Since at time t_7, the velocity is V, electrode **18** supplies device **24** with a combined tone whose effective frequency is f. When element **41** is near electrode **18**, element **43** is at electrode **17**. From FIG. 2 and the foregoing description, it should be apparent that signals are stored in element **43** by electrodes **16** and **17** at time t_3 and t_7, respectively, when the velocity is V. Thus, two unmodulated signals are stored in element **43**. However, when at time t_9, element **43** is near electrode **18**. The velocity is V_2. Consequently, the frequency of each of the signals stored in the element is effectively increased to a maximum to produce a vibratoed tone at the top of the vibrato range.

Element **44** opposite element **43** passes by electrodes **41** and **42** at times t_7 and t_{11} when the velocity is V so that it also stores two unmodulated signals f. However, when element **44** passes by electrode **18** at time t_{13}, the velocity is at a minimum value (V_4). Consequently, the two unmodulated signals are frequency shifted to produce a vibratoed tone at the bottom of the vibrato range.

From FIGS. 1 and 2 it should be apparent that any other element on surface **14** stores two signals which when read out by electrode **18** result in the production of a vibratoed tone which lies between the top and bottom of the vibrato range. In the particular example, the vibrato range equals the difference between the maximum and minimum frequencies produced when the surface velocity is at its maximum and minimum, respectively.

It should be pointed out that the position of read electrode **18** with respect to record electrodes **16** and **17** is not critical. It can be positioned at any convenient location as long as surface **14** passes thereby. However, the positioning of record electrodes **16** and **17** is critical. The two must be located on opposite sides of center **12** on a line extending therethrough so that any surface element, such as **41** which passes by one record electrode, such as **16**, appears by the other record electrode one half revolution period later.

It should be pointed out that if desired, the invention may be practiced by incorporating a single record electrode rather than the two oppositely positioned electrodes, such as electrodes **16** and **17**. It is appreciated that the use of the two record electrodes as taught herein result in the storing of two tones at each storage element

of the storage surface, so that the effect of sharp and flat tones are not disturbing to a listener or their effect may be ignored, one record electrode would suffice, since the vibrato effect is actually produced by the frequency or Doppler shift of the tones, stored at the surface elements, which is in turn produced by the varying velocity of the storage surface as it passes by the read electrode.

The characteristics of the record and read electrodes depend on the characteristics of the signal-storing surface **14**. Peripheral surface **14** or a circular surface about center **12** on the front face of disc **11** may be coated with magnetic matter. In such a case the record electrodes would consist of magnetic record heads and a magnetic read head, of the type used in conventional magnetic tape recorders. However, in order to provide a signal-sustaining characteristic, which as herebefore described is very advantageous, it is preferable to employ a signal-storing medium from which the stored signal is partially removed each time it is read out, so that after several revolutions, the stored signal is completely erased. This may be accomplished by employing a surface coated with a dielectric material in which signals are stored as electrical charges. Read out is accomplished by partial discharge of each surface element. In the following description the invention will be described in conjunction with such a signal-storing medium.

Reference is now made to FIG. 3 which is a side view of one embodiment of the invention. FIGS. 4 and 5 are views along lines **4**—**4** and **5**—**5** of FIG. 3, respectively. Briefly, the apparatus includes a container **50** which is supported by a support structure **52**. The rotatable disc **11** is supported in the container for rotation therein by a shaft **54** which extends into the chamber and is connected to the disc center **12**. If desired, disc **11** may be replaced by any cylindrical body which can be rotated about each longitudinal axis. The container **50** has a hole sufficiently large to enable the shaft to pass therethrough without coming in contact with the container. A cover plate **55** is provided at one side of container **50** to afford access to its interior. The shaft **54** is supported for free rotation by bearing blocks **56** and **58** which are mounted on the support structure **52**.

The drive unit **25** heretofore referred to as the unit which causes the rotation of member **11** is shown including a motor **60** mounted on structure **52**. The motor's shaft **62** supported by bearing block **64** has a drive pulley **66** coupled to its end. A drive belt **68** couples pulley **66**, to a mating pulley **70** which is supported by shaft **54**.

When motor **60** is energized, shaft **62** rotates, in turn rotating pulley **66** which by means of belt **68** rotates pulley **70**. Thus, shaft **54** and the particularly disc member are rotated. To produce the varying rate of rotation in order to produce the varying velocity of the disc surface, biasing means are coupled to pulley **70** in order to vary the torque, applied thereto. In FIG. 3 the biasing means comprise a spiral spring **72**, connected at one end to an idler **74**, which is mounted on a short stub **75** which extends from the back face of pulley **70**. The other end of the spring is connected to a control member, such as a handle **76** which is pivotably supported by structure **52** at a pivot point **77**. Thus, spiral spring **72** is supported so that its longitudinal axis is substantially perpendicular to the axis about which shaft **54** rotates. By varying the maximum spring tension, which is achieved by adjusting the position of the control member about point **77**, as indicated by arrow **78** (FIG. 5), the range of velocity change is controlled, thereby controlling the vibrato range.

The use of the spring in combination with the pulley **70** to vary the velocity of the disc surface has been found to be highly advantageous from several points of view. The combination is very simple, inexpensive and highly reliable. Also, it is very easy to vary the range of velocity change since all that is required to accomplish the variation is a change of maximum spring tension which is achieved by adjusting the position of control member **76**.

Referring now to FIG. 4, the peripheral surface **14** of disc **11** is shown comprising a dielectric surface or layer **80** which has a conductive backing **82**. A preferred arrangement comprises making the disc **11** or at least the conductive backing portion thereof of aluminum, with the outer periphery or dielectric layer **80**, made of aluminum oxide formed by anodizing the aluminum.

Extending through the container **50** to afford electrical communication with the dielectric layer **80** are the record electrodes **16** and **17** and the read electrode **18**. It has been found that conductive rubber, which consists of rubber impregnated with graphite affords the required connection with the dielectric layer **80** and yet is soft so as not to gouge the layer as it is rotated by these electrodes.

It is appreciated that a minimum pressure must be applied between the dielectric layer **80** and the electrodes to provide proper electrical contact. In order to compensate for the adverse effect of friction in a preferred embodiment, a lubricating fluid **85** is poured into the bottom of container **50** through the opening provided when the cover plate **55** is removed. Sufficient fluid is poured into the container so that the disc **11** dips into the fluid as it rotates. There is provided a wiper **86** for removing excess lubricating fluid and for leaving a thin film on the surface of the cylinder. The wiper **86** may be of any soft material which still has sufficient rigidity to remove the excess fluid. The wiper is supported from the container.

The lubricant **85** may be an electrically conductive fluid which will cover the dielectric in the form of a thin film. The conductivity of the fluid allows electrical energy to pass between the electrode and the dielectric and thereby forms a more intimate electrical contact, minimizing the effects of porosity and irregularities in the dielectric. Also, it enlarges the size of the useful capacitance in the region of friction. The conductivity of the lubricating fluid, however, should not be such as to cause a discharge between the reading and writing electrodes.

A preferred resistance for the fluid is one which ranges between 10 megohms per cubic centimeter to 200 megohms per cubic centimeter. A preferred fluid which provides both the lubricating and the conductive qualities desired is a polyalkylene oxide derivative which is sold by the Union Carbide Company under the trade name of "Ucon" LB 65 fluid. This fluid is mixed with alcohol until its conductivity reaches a desired value. However, any lubricating fluid having the desired conductivity may be used instead.

It should again be stressed that although in FIGS. 1 and 4 the signal-storing medium is shown at the peripheral surface of the rotatable disc **11**, the medium such as the dielectric layer **80** may be located as a circular layer on the face of the disc **11**. Such an arrangement is shown in FIG. 6 in which elements like those previously described are designated by like numerals.

If desired, the face of disc **11** may define a plurality of concentric tracks or rings of signal-storage material, with each track being associated with a pair of record electrodes and a read electrode. One example of such an arrangement is shown in FIG. 7 wherein numerals **91**, **92** and **93** designate three tracks. Record electrodes **91***a* and **91***b*, **92***a* and **92***b*, and **93***a* and **93***b* are positioned to store signals in tracks **91**, **92** and **93**, respectively. As shown, the six heads are connected to store the same input signal, received from signal source **20**. Clearly, however, each pair of electrodes may be connected to a different signal source so that a different input signal may be stored in each track.

Read electrodes **91***c*, **92***c* and **93***c* are positioned adjacent tracks **91**, **92** and **93**, respectively. Since the three tracks are of different radii, as the disc is rotated at a variable rate, the ranges of velocity change of the elements in the various tracks are different. Consequently,

the vibrato ranges of the tracks are different. The outputs of the three read electrodes **91***c*, **92***c* and **93***c* are shown supplied to a switch **92**, which can be operated to supply the output of any one or of a combination of the three read electrodes to the utilization device **24**. Thus, with the novel arrangement shown in FIG. 7, any combination of up to three vibratoed tones which are vibratoed at different ranges may be produced and utilized. It is apparent that any desired number of tracks may be employed. It should further be pointed out that either electrostatic or magnetic-signal storing techniques may be employed. For example, the multitrack disc **11**, shown in FIG. 7, may be a multitrack magnetic disc in which case, the various electrodes would be write and read magnetic type heads.

There has accordingly been shown and described herein a novel vibrato-producing apparatus. It consists of a signal-storing surface, a pair of record electrodes and a read electrode positioned adjacent the surface. The surface is cyclically rotated at a varying velocity so that each element thereof passes by one record electrode and one half revolution later it passes by the other record electrode, both of which apply the same input signal for storage in the surface. Thus, after one revolution, each surface element stores signals at frequencies above and below an average frequency of the input signal. The read electrode responds to the two signals which are stored in each element and which are frequency shifted by an equal frequency value or amount, which is a function of the velocity of the element as it passes by the read electrode. However, since the velocities of adjacent surface elements are different, the signals at the various elements are phase shifted by different or varying amounts. It is this varying frequency shift which produces the vibrato effect. The vibrato range is a function of the difference between the maximum and minimum velocities.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. A vibrato-producing apparatus comprising:
a signal-storing medium rotatable about a center;
first and second electrode means positioned adjacent said medium, for applying signals, simultaneously supplied to said first and second electrode means to said signal-storing medium, said first and second electrode means being positioned on opposite sides of said center on a straight line extending therethrough;
means for rotating said medium about said center at a varying rate during each of a succession of equal duration cycles, said rate varying during each cycle above and below a preselected average rate of rotation; and
a third electrode means positioned adjacent said rotating signal-storing medium for removing signals from medium element passing thereby.

2. The vibrato-producing apparatus as recited in claim **1** wherein said signal-storing medium includes a conductive surface and a dielectric material covering at least a portion of said conductive surface which defines a circle about said center.

3. The vibrato-producing apparatus as recited in claim **2** further including lubricating means having a predetermined conductivity and means for applying said lubricating means to said dielectric material in a thin film to be present at said first, second and third electrode means.

4. The vibrato-producing apparatus as recited in claim **3** wherein said lubricating means is a lubricating fluid and said means for applying said lubricating means include a reservoir for said fluid through which said dielectric material moves when said conductive surface is rotated, and means for limiting the amount of fluid carried by said dielectric material after said dielectric material has passed through said reservoir.

5. A vibrato-producing apparatus comprising:
a signal-storage medium of predetermined configuration and signal storage characteristics;
signal record means to which a signal in the audio frequency range is supplied, said signal record means being disposed adjacent said signal-storage medium for storing therein the signal received thereby;
drive means for varying the relative velocity of said medium with respect to said signal record means at a variable rate during each of a succession of equal duration cycles, whereby during each cycle said medium moves with respect to said signal record at a velocity which varies above and below an average velocity; and
signal read means positioned adjacent said signal-storage medium which is moved at said varying velocity for reading out the signals stored in each element of said signal-storage medium.

6. The vibrato-producing apparatus as recited in claim **5** wherein said signal record means comprises at least one record electrode, and said signal read means comprises a single read electrode.

7. The vibrato-producing apparatus as recited in claim **6** wherein said signal-storage medium comprises a plurality of concentric signal-storage tracks on a disc rotatable about its center at a varying rate by said drive means, said signal record means including at least one record electrode disposed adjacent each track for storing signals therein, and said signal read means includes a single read electrode adjacent each track for reading the signal stored in each track element as said track is moved by said read electrode.

8. A vibrato-producing apparatus comprising:
a movable conductive surface;
a dielectric material covering said surface;
first and second electrode means for applying simultaneously the same signals to said dielectric material;
means for moving said surface coated with the dielectric material at a varying velocity during each of a succession of equal duration cycles with each element of said coated surface which is being adjacent each of said first and second electrode means at half cycle intervals, the velocity of said surface varying during each cycle above and below an average velocity with the maximum and minimum velocities occurring at half a cycle interval apart; and
third electrode means positioned adjacent said coated surface for reading signals from each element of said dielectric material which moves adjacent thereto.

9. The vibrato-producing apparatus as recited in claim **8** including a lubricating fluid having a predetermined conductivity, and means for continuously applying said fluid to said delectric material in a thin film to be present at said first, second and third electrode means.

10. The vibrato-producing apparatus as recited in claim **9** wherein said means for continuously applying said fluid to said dielectric material in a thin film includes a reservoir for said fluid through which said dielectric material on said movable conductive surface is moved, and brush means for removing any fluid excess after said dielectric material has passed through said reservoir.

11. A vibrato-producing apparatus comprising:
a conductive cylindrical body, defining a longitudinal axis;
a dielectric material covering a selected portion of the surface of said body;
a container;
means for rotatably supporting said cylindrical body within said container;

means for rotating said body about its longitudinal axis at a varying annular rate of rotation during each complete revolution, said rate of rotation varying above and below a mean rate of rotation;

first and second electrode means positioned adjacent said cylindrical body on opposite sides of said longitudinal axis, said first and second electrode means affording electrical connection with said dielectric material for storing therein signals which are simultaneously applied to said first and second electrode means;

third electrode means affording electrical connection with said dielectric material to receive signals stored in said material; and

lubricating fluid having a predetermined conductivity, said lubricating fluid being within said container in an amount sufficient to insure that the dielectric

material on the surface of said body comes in contact therewith.

12. The vibrato-producing apparatus as recited in claim **11** wherein each of said first, second and third electrodes is a conductive rubber member and said fluid is a mixture of a polyalkylene oxide derivate and alcohol.

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WARREN E. RAY, Primary Examiner