

Sept. 13, 1966

H. C. CHAMBERLIN
ELECTRICAL MUSICAL INSTRUMENT HAVING PRE-RECORDED
TAPE FOR TONE GENERATION

3,272,907

Filed Feb. 3, 1964

4 Sheets-Sheet 1

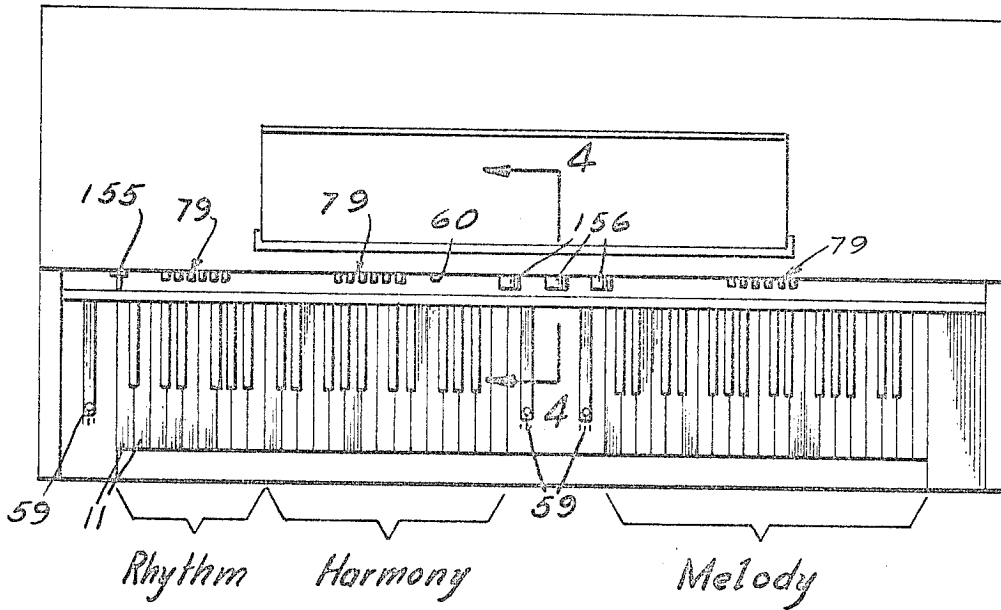


Fig. 1.

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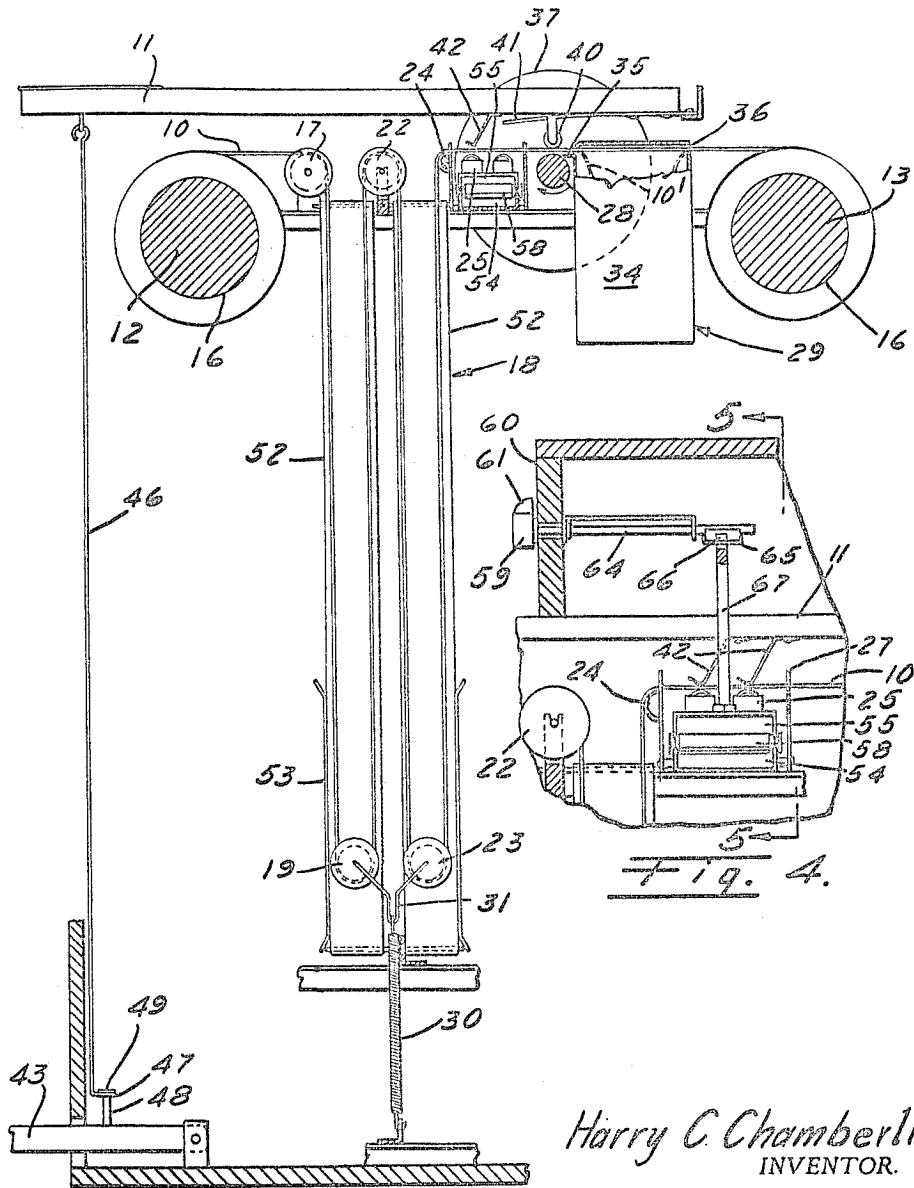
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Fig. 2.



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Fig. 7.

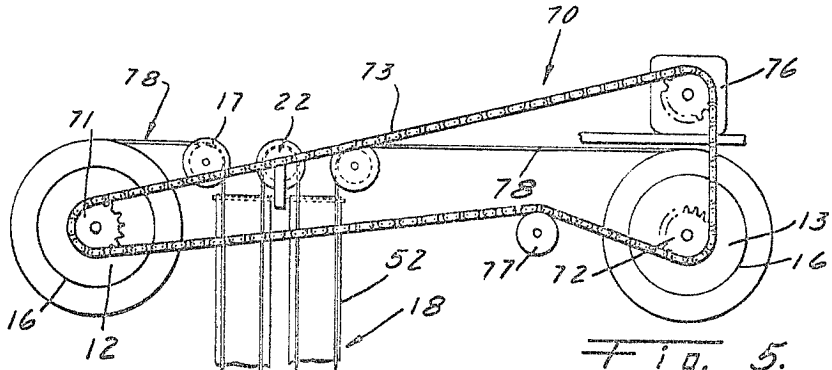


Fig. 5.

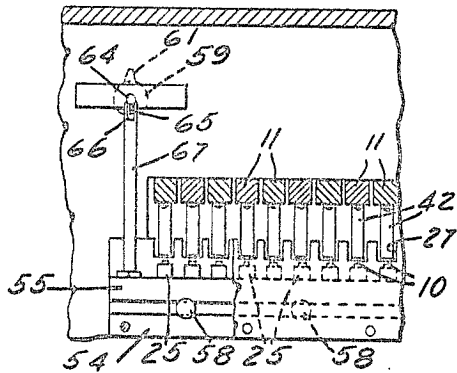


Fig. 6.

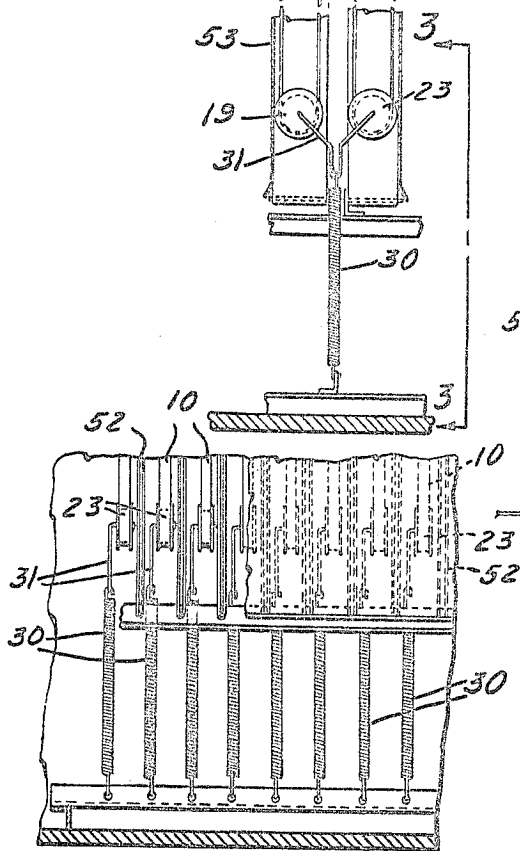
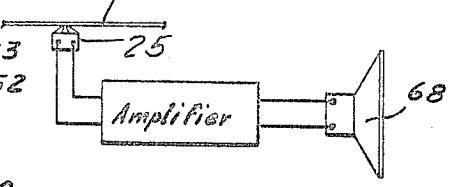


Fig. 3.

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3,272,907

**ELECTRICAL MUSICAL INSTRUMENT HAVING
PRE-RECORDED TAPE FOR TONE GENERATION**

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Filed Feb. 3, 1964, Ser. No. 341,952

6 Claims. (Cl. 84-1.28)

This invention relates generally to musical instruments and particularly relates to that type of instrument where prerecorded tapes are selected according to the action of the player and reproduced to produce a complete musical composition by selectively combining recorded rhythm and harmony chords as well as solo notes.

The present invention discloses a musical instrument which may be considered an improvement over that disclosed in my co-pending patent application, Serial No. 40,701, filed July 5, 1960, and entitled, "Musical Instrument."

The instrument disclosed in my above-referred to co-pending application includes three groups of prerecorded tapes. One set of tapes may be called the rhythm group or the bass group. The second set of tapes may be called the harmony or accompaniment group while the last group has prerecorded tapes for playing the melody, that is, solo notes. In accordance with my co-pending application, both the rhythm and the harmony tapes have prerecorded thereon various chords in different keys and played at different tempos.

In accordance with the present invention the tapes of the rhythm section have recorded thereon what might be called incomplete chords. Thus, each incomplete chord consists of the first or fundamental note, the fifth note and the octave. In other words, the third note which is normally included in a complete chord has been deliberately omitted.

It is well known that an octave contains twelve major keys in the chromatic scale. In other words, there are twelve half-tones in an octave. For example, when recording a C chord and using the first, third, fifth and octave, this will only match a C major key. In order to play C minor, C seventh and C sixth, different chords are needed. Thus, for the chromatic scale of twelve keys, there would be required four times twelve, or forty-eight different chords, each selected by one of forty-eight keys.

By omitting, in accordance with the present invention, the third note from each incomplete chord of the rhythm section, it is possible to match, for example, by recording a C major chord, consisting of the first, the fifth and the octave, not only the C major but also the C minor, C seventh and C sixth keys or scales. This makes it possible to eliminate three extra selecting keys from the keyboard which would otherwise be needed to play the C minor, C seventh and C sixth chord.

Therefore, in accordance with the present invention, the rhythm keys consist of twelve keys, each for selecting one of the twelve incomplete chords of the chromatic scale. All that is needed in addition are three extra keys for selecting three recorded diminished chords, namely, the A diminished, B flat diminished and B diminished. Each of the diminished chords is a complete chord. It will, therefore, be seen that fifteen keys is all that is needed for the rhythm section of the instrument of the present invention.

It is accordingly an object of the present invention to provide a musical instrument where prerecorded tapes are selected and reproduced by the actuation of a standard keyboard, there being three groups of tapes corresponding to the rhythm group, the harmony group and the melody group in such a manner that the rhythm group of tapes includes twelve separate tapes each having recorded there-

on an incomplete chord consisting of the first, the fifth, and the octave.

It is another object of the present invention to provide a musical instrument of the type herein referred to which requires only fifteen keys to select and reproduce twelve incomplete chords and three complete diminished chords instead of forty-eight which would otherwise be necessary to reproduce rhythm chords to match the respective twelve keys of the chromatic scale.

A further object of the present invention is to provide an instrument of the type referred to which can be provided with a standard keyboard to select and reproduce any one of a number of previously recorded tapes.

Still a further object of the present invention is to provide a novel tape selection and transport circuit for selecting any one of a number of prerecorded sections of a group of tapes.

As explained in my prior co-pending application, above referred to, each of the tapes may, for example, consist of six consecutive sections. In addition, each tape may be provided with three adjacent tracks. Therefore, each tape includes 18 distinct portions which can be selected. Preferably, the sections are arranged in such a manner that each section will play continuously for eight seconds. Since the tape moves at 7½ inches per second, the tape will move during eight seconds through sixty inches or five feet. Accordingly, each tape may be thirty feet long.

Preferably, the various sections of the melody tapes, the harmony tapes and the rhythm tapes can be independently selected. However, it is also possible to select simultaneously adjacent sections of both the rhythm and the harmony groups of tapes.

Preferably, each of the sections of the tapes and each of the different tracks of the tapes may have recorded thereon, either recordings of different instruments or groups of instruments, or recordings made in different tempos. For convenience, the three adjacent tracks of each tape may be called the A track, the B track and the C track.

By way of example, the first section of the rhythm group of tapes may have recorded on their A tracks, eight second recordings of incomplete chords as explained hereinabove in a standard three-quarter time waltz, tempo 84, in the key of C. As explained above, there are fifteen such tapes in the rhythm group corresponding to the twelve incomplete chords of the chromatic scale and the three diminished chords. Accordingly, when section 1 of the rhythm section is selected and track A thereof, all the tapes will have recorded thereon a three-quarter waltz, waltz time tempo 84. The same arrangement may very conveniently be used for section 1, track A of the harmony group of tapes.

However, the tapes in the melody group may have recorded thereon selected instruments such as violins, saxophones, trombones or guitars.

In the B track of section 1, of the rhythm groups, there may, for example, be recorded again in the key of C, a Viennese waltz flavor having the tempo of 168. Finally, in the C track of the first section there may be recorded a fox trot, tempo of 168, again in the key of C and in the corresponding other keys of the chromatic scale including the diminished chords. The harmony group in section 1 of the B track may have recorded thereon a ten-man violin piccicato arpeggio. Thus, to summarize, in the three respective tracks of the first section there may have been recorded a standard waltz, tempo 84, a Viennese waltz, tempo 168, and a fox trot, tempo 168.

Further, by way of example, in the second through the sixth sections of the A tracks of the rhythm groups, there may be recorded thereon, respectively, a march in the

key of C, 126 beats, 2/4 time; a fox trot, tempo 152; a fox trot, tempo 116; a fox trot, tempo 108, and a fox trot, tempo 132. Preferably, although not necessarily, the corresponding sections and tracks of the harmony group may have similar tempos recorded thereon.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view illustrating particularly the keyboard of a musical instrument according to the present invention;

FIG. 2 is a side elevational view illustrating one magnetic tape and its operating key;

FIG. 3 is a fragmentary rear view illustrating the arrangement of the magnetic tapes and taken as indicated by the line 3—3 of FIG. 7;

FIG. 4 is a fragmentary side view taken as indicated along the line 4—4 of FIG. 1;

FIG. 5 is a rear elevational view taken along the line 5—5 as indicated in FIG. 4;

FIG. 6 is a diagrammatic view and circuit diagram of the equipment for taking the sound off the tape and reproducing it;

FIG. 7 is a side elevational view of a tape transporting system; and

FIG. 8 is a diagrammatic view and circuit diagram of the relay circuit for operating one of the tape transporting systems in a searching mode.

Referring now to the drawings and particularly to FIG. 1, there is illustrated here a keyboard of a musical instrument embodying the present invention which may, as shown, have the form of a spinet. The keyboard consists of three groups of keys as indicated, namely, those which play the rhythm portion, those which play the harmony or accompaniment and those for playing the melody of a musical composition. The keys are indicated generally at 11.

Each key serves the function to select a particular section and track of a prerecorded magnetic tape which may then be reproduced in a conventional manner by a pickup head, amplifier and loudspeaker. Each of the magnetic tapes may have three tracks and each track may be divided into six consecutive sections, for example. Therefore, for each tape there are eighteen different playing positions, the recordings, any one of which may be selected by the depression of one key and reproduced.

In the rhythm part, the tapes have recordings of incomplete chords which may be made by groups of various instruments such as the banjo, guitar, bass viol and drums. In the harmony or accompaniment part, the tapes may have recordings of groups of instruments such as saxophone, trombone, etc. In the melody part, one more is recorded on each track in each section of the tapes ranging chromatically from G to F, or from C to B, each note having been produced by one or a plurality of like instruments or the human voice so that the melody chords may be produced in solo form.

The instrument is preferably played by first depressing a rhythm key as well as a harmony key. Thereupon, the melody keys are depressed by the player in accordance with the rhythm which the player can hear. Accordingly, a complete musical composition can be played in this manner, even by a novice. The missing third note of the incomplete rhythm chords may be supplemented or made up by the appropriate melody keys or by the harmony recordings.

It might be noted here that the instrument as illustrated in FIG. 1 has three knobs 59, each for selecting one of the three tracks, A, B, or C of the rhythm, harmony and melody tapes. In addition, there are three groups of push buttons 79, each for selecting one of the six sections

of the rhythm, harmony and melody tapes. Furthermore, there are three knobs 156 for controlling, individually, the volume of the rhythm, harmony and melody tapes, and finally a master switch 155 is provided for turning the instrument on and off.

As indicated in FIGS. 2, 3 and 5, the individual tapes 10 are in side by side relationship, corresponding in number to the number of keys so that the downward movement of each key actuates an associated recorded tape. In FIG. 2, one tape 10 and its actuating key 11 are illustrated schematically. To store the various sections of tape, the device may have 3 front drums 12, only one being shown, and 3 rear drums 13, only one being shown, arranged in spaced parallel relationship transverse to the keys. On one set of front and rear drums 12, 13, the tapes having the rhythm and harmony recordings thereon, are stored and the other set of drums, in axial alignment with the first set, store the tapes having the melody notes recorded thereon. Each drum has a plurality of circumferential channels 16 forming spools on which the opposite ends of the tapes 10 are fastened and wound. The tapes, accordingly, are not endless. Each tape is divided into six longitudinal sections, for example, and each section may selectively be brought into sound reproducing position in the device by suitable rotation of the sound reproducing tape storage drums 12 and 13.

From the front spool 12, each tape extends horizontally to an idler roller 17 and then downwardly into a reservoir, generally designated as 18, and in which the tape is in position to have its recorded sound reproduced. The tape in the reservoir is in four portions, that is, it extends downwardly from idler 17 to a first retracting pulley 19 and upwardly from pulley 19 to idler 22. From idler 22, it again extends downwardly to a second retracting pulley 23 to a small roller or smooth curved surface 24. It then extends horizontally rearwardly over its associated spaced magnetic pickup heads 25, one of which is required for each tape. As may be best seen in FIGS. 4 and 5, the tapes are guided as they pass over the heads by channel members 27.

Rearwardly of the pickup heads 25, the tape extends over a driving roller 28 through a tape receiver or tape tank 29 on to drum 13. The drums 12 and 13 are normally held against rotation and the magnetic tape 10 is held taut between the drums by the retracting rollers 19 and 23 which are urged downwardly by a coil spring 30, having its upper end attached to an extension 31 of the axles of the pulleys 19 and 23, and being secured at its lower end to the frame of the device.

Each tape tank 29 into which the tape feeds when it is played or reproduced comprises a flat container having opposite side walls 34, only one of which is shown, spaced apart a distance slightly greater than the width of each tape 10. The upper portion of the tank 29 is formed so as to provide an inlet lip 35 close to the top portion of the drive roller 28 and at the rear end of the receiver is an opening 36 through which the tape passes when it is transported on the drums.

When the musical instrument is ready for playing, the driving roller 28 is driven by a pulley 37 so as to be in continuous rotation, the pulley in turn being driven by a motor, not illustrated. For each tape 10 having recordings thereon, there is an associated roller 40 adapted to deflect the tape downwardly into frictional engagement with the continuously rotating driving roller 28, with the result that the tape will be moved rearwardly or to the right in FIG. 2, pulling it upwardly from the reservoir 18 and feeding it through the inlet lip 35 into the interior of the tank 29 wherein the tape folds back and forth in convolutions, one on top of the other, as indicated in part by the phantom line 10'. This operation occurs when a tape is played or reproduced and the roller 40 is depressed by means of a leaf spring 41 supporting the associated playing key 11. At the same time the key is depressed, a spring 42 forces the tape 10 and at least

one of the three tracks into contact with its magnetic pickup head 25. When the key is released, and the roller 40 is lifted so as to disengage the tape 10 from the drive roller 28, the tape portion having been played and moved into the tape tank is substantially instantaneously pulled therefrom and returned to reservoir 18 by the tape retracting means, formed by the two pulleys 19 and 23 and the spring 30. The high speed return to the reservoir 18 of the tape from within the tank 29 is accomplished because the tape in the latter is not restrained therein. The arrangement of four spaced portions of tape in the reservoir 18 permits the movement of four times as much tape out of the reservoir as the distance of the stretching movement of the spring 30. The particular embodiment permits the playing of the chords or notes on each tape at a rate of 7½ inches per second for eight seconds (corresponding to five feet of tape) which is a considerable longer period of time than necessary for the playing of individual chords and notes of most musical compositions.

The key 11, as shown in FIG. 2, may also be operated by a foot pedal 43. The key 11 has one end of a wire 46 connected thereto, the lower end of the wire having a horizontal loop 47 which is slidably engaged on a pin 48 in the foot pedal, the loop being held on the pin by its head 49. The foot pedal arrangement need only be attached to the third set of keys on the left in FIG. 1, namely, the rhythm group to provide a means to depress the keys in the latter group when the two hands are engaged in playing the harmony and melody. By this arrangement the leaf spring 41 urges the foot pedal, as well as the key upwardly into its nonplaying position. If, however, the key is played by hand, the loop 47 permits the wire to move downwardly on the pin 48 without effecting movement of the foot pedal.

Each of the tapes 10 is spaced between vertical plastic strips 52, suitably supported at their ends by frame members, as shown in FIGS. 2 and 3. Extending transversely in relation to the tapes at their lower portions is an upwardly opening U-shaped frame member 53, which together with the plastic strips holds the tapes 10 and the lower pulleys 19 and 23 in proper alignment.

Referring now to FIGS. 2, 4 and 5, the pickup heads 25, one for each tape 10, are supported on a lower support member 54, in turn supported on a frame member of the device, and which extends transversely with respect to the tape and the keys. Directly under the heads is an upper support member 55 which is supported on rollers 58 so as to be slidable with respect to the fixed lower support 54. Thus, each head may be moved transversely substantially the width of each tape 10 so that the head may be in playing position on a selected one of the tape's three tracks, or when desired, in playing position on two of the three tracks which are next to each other so that the sounds of both of the latter may be reproduced simultaneously. The means for moving the heads transversely to the three track positions is comprised of a knob 59, one of which is provided for each of the three groups of tapes, as shown in FIG. 1, and extends outwardly of a front panel 60. The knob has a pointer 61 which may cooperate on the panel 60 with circumferentially spaced indicia, such as the letters A, B and C, which indicate the different tracks. Positions between two of the letters for positioning the heads to play two tracks on one tape at the same time may similarly be indicated. Knob 59 extends outwardly from the device on a rod 64 supported horizontally by a frame member secured to the panel 60 and which has at its inner end a downwardly directed key-forming wire 65, fitted into a vertical open-ended slot 66 in the top of vertical rod 67 secured to slidable support 55. Thus, when knob 59 is rotated to rotate rod 64 and key 66, its rotational movement causes rod 67 and support 55 to move linearly in a horizontal direction to displace the heads to a position under the desired track on each tape in each group.

In FIG. 6 a typical sound reproducing system is shown on which a magnetic pickup head 25 is in recording contact with a magnetic tape 10 to produce a sound signal which is amplified in the audio amplifier and reproduced in the loudspeaker 68. To achieve a stereophonic effect, a separate sound reproducing system is used for each group of tapes, that is, recordings on the rhythm tapes, the harmony tapes and the melody tapes are each reproduced by a separate speaker or a separate group of speakers.

Referring now to FIGS. 7 and 8, there is illustrated a tape transport system, generally designated at 70 in FIG. 7, and its electrical circuit. Preferably, there are three such systems, one for the rhythm, the second for the harmony, and the third for the melody group of tapes. That is, it is desirable to move the rhythm, harmony and solo or melody tapes separately. However, it is also feasible to move the rhythm and harmony tapes in unison as disclosed in my prior co-pending application previously referred to.

On each of the 3 sets of drums 12 and 13 are sprockets 71 and 72 by which the drums are simultaneously rotated in the same direction by means of a chain 73, driven in turn by a sprocket on motor 76. Idler 77 is provided to properly position and tension the chain on the sprocket 72.

The control tape shown in FIG. 7, designated as 78, is of the same material as tape 10 and follows its same path, as may be seen by comparing FIG. 7 with FIG. 2, but has no recording on it. However, it is provided with longitudinal slots, one of which is shown at 82 in FIG. 8, to break the searching circuit so as to stop the associated recorded tapes at the desired position so that the one selected section of the six on each tape 10 is in the reservoir 18 in position for playing. Control tape 78 has one slot such as 82 at the beginning of each of the six tape sections.

Now referring to FIGS. 1 and 8, the three groups of selector buttons 79 are each adapted to actuate the appropriate tape transporting circuit when it is desired to transport a selected one of the six sections of the recorded tapes 10 into a playable position in the reservoir 18 and, of course, to remove the tape section presently in the reservoir 18. This is accomplished by the transporting circuit shown in FIG. 8 which has a searching mode. The three groups of selector buttons 79 shown on the panel 60, have each six separate buttons. Each of the six buttons of a group when depressed to select a desired new section, causes a transport motor 76 to be energized from a source of alternating current indicated at 83 and to drive one set of drums 12, 13 to move the tapes either forwardly or rearwardly to one or the other of the drums.

Referring now particularly to FIG. 8 there is illustrated a relay circuit for moving a group of tapes, for example, the group of prerecorded rhythm tapes to a selected section. Thus, FIG. 8 illustrates a portion of the control tape 78 having a longitudinal slot 82 therein which serves the purpose to break the transport circuit when the tape is in the desired position. The relay circuit is designed to cause the tapes to cycle back and forth until they finally come to rest in the proper position. It should be understood that there is one slot 82 aligned with each of the six consecutive sections of the associated group of recorded tapes 10. The relay circuit serves the purpose to control the tape transport motor 76 which is a reversible alternating current motor. The motor 76 has a common lead 84 which, when energized together with the lead 85, will cause the motor to run in a predetermined direction which for convenience will be called the forward direction. When the common lead 84 and another lead 86 are energized, the motor will be caused to rotate in the opposite direction which, for convenience, may be called the reverse direction.

The leads 84 to 86 of the tape transport motor 76 are controlled by a forward relay generally indicated by the

dotted box 87 and including a relay coil 88. A reverse relay is generally indicated by the dotted box 90 and has a relay coil 91. A third relay is generally indicated by the dotted box 92 and might be called the controlled relay which controls the common lead 84 of the motor 76. The controlled relay 92 also has a relay coil 93. The controlled relay 92 includes in its circuit a safety switch indicated by the dotted box 94 which will stop the tape transport motor 76 when one of the keys 11 is accidentally depressed. There is also provided an indicator lamp 95 which lights up when the selected tape section has been positioned.

Cooperating with the slot 82 of the control tape 78 there is a tape switch 96 having a fixed contact 97 and a movable spring contact 98 which will open the normally closed tape switch 96 when it is passed through the slot 82 of the control tape 78. The dotted box 79 schematically indicates one of the group of six push buttons which selects a desired one of the six sections of the recorded tapes. Finally, the dotted box 100 indicates a screw-controlled switch assembly including a set of six switches corresponding to the six tape sections and which in turn control the forward relay 87 and the reverse relay 90. There may also be provided a normally closed cancel switch 101 which when opened will cancel the previous selection made by actuation of one of the six selector push buttons 79.

The screw-controlled switch assembly 100 includes a rotatable screw 102 which is driven by the chain 73 engaging a sprocket wheel 99. The tape transport motor drives the chain 73 as well as the control tape 78 and the associated group of recorded tapes 10. The screw-controlled switch assembly 100 includes a set of six switches corresponding to the six sections of the tapes 10. Thus, the switch 103 corresponds to tape section 2 and is associated with a push button 104 for section 2 which has been shown closed in FIG. 8. The switch 103 has an arm 105 which normally engages a forward bus 106 but which is opened when a conductive knife edge 107 mounted on the screw 102 advances to depress the switch arm 105. The switch 103 has a second switch arm 108 which is also normally open but which is closed when the switch arm 105 is also depressed by the knife edge 107. The switch arm 108 is in electrical contact with a reverse bus 110. In addition, it should be noted that when the knife edge 107 moves in a forward direction, that is, from right to left, it will first engage the switch arm 105 of the successive switches and thereafter the switch arm 108.

The operation of the circuit of FIG. 8 will now be explained. Let it be assumed that the recorded tapes 10 were previously positioned in section number 5 corresponding to that control button 79 which is labeled number 5. Let it further be assumed that it is now desired to move the recorded tapes 10 from section 5 to section number 2. Therefore, the push button 104 which is labeled number 2, will be depressed so that the switch 104 is closed. In order to move the tapes from section 5 to section 2, the tape transport motor 76 must be energized to move the tapes in what has been referred to as the reverse direction, that is, from left to right. Therefore, it will be evident that controlled relay coil 93 and reverse relay coil 91 should now be energized. Since the screw 102 is driven by the tape transport motor 76, it will initially be in a position where the knife edge 107 opens the switch arm 105 and closes the switch arm 108 of the switch corresponding to section 5 in the screw assembly 100. The current flow through reverse relay coil 91 can be traced as follows:

From one terminal of alternating current source 83 through lead 112, lead 113 through normally closed contacts 114, 114' of the forward relay coil 87, through conductor 115 to one terminal of the reverse relay coil 91. It should be noted that normally closed contacts 114, 114', together with normally closed movable contact arm 116 and fixed contact 116' of the reverse relay 90 form

an interlock for the two relay coils 88 and 91 as will be more fully explained hereinafter. The current path from the other terminal of reverse relay coil 91 can be traced through conductor 117 to the reverse bus 110 and from there through switch arm 108 and switch arm 105 which are now closed to push button 104, cancel switch 101, conductors 118 and 120 back to the alternating current source 83.

Since reverse relay coil 91 is now energized, its associated normally closed contacts are opened while its normally open contacts are closed. Thus, the interlock contacts 116, 116' are now open while interlock contacts 116, 116', as well as contacts 121 are closed. Accordingly, the reverse lead 86 of the tape transport motor 76 is energized. The current flow to reverse lead 86 can be traced from lead 86 through closed contacts 121, leads 122, 120 to one terminal of the A.C. source 83. However, in order to energize the motor 76, its common lead 84 must also be energized. This is controlled by the controlled relay coil 93 which, therefore, must now be energized. The current path through the controlled relay coil 93 may be traced from the A.C. source 83 through leads 120, 122 and 123 to one terminal of the coil 93. From the other terminal of the coil 93, the current path goes through lead 124, safety switch 125, lead 126, interlock switch 116, 116', which is now closed, leads 113, 112 back to the source 83.

As a result of the energization of controlled relay 93, its contacts are pulled down and thus switch 127 is now closed. Accordingly, common lead 84 is energized through closed switch 127, lead 112 back to the source 83. Accordingly, tape transport motor 76 is energized in a reverse direction which causes the knife edge 107 to move from left to right.

This movement of the tape transport motor 76 and of the tapes 10 and 78 continues until the knife edge 107 releases the switch arm 108 of switch 103 so that the circuit to the reverse lead 86 of the motor 76 is now interrupted. However, at the same time, the holding circuit for the reverse relay coil 91 is connected now to the tape's switch 97, 98 for the searching mode of operation which finally stops the electric motor after the tape switch 97, 98 remains opened.

Thus, the circuit through the relay coil 91 can be traced as follows:

One terminal is again energized from the alternating current source 83 through leads 112, 113, switch 114, 114', lead 115. The circuit from the other terminal of reverse relay 91 can be traced as follows: From the terminal through switch 119 which is now closed, lead 121, lead 137 through the closed tape switch contacts 97, 98, lead 138, conductor 140, knife edge 107, switch arm 105, switch button 104 and back through cancel switch 101 and leads 118, 120.

However, it will be readily seen that this holding circuit for the reverse relay coil 91 includes a tape switch 97, 98. Accordingly, as soon as the aperture 82 of the control tape 78 reaches the switch 98, the tape switch is opened, thus, deenergizing relay coil 91. This, in return, will cause the tape transport motor 76 to stop momentarily until it is immediately again energized to run in the forward direction.

It should be noted that the screw control switch assembly 100 includes a reversing friction switch 130. The switch 130 is connected to the screw 102 as indicated schematically at 131 by the broken lines. The reverse friction switch 130 has a movable arm 132 and two fixed contacts 133 and 134. When the motor 76 is driven in the reverse direction, the switch arms 132 and 133 are closed as shown.

The tape transport motor 76 is now energized in the opposite direction, that is, in the forward direction in the following manner:

As soon as reverse relay coil 91 is deenergized, the holding circuit for the relay through switch 119 is also opened

even though power through the tape transport motors 76 is now interrupted, the motor will continue to coast. As a result, the tape switch 97, 98 is closed again just as soon as the switch arm 98 passes the aperture 83 in the control tape 78. At this time, the conductive knife edge 107 has broken both the reverse and forward contacts with the two bus bars 106 and 110. The searching circuit now operates through the tape switch 97, 98.

The current through the forward relay coil 88 can be traced from alternating current source 83 through conductors 112, 113, the now closed interlock switch 116, 116' and conductor 135 to one terminal of the coil 88. From the other terminal of coil 88, the current flow can be traced through the capacitor of normally opened switch 129 leads 135, 137, the now closed tape switch 97, 98, leads 138, 140, knife edge 107, switch arm 105, switch 104 through cancel switch 101 and leads 118, 120 back to the current source 83. As soon as the forward relay coil 88 has energized, its contacts 129 will be closed thereby to hold the circuit through the coil 88.

At the same time the current through the controlled relay 93 is also closed in the following manner: From source 83 through leads 120, 123 to one terminal of coil 93. From the other terminal of the coil through the lead 124, safety switch 125, lead 126, closed switch 114, 114' and back through leads 113, 112 to the source.

Consequently, the common lead 84 of the transport motor 76 is energized from source 83 through lead 112, closed contacts 127 and common lead 84. The forward lead 85 of the motor 76 is energized through now closed switch 158 and back to source 83 through leads 122 and 120. Accordingly, transport motor 76 is now energized to run in the forward direction.

However, as soon as the motor 76 drives the screw assembly 100 in the forward direction, that is, from right to left, the control tape 78 is also driven in the opposite direction. Consequently, very soon thereafter, the tape switch arm 98 will again engage the aperture 82 and thereby open the tape switch. This immediately causes deenergization of the forward relay 88 and immediately thereafter the reverse relay coil 91 is again energized. This is effected in the following manner:

From one terminal of the source 83 through conductors 112, 113, through closed interlock switch 114, 114' and conductor 115 to one terminal of the coil 91. From the other terminal of coil 91 the current flows again through the capacitor of switch 119 through leads 121, 135, 137 and the tape switch 97, 98 to the knife edge 107, conductor 105, push button switch 104, cancel switch 101 and leads 118, 120 back to the current source 83. As soon as the reverse relay coil 91 has energized, it is locked in through the now closed contact 119. The motor 76 is again energized in the forward direction through energization of relay coil 93 in the manner previously outlined.

It will now be seen that the motor 76 cycles back and forth until eventually the tape switch arm 98 remains engaged with the slot 82 to break the connection to the electric motor 76 permanently whereupon the recorded tapes are in their desired position.

It will be evident that if, for example, the tape is positioned at section 2, and if it is desired to move the tapes to position number 5, or section number 5, the above described sequence of events will be reversed. In other words, if push button number 5 is pushed, this switch automatically opens all other circuits such as number 2 and closes number 5. This will energize the forward relay coil 88. This circuit can be traced from one terminal of the source 83 through conductors 112, 113, interlock switch 116, 116', conductor 135 to one terminal of the coil 88. From the other terminal of the coil 88, a circuit can be traced through conductor 136 to the forward bus 106 and then through push button number 5 which is now closed, cancel switch 101 and conductors 118, 120 back to the alternating current

source 83. It will also be evident that now the interlock switches 114 and 116 always cause energization of the controlled relay 93 so that the common return lead 84 of the motor 76 is energized whenever either coil 88 or coil 91 is energized.

Thus, to summarize, the operation of the tape transport circuit, the proper relay, that is, either 88 or 91, is energized by the actuation of one of the push buttons 79 to cause the tapes to move in the proper direction. After the tape has approached its proper direction, the assembly switches 103 are opened or closed as the case may be and thereupon the control of the relay circuit is taken over primarily by the tape switch 96. The tapes are caused to cycle back and forth in a searching mode, with each movement of the tape being smaller than that before until eventually the tape comes to rest in such a position that the tape switch arm 98 is engaged by the aperture 82 of the control tape.

While a group of tapes 10 is being transported in the manner previously indicated from one section to another, it is important that the tapes should not be moved out of reservoir 18 by depressing the roller 40 into contact with the drive roller 28. This of course may cause the tapes to become tangled. To this end, the safety switch 125 is provided. This switch is normally closed as shown and is in series with the controlled relay coil 93 as previously explained. However, when one of the keys 11 is depressed, the safety switch 125 is opened so that the circuit through the relay coil 93 and hence through the common transport motor lead 84 is broken which immediately stops movement of the tapes. Accordingly, it will be seen that the safety switch 125 prevents both a playing and transport movement of the tapes thus positively preventing entanglement of the tapes.

It should also be noted that the indicator lamp 95 is normally connected to the alternating current source 83. This circuit may be traced from one terminal of the source 83 through lead 120, lead 145, normally closed switch 146, of the controlled relay 93, lead 147 through the lamp 95 and back through leads 148, 112 to the source 83. It will also be noted that as soon as controlled relay coil 93 is energized, the switch 146 opens thus interrupting the electric circuit through the lamp 95. Thus, the lamp 95 will be normally on. However, the current through the lamp 95 is interrupted while the tape is being transported from one section to another. The lamp 95 may flicker on and off every time the motor reverses and a steady light indicates that the tape is now in position to be played.

The leads 150 which are directly connected to the terminals of the source 83 may be connected to the tape transport circuit for another group of tapes such as the melody tapes. Capacitors, such as capacitor 151, connected across the switch contacts 114, 114' of the interlock may be provided across various switch contacts to minimize arcing when the contacts are open. The reactance of the capacitors such as 151 is selected to be very large at the low alternating frequency of the source 83.

In accordance with the previous explanation, it will now be evident how the instrument of the present invention can be played. A novice, for example, can follow an instruction book having the key numbers thereon of the various groups of tapes. In other words, the instruction book indicates what has been recorded on each of the sections and on each of the tracks. Without being able to read music, a novice can easily learn to play an unlimited number of complete musical compositions with the sound effects of a ten or more piece band.

There has thus been disclosed an improved musical instrument which can be played by means of a standard keyboard. The instrument includes a rhythm section having twelve chromatically arranged incomplete chords so as to match with any of the musical keys or scales. In addition, the rhythm section has three separate keys for reproducing three complete diminished chords. Further-

more, the improved instrument of the present invention has a novel circuit for selecting any one of a number of sections of the tapes. The circuit is so arranged that the tapes will cycle back and forth until they finally come to rest at the selected tape section.

The invention and its attendant advantages will be understood from the foregoing description. It will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example. I do not wish to be restricted to the specific form shown or uses mentioned except as defined in the accompanying claims, wherein various portions have been separated for clarity of reading and not for emphasis.

I claim:

1. An instrument for playing musical compositions, comprising:

- (a) a rhythm reproducing part;
- (b) and a melody reproducing part;
- (c) said rhythm reproducing part including a first set of twelve tapes, each tape of said first set having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a certain musical fundamental tone without the third, said first set of tapes corresponding to twelve consecutive half tones of the chromatic scale;
- (d) twelve manually operable keys, each for selecting one of said first set of tapes;
- (e) means for reproducing the chords recorded on a selected tape of said first set, whereby one incomplete chord of twelve consecutive half tones can be reproduced at will;
- (f) said melody reproducing part including a second set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (g) a corresponding plurality of keys for selecting a particular one of said second set of tapes; and
- (h) means for reproducing the sound recorded on a selected one of said second set of tapes.

2. An instrument for playing musical compositions, comprising:

- (a) a rhythm reproducing part;
- (b) and a melody reproducing part;
- (c) said rhythm reproducing part including a first set of twelve tapes, each tape of said first set having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a certain musical fundamental tone without the third, said first set of tapes corresponding to twelve consecutive half tones of the chromatic scale;
- (d) a second set of three tapes, each tape of said second set having recorded thereon a complete diminished chord;
- (e) twelve manually operable keys, each for selecting one of said first set of tapes;
- (f) three manually operable keys, each for selecting one of said second set of tapes;
- (g) means for reproducing the chords recorded on a selected tape of said first and second sets, whereby one incomplete chord of twelve consecutive half tones or one of the three diminished chords can be reproduced at will;
- (h) said melody reproducing part including a third set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (i) a corresponding plurality of keys for selecting a particular one of said third set of tapes; and
- (j) means for reproducing the sound recorded on a selected one of said third set of tapes.

3. An instrument for playing musical compositions, comprising:

- (a) a rhythm reproducing part;

- (b) and a melody reproducing part;
- (c) said rhythm reproducing part including a first set of twelve tapes, each tape of said first set having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a certain musical fundamental tone without the third, said first set of tapes corresponding to twelve consecutive half tones of the chromatic scale;
- (d) a second set of three tapes, each tape of said second set having recorded thereon a complete diminished chord;
- (e) twelve manually operable keys, each for selecting one of said first set of tapes;
- (f) three manually operable keys, each for selecting one of said second set of tapes;
- (g) means for reproducing the chords recorded on a selected tape of said first and second sets, whereby one incomplete chord of twelve consecutive half tones or one of the three diminished chords can be reproduced at will;
- (h) said melody reproducing part including a third set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (i) a corresponding plurality of keys for selecting a particular one of said third set of tapes;
- (j) means for reproducing the sound recorded on a selected one of said third set of tapes;
- (k) each of said tapes having a plurality of consecutive sections with different sounds recorded thereon; and
- (l) means for selecting a desired section of said first and second set of tapes and for independently selecting a desired section of said third set of tapes.

4. A manually operable musical instrument for playing musical compositions from prerecorded tapes, comprising:

- (a) a rhythm reproducing part including a first set of twelve tapes, each having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a selected musical fundamental tone without the third, said first set of tapes having chords in a selected rhythm of twelve consecutive half tones of the chromatic scale within one octave recorded thereon;
- (b) a first set of twelve keys for manually selecting a tape of said first set;
- (c) a harmony reproducing part including a second set of a plurality of tapes, each having recorded thereon groups of instruments;
- (d) a second set of keys corresponding to said second set of tapes for selecting any one tape of said second set;
- (e) a melody reproducing part including a third set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (f) a third set of keys corresponding to said third set of tapes for selecting a tape of said fourth set; and
- (g) means for reproducing the sound from selected tapes.

5. A manually operable musical instrument for playing musical compositions from prerecorded tapes, comprising:

- (a) a rhythm reproducing part including a first set of twelve tapes, each having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a selected musical fundamental tone without the third, said first set of tapes having chords in a selected rhythm of twelve consecutive half tones of the chromatic scale within one octave recorded thereon;
- (b) said rhythm reproducing part further including a second set of three tapes, each having recorded thereon a complete diminished chord in a selected rhythm;
- (c) a first set of fifteen keys for manually selecting any one tape of said first and second sets;

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- (d) a harmony reproducing part including a third set of a plurality of tapes, each having recorded thereon groups of instruments;
- (e) a second set of keys corresponding to said third set of tapes for selecting any one tape of said third set; 5
- (f) a melody reproducing part including a fourth set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (g) a third set of keys corresponding to said fourth set of tapes for selecting a tape of said fourth set; and 10
- (h) means for reproducing the sound from selected tapes.
- 6. A manually operable musical instrument for playing musical compositions from prerecorded tapes, comprising: 15
 - (a) a rhythm reproducing part including a first set of twelve tapes, each having recorded thereon an incomplete chord consisting of the first or fundamental, fifth and octave of a selected musical fundamental tone without the third, said first set of tapes having chords in a selected rhythm of twelve consecutive half tones of the chromatic scale within one octave recorded thereon; 20
 - (b) said rhythm reproducing part further including a second set of three tapes, each having recorded thereon a complete diminished chord in a selected rhythm; 25
 - (c) a first set of fifteen keys for manually selecting any one tape of said first and second sets;
 - (d) a harmony reproducing part including a third set 30

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- of a plurality of tapes, each having recorded thereon groups of instruments;
- (e) a second set of keys corresponding to said third set of tapes for selecting any one tape of said third set;
- (f) a melody reproducing part including a fourth set of a plurality of tapes, each having recorded thereon a particular tone played by a selected instrument;
- (g) a third set of keys corresponding to said fourth set of tapes for selecting a tape of said fourth set;
- (h) means for reproducing the sound from selected tapes;
- (i) each of said tapes consisting of a plurality of sections, each section of each tape having different recordings thereon; and
- (j) relay controlled selection means for selecting a desired section of at least said first and fourth set of tapes for reproducing any sound recorded on a selected section of each tape.

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