

Aug. 6, 1957

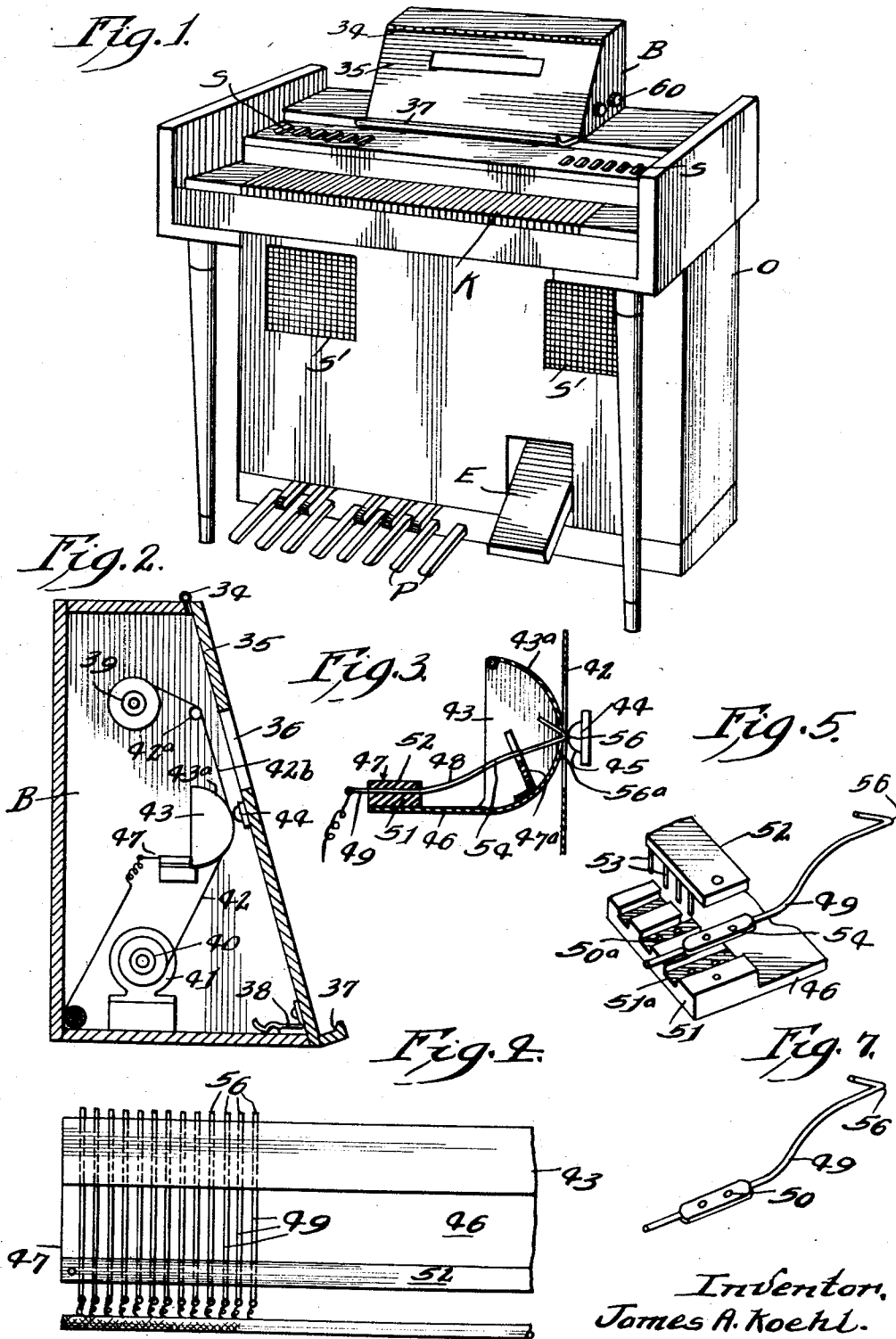
J. A. KOEHL

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OUTSIDE PLAYER FOR ELECTRICAL MUSICAL INSTRUMENT

Filed Sept. 28, 1954

3 Sheets-Sheet 1



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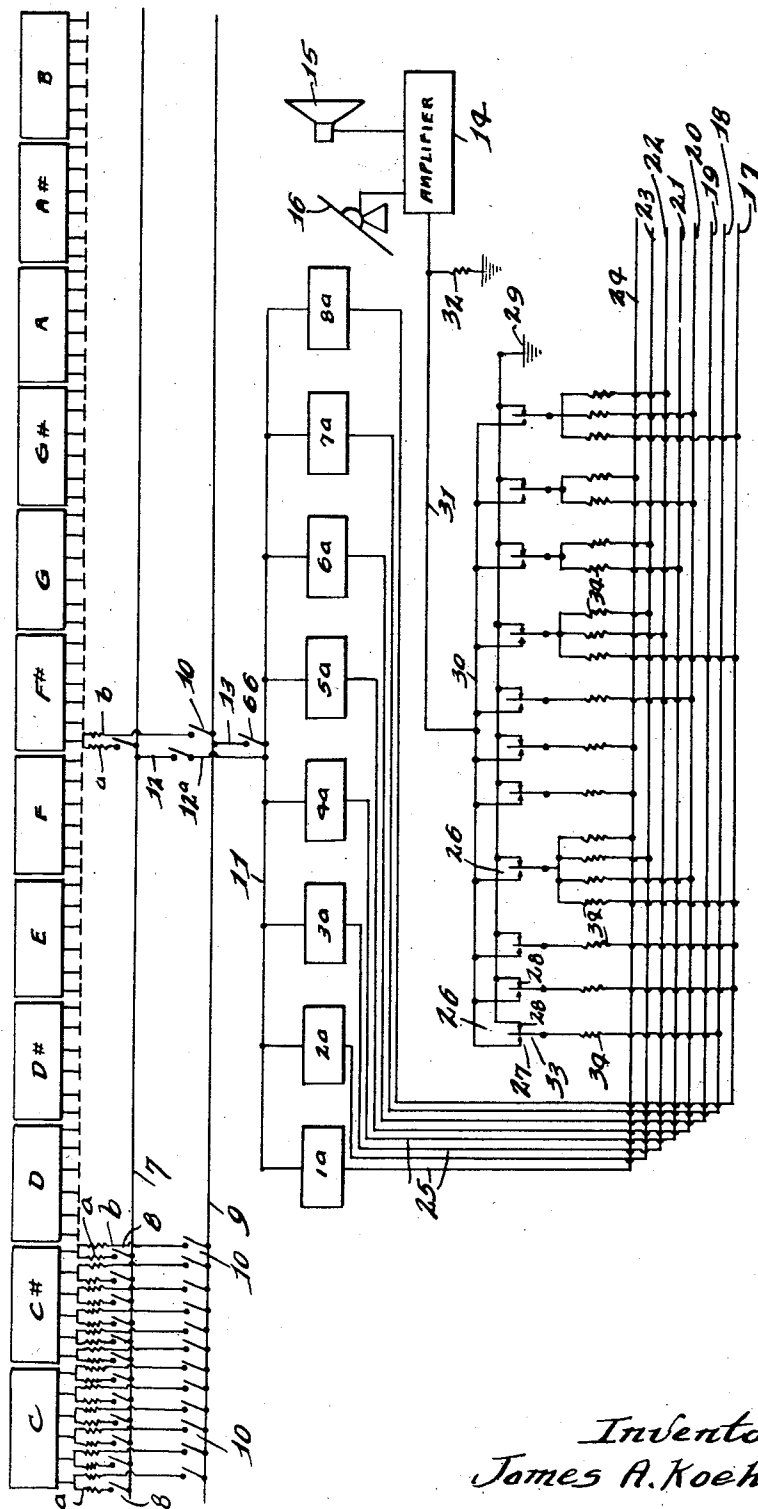
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OUTSIDE PLAYER FOR ELECTRICAL MUSICAL INSTRUMENT

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Fig. 6.



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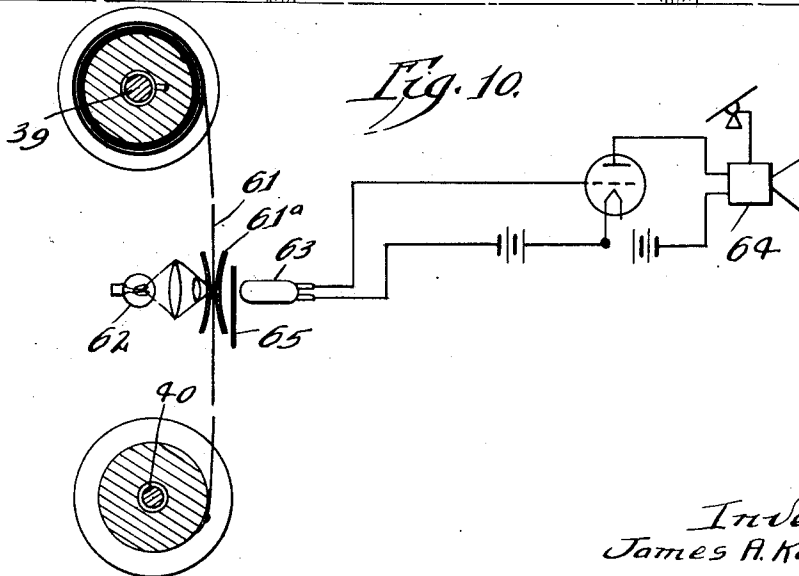
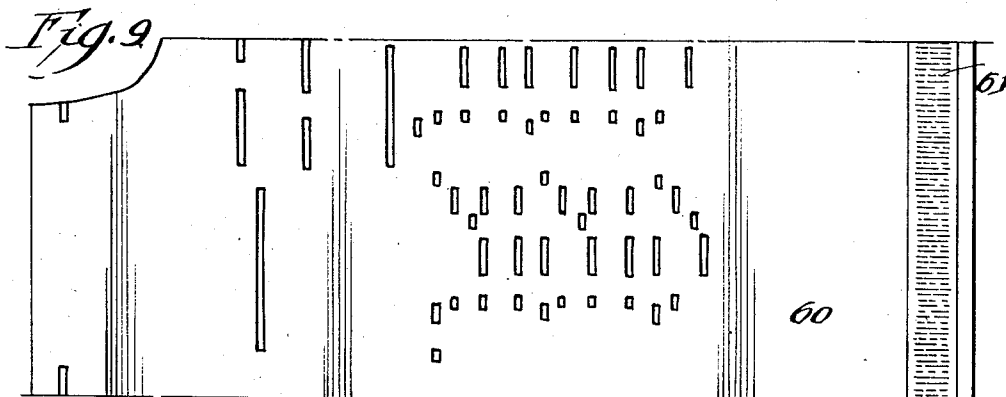
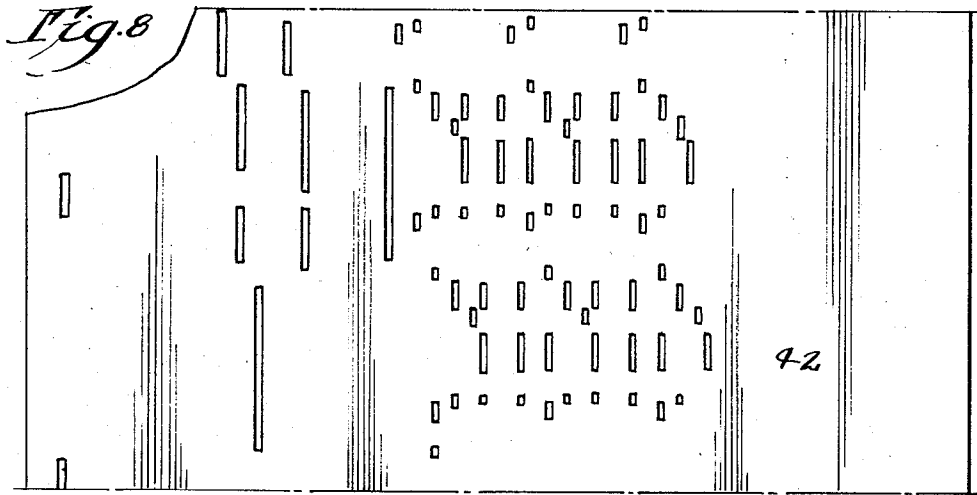
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OUTSIDE PLAYER FOR ELECTRICAL MUSICAL INSTRUMENT

Filed Sept. 28, 1954

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OUTSIDE PLAYER FOR ELECTRICAL MUSICAL INSTRUMENT

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Application September 28, 1954, Serial No. 458,827

1 Claim. (Cl. 84-107)

This invention relates to players for electric organs of the class employing generators producing tone signals at the vibration frequencies of the notes of the chromatic scale and means for translating said signals into audible sounds of any desired quality and volume.

An object of the invention is the provision of an automatic player which is characterized by a simple and inexpensive organization of instrumentalities adapted to be connected in the electrical network of an electric organ, whereby the output signals from said generators will be transmitted to the signal translating system of the instrument in accordance with well known arrangements of perforations in a tune sheet of the form commonly employed in players that are operated pneumatically.

A further object is the provision of a player having means for utilizing the perforations in a conventional tune sheet to control conduction of tone signals to an electroacoustic translating system and without the necessity of pneumatics and without relying upon or in any way requiring motion of the keys of the instrument's keyboard for the production of audible sounds for musical expression.

A still further object is the provision of an electric organ which may be played either by hand as from the instrument's keyboard or automatically by means of a perforated tune sheet.

A still further object is the provision of a set of a resilient electrical contactors, the individual contactors of which are coactive with a common output bus-bar and with a perforated tune sheet, whereby during motion of the sheet from a pay-off roll to a pay-on roll, the contactors will project through coactive perforations in said sheet and electrically contact said bus-bar and impress tone signal voltages thereon from signal supply sources, and whereby said contactors will be electrically insulated from said bus-bar by imperforate portions of the sheet at all times except when the perforations are in registration with said contactors.

A still further object of the invention is the provision of a spool box for the operating mechanism of the perforated tune sheet, the same adapted to form a part of the console of the organ and to occupy a position where the sheet will be visible to one seated at the instrument.

A still further object is the provision of a spool box for the player, the form and design of which will not detract from the attractive design of the organ of which it is a part, and whereby said box will function as a music rack when the organ is played by hand from the customary keyboard.

A still further object is the provision of a player, the electrical contactors of which are so arranged, formed and designed as not to tear the perforated sheet or mutilate the perforations thereof.

A still further object is the provision of a player, the electrical contactors and coating bus-bar of which will be maintained in a clean condition by rubbing engagement thereof with the imperforate portions of the tune sheet.

A still further object is the provision of a spool box

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for the player mechanism, the form, design and construction of which enables quick and convenient access thereto for changing the music rolls.

A still further object is the provision of a player, the structural features and design of which enable it to be applied either as an attachment to or as an integral part of the console of an electric organ.

A still further object of the invention is the provision of a player employing a perforated tune sheet having at one of its longitudinal edges a sound recording such as the voice of one or more singers or recording of any musical instrument or combination of instruments, which, when reproduced, can be heard with organ accompaniment, which recording can be thrown into and out of operation at the will of the player and can be played independently of the tune sheet and with an accompaniment produced when playing the keyboard K.

Other objects and advantages inherent in the invention will appear from the following description and accompanying drawings, in which:

Figure 1 is a perspective view of an electric organ embodying the invention;

Figure 2 is an enlarged vertical section through the spool box showing the cover closed in full lines and opened in dotted lines;

Figure 3 is an enlarged detail transverse section through the tracker bar;

Figure 4 is a fragmentary view in rear elevation of the tracker bar;

Figure 5 is a fragmentary perspective view of a portion of the tracker bar with parts of the circuit making and breaking devices detached from each other;

Figure 6 is a schematic view of an electrical network showing the manner of connecting the player in circuit with the tone generators, the wave filters and the electroacoustic translating system;

Figure 7 is a perspective view of one of the resilient contactors;

Figure 8 is a plan view of a portion of the tune sheet;

Figure 9 is a view similar to Figure 8 of a slightly modified form of tune sheet; and

Figure 10 is a schematic illustration showing the sound reproducing means for use with the tune sheet shown in Figure 8.

In carrying out the invention, use can be made of any well known electric organ of the class employing tone signal generators, a filter system for converting the output wave forms from said generators into wave forms approximating organ and orchestral tones, a system of stops for predetermining the quality of tone to be played, and an electroacoustic transducer for translating selected tone signals into audible sounds of any desired volume. The instrument shown and described in the Larsen Patent No. 2,403,090, or the instrument shown and described in Larsen et al. No. 2,568,644, or the instrument shown and described in the Langer Patent No. 2,533,821 will give excellent results. Any other well known type of electric organ can be used with satisfactory results, including the instrument shown and described in the Hammond Patent No. 1,956,350.

At Figure 6 twelve sets of generators are shown in block diagram connected in cascade as frequency divider circuits. These sets are designated C cascade, C# cascade, and so on, to and inclusive of the last of the sets, the same designated the B cascade. Each set of said generators may comprise any desired number of individual generators, such that when the master generator of a set operates at a controlled frequency and the several generators are coupled as frequency dividers, the outputs of said generators will be at octave separation. Thus, and assuming that each set of generators comprises six individual generators, there will be produced

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six output wave forms of output tone signals at octave separation. Accordingly, for the purpose of the herein disclosed invention, each generator has six output leads 1, 2, 3, 4, 5 and 6, each having two resistive branch paths *a* and *b*, such that the outputs from branch paths *a* may all thereof be impressed on a common output conductor 7 as will be controlled by selectively operative electric switches 8, whereas in the case of the outputs from branch paths *b* same will be impressed on output conductor 9 in response to actuation of electric switches 10, as clearly shown at Figure 6.

While the output wave forms from the tone generating sources are preferably rich in harmonics and therefore adapted to be repeated as wave forms differing in their harmonic composition by a wave filter system, I place no particular importance either upon the wave shapes of the output signals or upon how said signals shall be utilized to produce audible sounds simulating tones of different quality. Any means well known in the art can be employed. However, and for a full disclosure of the invention, I show a wave filter system comprising individual filters 1*a*, 2*a*, 3*a*, 4*a*, 5*a*, 6*a*, 7*a* and 8*a* connected together by a common bus-bar 11, the latter coupled to conductors 8 and 9 by leads 12 and 13 respectively.

At 14 is a power amplifier having a loud-speaker 15 in its output circuit and a volume control device 16 in its input circuit. At 17, 18, 19, 20, 21, 22, 23 and 24 are bus-bars, each connected by a lead 25 to a respective filter 1*a*, 2*a*—8*a*. At 26 are stops, each comprising a pair of contact elements 27 and 28, the latter connected to a common ground 29 and the former to an output conductor 30. Said output conductor connects to the input circuit of amplifier 14 via a lead 31, the same having a resistance 32 to ground. Each of said switches 26 includes a contactor 33 which is engageable with contact elements 27 and 28. Each of these contactors connects with one or more of said bus-bars 17, 18, 19—24 by one or more de-coupling resistances 34, whereby the wave forms of signal voltages impressed on the input circuit of said amplifier 14 may be either a single output wave from one of said filters or a wave which is the sum of a plural number of output waves from said filters.

At Figure 1 is an electric organ O having a single keyboard K, stops S, sound outlets S', a pedal clavier P and an expression control pedal E.

Mounted on top of the console of organ O at the center thereof is a spool box B. At Figure 2, the box is shown as having a forwardly disposed open front which inclines downwardly toward the keyboard K. Hinged at 34 to the forward portion of the box at the top thereof is a cover 35 having a sight opening 36. At the lower front portion of the cover and extending transversely thereof is a horizontal rail 37. Thus, as shown, said cover by reason of its downward and forward inclination constitutes a music rack which is directly in the line of vision of a person seated at the organ. When the cover is closed, it is held relatively rigid and against swinging relative to the open front of the box by a latching device 38.

Mounted in the box B is a pay-off spool 39 and a pay-on spool 40, the latter adapted to be operated by a motor 41. Mounted in the box and in front of spool 39 and close to the upper portion of sight opening 36 is an idler roll 42*a*. Wound on spool 39 is a perforated tune sheet 42, and it is understood that said spool is part of a music roll such as the conventional roll of a player piano and that it is removable from the box according as different rolls are to be played. Any well known mechanism can be used for drawing sheet 42 from spool 39 at a controlled linear velocity.

Mounted in a horizontal position in the spool box B, close to the inner face of door 35 and at a suitable elevation where it is intermediate of spools 39 and 40 and below the plane of the horizontal center of the sight opening 36 is a tracker bar 43. Said bar is preferably made of molded plastic material having good electrical insulat-

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ing properties, and same is formed with a thin concavo-convex wall 43*a* whose curvature is substantially a true arc of a circle, the convex surface of said wall being disposed in confronting relation to the inner face of door 35 so that the stretch 42*b* of the tune sheet 42 will pass over said convex surface and along a path which is tangential thereto, as shown at Figure 2. On the inner face of said door 35 and secured thereto so as to occupy a horizontal position and to be in close parallel relation to the convex surface of wall 43*a* of said tracker bar is a bus-bar 44 having an arcuate surface 45. When the door 35 is closed and latched, the arcuate surface 45 of said bus-bar confronts the convex surface 43*a* of said tracker bar so as to form therewith only a very minute space therebetween, about equal to the thickness of the material of tune sheet 42 but with sufficient tolerance to enable free movement of the sheet during translation of the sheet from spool 39 to spool 40 when the door 35 is closed as aforesaid. It follows that by the structural shapes and forms of said tracker bar and said bus-bar, the tune sheet will not be obstructed in its free movement and will not be injured during translation thereof. The tracker bar constitutes a substantially hollow structure whose external surface is perfectly smooth and, as illustrated at Figure 3, said tracker bar is formed with a base flange 46 which extends rearwardly and is of the same length as the body portion of the bar. The flange is shown in a horizontal position but can occupy any desired angular position to meet the purpose for which it is designed to serve. Mounted inside the tracker bar and extending the full length thereof is a comb 47*a*.

Mounted upon the flange 46 of the tracker bar is a contact assembly 47 comprising longitudinally spaced apart, substantially identical contactors 48, each of a suitable, more or less fine gauge wire having good conductive properties. These contactors have rearwardly extending terminal ends 49 which are flattened at 50 and firmly secured between a raised portion 51 on said wall and a clamp bar 52, the latter having pins 53 which pass through holes 54 in said flattened portions 50 and into holes 50*a* in the raised portion 51, thereby to prevent derangement of the effective bus-bar engaging portions relative to their coactive slots in said tracker bar. Also, as shown, the flattened portions 50 of said contactors are seated in rectangular depressions 51*a* in said portion 51. Each contactor extends forwardly toward the concaved surface of the wall 43*a* of said tracker bar and same is curved at 54 to render the contactor sufficiently resilient for the purpose it is designed to serve. The contactors extend through spaces between the teeth of said comb 47*a* which is mounted in the hollow of the tracker bar and positioned as shown at Figure 3. The opposite end of each contactor is bent on itself to form an effective curved contact portion 56 which is freely received in a vertical slot 56*a* in said wall 43*a* of the tracker bar. Normally, that is to say—in the absence of a tune sheet in box B, the curved portion 56 of each individual contactor bears yieldingly against the curved surface of the bus-bar 44. When a tune sheet is contained in the box and is connected with pay-on spool 40, the imperforate portions of the sheet have rubbing contact with the convex surface of wall 43*a* of the tracker bar and the arcuate surface of said bus-bar 44. When the perforations in the tune sheet register with the curved portions 56 of the respective contactors, said portions are projected through said perforations and electrically engage said bus-bar. As the perforations successively move across said portions, the latter are respectively projected to positions slightly beyond the surface 43*a*, then retracted back into their respective slots. When the imperforate portions of the sheet are at the slots, the sheet provides a dielectric between the contactors and said bus-bar.

The perforated tune sheet is preferably of the conventional form used with piano players in which pneumatics are operated as the sheet moves across a tracker bar to

thereby actuate the action of the piano. In the instant case, the organ will have a keyboard consisting of at least five octaves and it will preferably have a pedal clavier of not less than an octave of notes, say from $C_1=32$ cycles per second to $B_2=62$ cycles per second. Assuming that the keyboard K has sixty keys, there will be sixty tone generators, each producing an output signal corresponding to the vibration frequency of the note associated with a respective key. Accordingly, and as these same generators are used for operation of the player, there will be sixty contactors 48 and sixty slots in the tracker bar with which they are coactive.

The tune sheet 60 shown at Figures 9 and 10 is formed at one of its longitudinal sides with a sound record 61 having thereon a recording of a vocal selection, or a recording of instrumental music produced by one or more musical instruments. The record may be made by a photographic process and can consist of a relatively narrow strip of photographic film on which a variable density sound track is formed so that when the film is moved through the apertured gate 61a and across a light source 62, a correlated light-sensitive device 63 will be activated with resultant conversion of the recorded sound waves into electric waves and the latter impressed on said electroacoustic translating system 64, or, if desired, said waves may be translated into audible sounds by a separate transducer. A manually actuable shutter 65 at the apertured gate may be operated so as to exclude light from said light-sensitive device and thereby enable the tune sheet to be played independently. It is also possible to reproduce sound from the photographic record while playing an organ accompaniment at the keyboard K. This can be accomplished by control switch 66 in the lead 13 that couples the output conductor 9 to the filter conductor 11.

An important feature of the invention resides in the combination of functionally coactive elements and mechanisms that enable one more readily to master the art of playing and whereby many new, interesting and pleasing musical results are obtainable. The sound record may contain recordings of any musical instrument or combination of instruments including recordings of orchestras, bands, choirs, etc., which can be heard together with an organ accompaniment played from keyboard K.

On the spool box B or at some other convenient and accessible place are well known controls 60 for starting, stopping and reversing the direction of the musical rolls 39 and 40. Such controls are disclosed in the Calamari et al. Patent No. 2,488,170.

It is understood that in learning to play an organ, many difficulties are encountered by the beginner and that to overcome some of them, the beginner must master just so much of the art of playing as will offer and retain encouragement to learn. Fingering, expression and proper use of stops are each and all thereof difficult. Fingering and expression can best be accomplished by frequently repeating difficult phrases or parts of written music. With this end in view, we will assume that one wishes to become proficient in playing a given written musical composition which corresponds to the arrangement of perforations in the tune sheet of a music roll and that to accomplish this, use is made of the herein disclosed device. One seated at keyboard K will place the automatic player in operation and play the entire roll as often as desired. Music as written is then played by hand at said keyboard. When difficulty in fingering any part of the written music is encountered in playing, the player is again operated and the part responsible for the difficulty is played and re-played as often as desired for enlightenment one seeks. By thus starting, stopping and reversing the direction of motion of the tune sheet, and listening time and again to the difficult-to-play part or parts of music rendered by the automatic player, and then and in alternation therewith playing the same part or parts on the keyboard K, one's interest in playing is maintained and one's technique more easily mastered.

When the instrument is used in homes, churches and places of public entertainment, it offers many new possibilities. In small churches an entire choir of recorded voices can be heard during rendition of organ music played at keyboard K.

I particularly stress the forms, shapes and arrangement of the tracker bar 43 and bus-bar 44, each provided with a smooth curved surface. These surfaces lie close to each other with a space therebetween only sufficient for movement of the tune sheet across same while in rubbing engagement with said surfaces. This rubbing engagement of the tune sheet keeps the bus-bar clean, and as the effective bus-bar engaging portions of the resilient contactors 48 are also in rubbing contact with tune sheet, thereby any small particles of dust that might accumulate at the bus-bar and said effective portions of said contactors will be automatically eliminated therefrom. To the best of my knowledge, no one has ever before proposed a spool box in which an operative correlation of a bus-bar with a tracker bar is established when a swinging door is closed, and when the door is opened to expose the operating parts of the player mechanism for application of a music roll thereto or removal of same therefrom and without possible injury to the contactors 48. It is understood that comb 47a is of electrical insulating material.

In the lead 12 which connects conductor 7 to conductor 11 is a switch 12a so as to selectively control conduction to the filter system of signal voltage from said conductor 7.

What I claim as my invention is:

An automatic player for electric organs of the class having a plurality of tone signal generators respectively producing tone signals for a range of more than an octave of notes of the tempered scale; a keyboard; an electroacoustic translating system for converting said signals into audible sounds; an output conductor coupled to said translating system, and means actuable from said keyboard for selectively impressing on said output conductor the output signal from any generator of said plurality of generators; said player comprising a forwardly opening spool box having a cover tiltable vertically from a closed position to an open position enabling insertion of a spool in and removal of same from said box; a perforated tune sheet; a horizontally disposed hollow tracker bar of substantially semi-circular form in vertical section, providing a longitudinally disposed convex surface facing the open front of the box and having formed therein a longitudinal series of apertures, said perforated tune sheet adapted to move across said convex surface at a relatively constant linear velocity for registration of the perforations therein with respective ones of the aforementioned apertures; a bus-bar mounted on the inner face of said cover and disposed in close parallel relation to said longitudinal row of apertures in said tracker bar when said cover is closed; said tracker bar containing therein a set of horizontally disposed, spaced apart contactors having effective free end portions resiliently urged in a forward direction and accommodated in respective apertures in said tracker bar to move freely therein and extend slightly beyond the convex surface of the tracker bar and against said bus-bar for effective electrical engagement therewith during motion of the tune sheet and when said cover is closed, each of said contactors adapted to be connected to an assigned one of said generators, and said bus-bar adapted to be connected to said output conductor.

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