

Oct. 18, 1949.

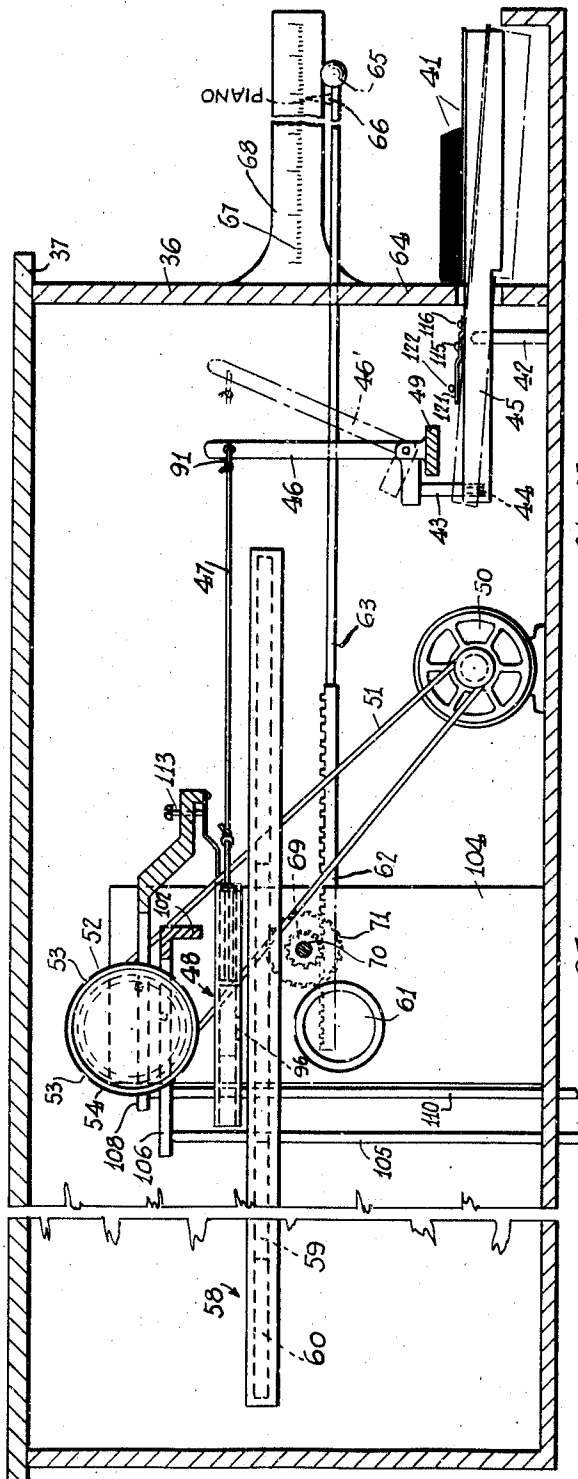
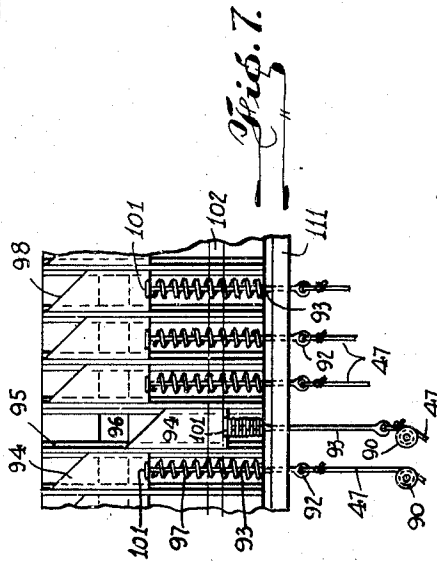
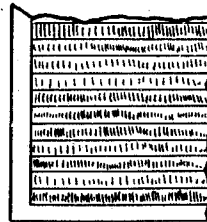
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2,484,881

RECTANGULAR TRANSLUCENT SOUND TRACK RECORD

Original Filed Dec. 14, 1942

3 Sheets-Sheet 1



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RECTANGULAR TRANSLUCENT SOUND TRACK RECORD

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3 Sheets-Sheet 2

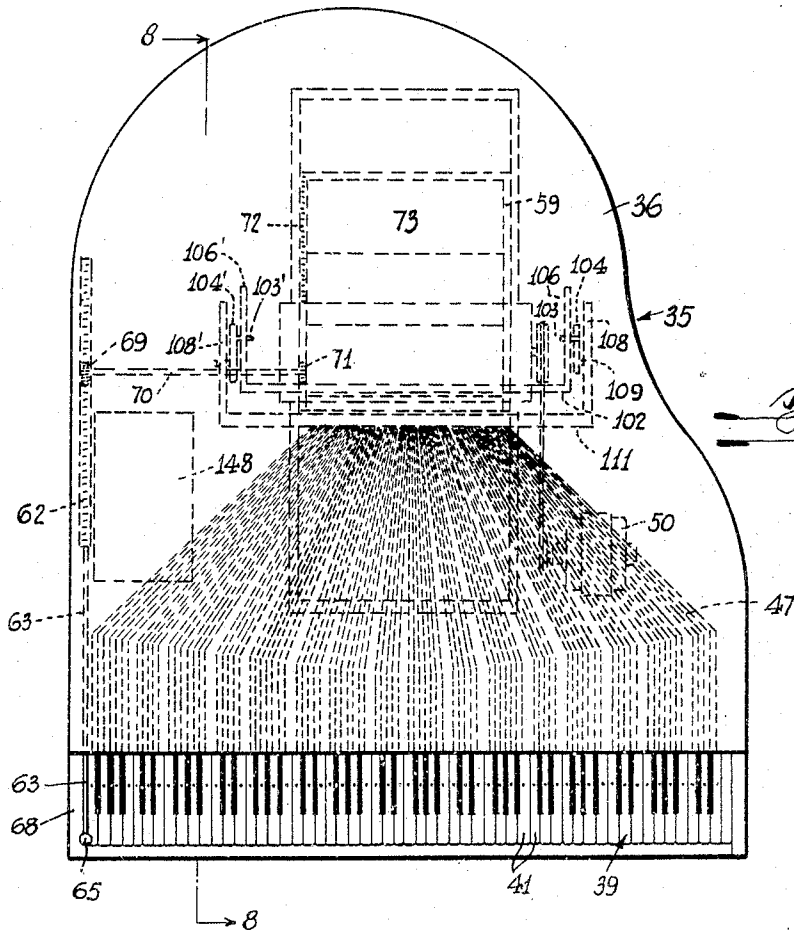


Fig. 2.

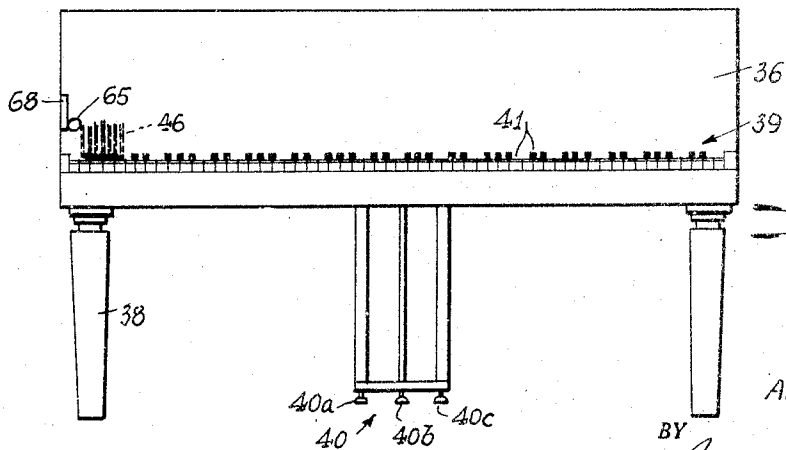


Fig. 3.

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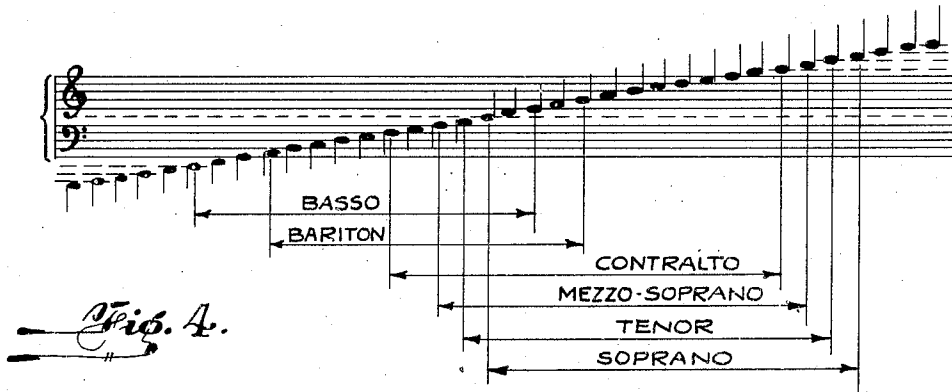
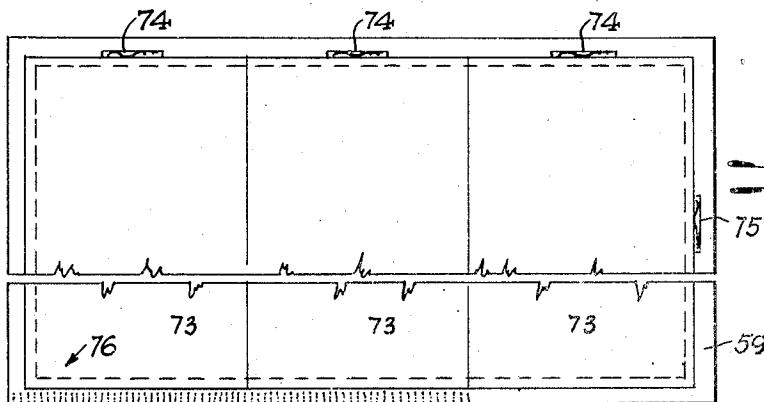
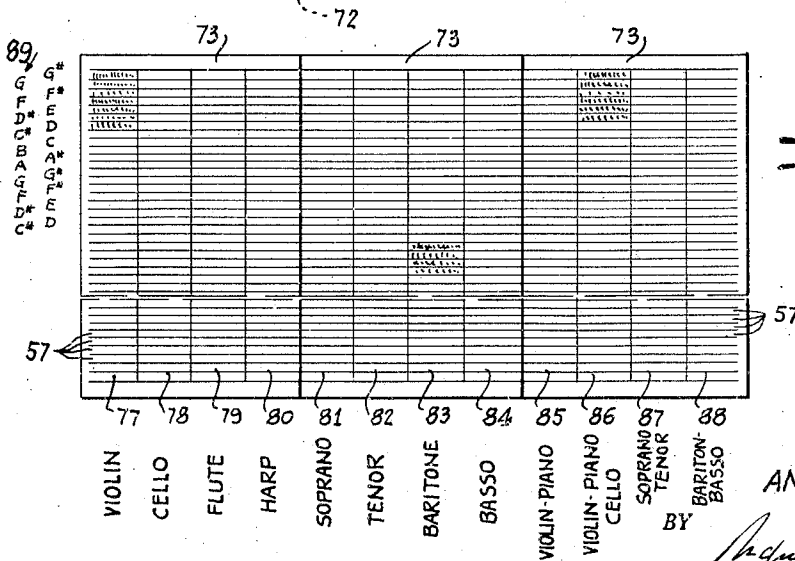
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RECTANGULAR TRANSLUCENT SOUND TRACK RECORD

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3 Sheets-Sheet 3



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2,484,881

RECTANGULAR TRANSLUCENT SOUND
TRACK RECORD

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Original application December 14, 1942, Serial No. 469,023, now Patent No. 2,452,743, dated November 2, 1948. Divided and this application May 12, 1944, Serial No. 535,374

2 Claims. (Cl. 274—41.6)

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This invention relates generally to method and means of producing a sound track for a reproducing apparatus, such as, musical instruments, particularly of the kind in which musical tones or notes are produced in an amplifier-loudspeaker unit by the action of light upon a light sensitive cell, through the intermediary of a translucent instrumentality having photographically recorded thereon the sound waves to be reproduced.

The invention is particularly adapted for cooperation with a keyboard instrument which through manipulation of its keys will reproduce with fidelity and accuracy and in any desired sequence simple and complex sounds corresponding to sound waves photographically recorded on a translucent member, the latter member being interposed between a light source and a light sensitive cell, the sounds being produced through a sound transforming and amplifying unit.

By employment of the present invention a keyboard instrument will produce sound effects identical with those of any instrument, combination of instruments, vocal or combination of vocal utterances, or any combination of vocal utterances and instruments; will so faithfully reproduce sounds recorded on a translucent member made in accordance with the invention, that even a trained ear may not distinguish the same from the original sounds which were recorded.

It is an object of the present invention to provide a translucent sound track having recorded or reproduced thereon in separate bands respectively notes of the chromatic scale produced by a skilled originating performer, and which notes by manipulation of the keys of a keyboard instrument a person, less skilled, may reproduce, and in sequence of any musical composition.

Another object of the present invention resides in method and means to provide a master record from which economical copies may be made by which the original notes or tones may be reproduced through a keyboard instrument of the aforementioned character, such provision being accomplished by recording on film the chromatic scale as rendered by vocalist or instrument player or both simultaneously, cutting from the negative film, small strips or bands each of which carries a note of the chromatic scale, securing these strips or bands upon a transparent plate in chromatic scale order, thus forming a sound or tone track, and printing copies from this plate. Thus, each band of the track constitutes a single note of the chromatic scale arranged in predetermined sequence, and embodies the true tonal

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quality and individuality of the artists and of the instrument played, so that any person capable of operating the keyboard instrument may reproduce the same in any desired sequence of musical composition.

A further object is to provide a flat rigid plate containing a plurality of tracks, each track made up of bands each having a photographic record of a chromatic scale note of simple or complex quality or tone and the bands arranged in predetermined sequence or chromatic scale order.

Yet another object is to provide a photographic sound record for a keyboard instrument of the aforementioned type, which is very inexpensive, which occupies relatively small space, having the advantage of reducing the instrument to a short length; which is easily removable for replacement purposes, and which is capable of providing a great number of changes through the keyboard of the instrument, and method for producing the same.

A further object is to provide in an instrument of the aforementioned type, a photographic sound record upon which the sound bands are so arranged as to avoid cuts in the sound waves between adjacent bands and to thereby avoid any possible "clicks" which might otherwise be due as a result thereof.

This application is a division of my copending application, Serial Number 469,023, filed December 14, 1942, now Patent No. 2,452,743, issued November 2, 1948.

The above and further objects and advantages of the invention will appear from the following disclosures thereof together with the attached drawings which illustrate an embodiment thereof, and in which:

Fig. 1 is a diagrammatic partial view of a sound track plate employed in the invention;

Fig. 2 is a top plan view of a musical keyboard instrument to which the invention may be applied;

Fig. 3 is a front elevational view of Fig. 2;

Fig. 4 is a view of a musical scale, particularly indicating the location of various human voices within the scale range;

Fig. 5 is a top plan view (partly broken away) of a frame employable in the invention for holding sound record plates;

Fig. 6 is a top plan view (partly broken away) of adjacently disposed record plates;

Fig. 7 is a partial top plan view of the shutter device employed in the instrument of Fig. 2; and

Fig. 8 is a cross-sectional view (partly broken

away) taken through the operating mechanism of the musical instrument on line 8—8 of Fig. 2.

Referring to Figs. 2, 3 and 8 of the drawings, there is indicated by the numeral 35, a musical instrument comprising the box or housing 36 and a cover 37, legs 38, keyboard 39 and pedals 40, all conventional in a grand piano.

The keys 41 of keyboard 39 are conventionally mounted as indicated at 42 (Fig. 8), and are provided at their extreme ends with pins 43 threaded into the key extensions 45 by means of threads 44, thus providing for necessary adjustments. Each pin 43 engages with a bell-crank lever 46 to which is attached a flexible cable 47 operating the light valve or shutter device 48. An electric motor 50 may be located within cabinet 35 and by means of drive belt 51 rotatively operates a light source cylinder 52 which may have on its outer surface an opaque coating or covering 54 in which are located a plurality of openings or slits 53. Cylinder 52 is mounted on support 58 fixed to the instrument 35. Support 58 carries a track 60 in which is slidably mounted the sound track frame 59 (Fig. 5). Below support 58 is the stationary light sensitive electric cell 61. The sound track frame 59 is slidably moved within the track 60 by means of a toothed rack 62 attached to rod 63 protruding through the front board 64 of housing 36. Rod 63 terminates in a handle or knob 65. Mounted on rod 63 is also an indicator 66 working in conjunction with a scale 67 mounted on a bracket 68. The scale 67 will indicate to the operator which musical instrument or voice is being played at any particular time. The toothed rack 62 is in engagement with a small pinion 69 mounted on a shaft 70, which shaft also carries the larger gear 71 in engagement with the teeth 72 (Fig. 5) on the underside of the sound track frame 59. As seen in Figs. 5 and 6 plates 73 each carrying a plurality of sound tracks may be employed and are held within the frame 59 by means of springs 74, 75, thus forcing the sound track plates into one corner of frame 59 as indicated by arrow 76. It is understood that any reasonable number of plates 73 may be removably mounted in frame 59 and that the latter may be of any reasonable size.

As clearly shown in Fig. 6, plate 73 is divided into a plurality of sound tracks or sections indicated in the first plate by the numerals 77, 78, 79, 80. These sound tracks or sections carry sound records of certain musical instruments or voices.

For example, in the first plate 73, sound tracks 77, 78, 79, 80 represent the tones respectively, of a violin, cello, flute, and harp; in the second plate 73, sound tracks 81, 82, 83, 84 represent the voice tones, respectively of soprano, tenor, baritone, basso; and the third plate 73, sound tracks 85, 86, 87, 88, represent the tones, respectively, of piano and violin, piano and cello, soprano and tenor, baritone and basso. Each sound track is divided into a plurality of bands 57, each band carrying a photographic sound wave or impression of a note of the chromatic scale and arranged in predetermined sequence. Each sound track is preferably provided with eighty-eight bands, portions or sections to cover the maximum number of notes of a full chromatic scale, such as G, G $\sharp$, F, F $\sharp$, etc., for piano, and as indicated by numeral 89 in Fig. 6. A more complete explanation will follow hereinbelow.

Interposed (as before mentioned) between the light source 52 and the sound or tone track frame 59 is the shutter or light valve mechanism 48, a portion of which is enlarged and illustrated in

Fig. 7. Each key of the keyboard controls a shutter 94 through a flexible cable 47. Cables 47 are trained over pulleys 90. One end 91 of cable 47 is secured to the bellcrank 46 (Fig. 8), while the other end of cable 47 is secured to the loop 92 of the rod 93 of shutter 94. As illustrated in Fig. 7, each shutter 94 slides in a track 95 which is provided with openings 96 located directly between the light source 62 and the light sensitive electric cell 61. Normally these shutters 94 are held in closed position by a tension spring 97 and are operated by the keys 41 through the medium of respective bell-crank levers 46, mounted on a transverse strip 49. The shutters 94 may be provided with an inclined surface 98 extending substantially from one side thereof to the other. Each shutter 94 has an extended lug 101 which may be brought into engagement with the transverse member or strip 102. Transverse member or strip 102 is swingably mounted by means of a pin 103 to bracket 104 (Fig. 2) to which is also fixed support 58 (Fig. 8).

My copending application, Serial No. 469,023, now Patent No. 2,452,743, issued November 2, 1948, is referred to for a further detailed description of the apparatus depicted in Figs. 5 and 8.

Reference is now more particularly made to Figs. 4, 5 and 6. In Fig. 4, there is illustrated a note range scale for the six voices indicated, namely, basso, baritone, contralto, mezzo-soprano, tenor, and soprano, without the sharp or flat notes. The complete normal note range of the chromatic scale for the six voices comprises forty-six notes including sharps or flats, but for the sake of clarity, the sharps or flats have been omitted from Fig. 4. As is well known, the complete chromatic scale for piano comprises eighty-eight notes.

The plates 73 illustrated in Fig. 6 are divided into a plurality of sound or tone tracks 77, 78, 79, 80, etc., each track comprising eighty-eight bands, each band being represented by the numeral 57. Thus each track represents the number of bands required for the complete chromatic scale of the eighty-eight piano notes controlled by the keyboard of the piano. Now, where it is desired to reproduce the complete chromatic scale of the piano, all eighty-eight bands of a track would be used. Thus, in track 85 there would be photographically recorded the complete chromatic piano scale of eighty-eight notes. Now, the normal chromatic scale of, say the violin, is less than eighty-eight notes, so that since in sound track 77, there are eighty-eight bands, the remaining bands may be utilized for recording thereon, those notes or another instrument, such as, piano, which come within a range different from that of the notes of the violin. So that, if for example, the scale of the violin notes recorded in sound track 77, run from three notes below middle C upwards thus taking in about from fifty-six to sixty notes in its chromatic scale, and therefore, using up only from fifty-six to sixty bands for violin, the remaining bands below middle C in sound track 77 may be used to record notes of the piano other than the notes recorded for the violin. This arrangement has many advantages, for example, the player in reproducing a musical selection or composition containing separate violin and piano notes, may sustain the violin note or notes by depressing the sustaining pedal 40c and continue playing, as an accompaniment piano notes. Again, a sound track of plate 73 may contain the notes of the complete chromatic scale for piano thus utilizing all of the bands 57 in a

track, and some of the bands of the same track may also have recorded thereon violin notes, so that when the player during rendition of a musical selection, presses the keys of the keyboard corresponding to the combined piano-violin note bands, the instrument will emit, at that moment, combined piano-violin sounds. Likewise, a single band in a sound track may contain the tone or pitch of a combined piano, violin, flute, cello, etc., note or the note pitch of any desired combination of instruments. Similarly, a sound track of plate 73 may contain separate instrument and voice notes (a note in each band); or the same band may contain the note pitch of a combination of instrument or instruments and voice or voices. Further, in the central portion of a sound track of plate 73, for example, comprising substantially forty-six bands of the track, each band may represent a separate note of a plurality of instruments and/or voices in chromatic scale order. That is, recorded on successive bands (one note on each band) may be the middle C note of baritone, the G# note of tenor, the D note of flute, the D# note of cello, the E note of violin, the F note of organ, the F# note of harp, the G note of clarinet, the G# note of cornet, the A note of mezzo-soprano, the A# note of soprano, the B note of tenor, and so on; so that if a cord of eight notes is played, it will represent variations in tone quality and produce an effective, aesthetic harmony.

Again, twenty-six successive bands of a sound track may have recorded thereon, respectively, the pronunciations or sounds of the complete alphabetic range, that is, from the letter A to the letter Z, and all in the same pitch, so that an intelligent delivery, such as, a lecture, sermon, speech, etc., may be assembled or organized by manipulation of the keyboard of the instrument. In order to make complete words or expressions, rhythm and time values are to be considered by the manipulator. The operator or manipulator of the instrument may have before him visual representations of the vowels and consonants and above the vowels and consonants musical notes representing the length of playing time of each vowel and consonant which will give the necessary rhythm to make the words understandable as they are being formed.

Now, if on each of five successive sound tracks there is recorded a vowel of the alphabet in chromatic scale order and all the consonants of the alphabet in one pitch, it is believed that a vocal composition may be rendered by the instrument. To further illustrate on one sound track, the vowel "a" is recorded in chromatic scale order, a note on each band, and all of the consonants of the alphabet in one pitch is recorded on the same sound track, each consonant letter on a separate band; on the next sound track, the vowel "e" is recorded in chromatic scale order, a note on each band, and all of the consonants of the alphabet in one pitch is recorded on the said next sound track, each consonant letter on a separate band; and so on, for the remaining vowels. We will now have five sound tracks each track having a vowel recorded in various pitches or sounds and all of the consonants in the same pitch.

To take a more specific example, the chromatic scale of soprano averages from high D to low middle C, containing twenty-nine notes and thus utilizing twenty-nine bands of a sound track for the vowel recorded thereon. The consonants in one pitch will utilize twenty-one bands more on the sound track. The plate upon which these five sound tracks are mounted is shiftable by knob 65,

to bring the selected sound track under the influence of the light source, shutters, and light sensitive cell. If a song is to be "sung" in soprano through the manipulation of the keyboard by the player, say "Ave Maria" the following play for say, the first word "Ave" would be made. The key of the keyboard corresponding to the proper note on the track sound, having the chromatic scale of the vowel "a," is depressed for such time equivalent to the value of the note (being a quarter value); the key corresponding to the consonant "v" in the same sound track is depressed for about a one-sixty-fourth value giving an accent to the consonant, the plate being then shifted soon after the "v" is played and the key corresponding to the prior note on the said track having the chromatic scale of the vowel "e" is depressed for the time value of the note written by the composer. It is understood that any song may be produced through the vowels, accent being given to the consonants. The vowels being recorded in chromatic scale order, express the melody as well as the words and in combination with the consonants express the accents and the words.

Although recording on the sound bands 57 in the tracks 77, 78, etc., may be accomplished in several ways, a very simple means for doing so and which has been found by experiment to be convenient and practical will now be outlined.

The players and vocalists may be assembled in a recording studio supplied with electrical recording apparatus in which film is used for recording. Let it be assumed, that it is desired to record the notes of the chromatic scale of violin. The recording apparatus is set in operation thus causing the film to travel. The musician plays on his violin the first note of the chromatic scale holding the same for about one-quarter value of note which is recorded on the moving film. The musician rests for about one-eighth or one-sixteenth value of note and then proceeds with playing the second note of the chromatic scale for about one-quarter value of note and then rests for a like period, this being continued until he completes playing the chromatic scale, the film in the meantime moving at a uniform rate. The rest periods or pauses separate on the film the record of the successive notes. The negative when developed, will show fully exposed areas representing those rest periods or pauses, that is, substantially white areas will appear between successive note-recorded areas.

From the sound track or note-recorded area of each note on the negative, a band or strip substantially one-eighth inch or three-sixteenths inch wide and about one-half long is cut.

There will be as many of such bands as there are recorded notes. These bands are secured to, preferably a glass plate, in chromatic scale order from lowest note to highest note, and constitutes the negative from which the track 77 of the plate in Fig. 6 is printed. The bands 57 are the prints of the bands or strips assembled on the said glass plate. The same process is repeated as respects the different instruments for producing each of the other tracks 78, 79, 80, etc., of the plate in Fig. 6. In the case of vocal recording, the singer holds each note for one-quarter value note with a rest period of about one-eighth or one sixteenth value note, as in the case of recording of the notes of the instruments.

It is understood that combination notes may be made in the same manner. For example, a chromatic scale of two or more singers singing

and/or instruments playing simultaneously may be recorded on the same band. Singers may sing the same note but with different vowel sounds, such as for example, a tenor may sing the note high C with the vowel sound of "a" and simultaneously, a soprano may sing the same note (high C) with the vowel sound of "e." Thus, it can be seen that a great many variations in quality and harmony may be produced.

The master plate, that is, the plate having secured thereon the negative strips or bands may comprise a plurality of tracks, each track made up of recorded notes of the chromatic scale in accordance with the procedure hereinabove outlined. Since provision is made in each track for eighty-eight bands, the space, in the track in which the chromatic scale of a recorded instrument is less than eighty-eight notes, may be utilized for containing the negative record bands or strips representing notes of another instrument or voice. After the desired number of recordings have been completed and the corresponding negative bands or strips have been assembled and secured to the glass plate to form the master plate, from this master plate (which is the negative) as many prints as desired may be made. The print is mounted on a suitable transparent plate made of glass, plastic composition, paper or other suitable material. Fig. 6 diagrammatically indicates such prints which are removably received in the holder shown in Fig. 5.

It can be readily understood that reproductions or positive prints can be made at very little cost, making replacements inexpensive. Furthermore, it makes possible the attainment of plates having various combinations thereon, at relatively small expense.

Referring to the reproduction of the chromatic scale of the piano, which comprises eighty-eight notes, the negative bands or strips having recorded thereon the successive notes of the chromatic scale are, likewise, secured to the glass plate in chromatic scale order from which the track 85 is produced. The keys of the keyboard of the piano normally representing the notes of the chromatic scale corresponds to the same notes recorded on the bands of track 85, and therefore, controls the selection of the notes to be played, through the means previously described. Thus, piano tone effects may be obtained without the use of piano strings; with the added effect of full tone value, since with a string piano the tone of a note dies down irrespective of how long the key is depressed, whereas, with the instrument made in accordance with this invention, the full tone of the same note may be prolonged as long as the key is maintained in a depressed position.

Operation

Referring to Fig. 2, which shows a grand piano-like instrument, each key of the keyboard has respective relation to a band of a track, through respective flexible cables and the corresponding shutter mechanism.

Assume that a plate in Fig. 6 has been selected which contains the sound track to be played.

This plate is positioned in the holder or frame 59 shown in Fig. 5 and the frame positioned in support 58 (Fig. 8). Let it be further assumed that it is desired to play from track 85 (Fig. 6), that is for a piano composition. Lever 65 (Fig. 8) is moved until the indicator 66 points opposite the indication marked "piano" on the scale 68. This will bring sound track 85 under the revolving light-source cylinder 52. The light sensitive electric cell 61 and the light source 52 are put in operation. The player now operates the keys of the keyboard in a manner performed for a piano-selection, following the notes of the selected musical composition which he desires to play. As a key of the keyboard is depressed in accordance with a note of the musical composition, a corresponding shutter 94 (Fig. 7) is operated through cable 47, permitting the ray of light from light source 52 to pass through the opening 96 and penetrate the band 57 of track 85 upon which the note is recorded, impinging upon the light sensitive cell 61 which influences the sound emission means (loudspeaker and amplifier unit 148). The particular band 57 thus brought into play has recorded thereon the note corresponding to that represented by the piano-key just depressed.

From the foregoing description taken in connection with the accompanying drawings, it is apparent that an improved simple, practical and inexpensive device for the purpose intended is provided. It is apparent, however, that immaterial changes and modifications may be made by skilled persons without departing from the true spirit and scope of the invention as outlined in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A record for sound reproducing apparatus comprising a rectangular frame, a flat rigid translucent plate on said frame, and a plurality of bands on said plate, each of said bands carrying a photographic record of a sound, said band being a photographic transfer upon said plate of a film carrying said sound.

2. A record according to claim 1 wherein the photographic record of sounds comprises musical notes arranged in chromatic scale order.

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