Feb. 6, 1951 W. W. PHILLIPS 2,540,285

SELECTIVE FREQUENCY SOUND REPRODUCER
OF THE SOUND ON FILM TYPE

Filed Dec. 14, 1948 2 Sheets-Sheet 1

FIG. 1.

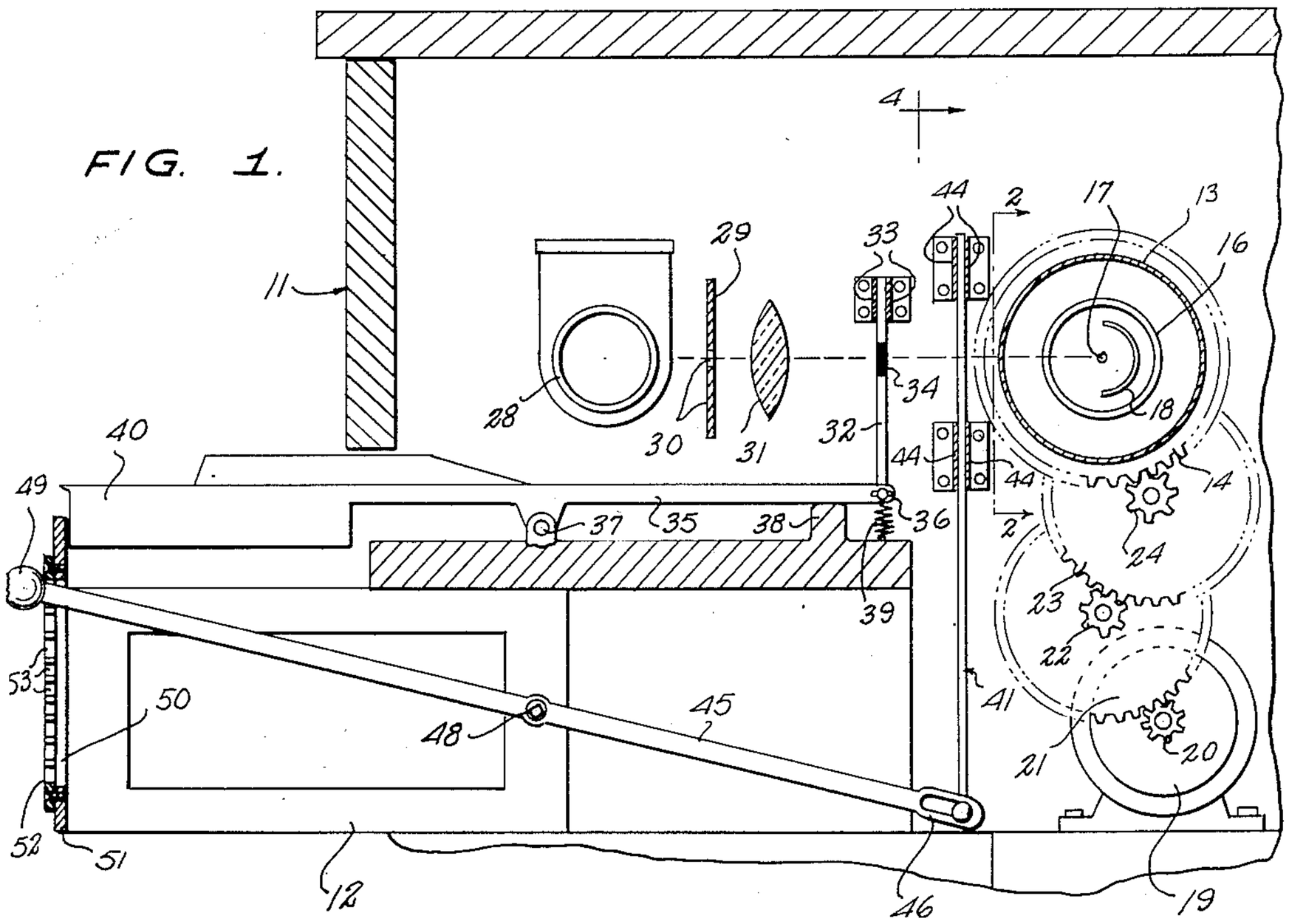

FIG. 2.

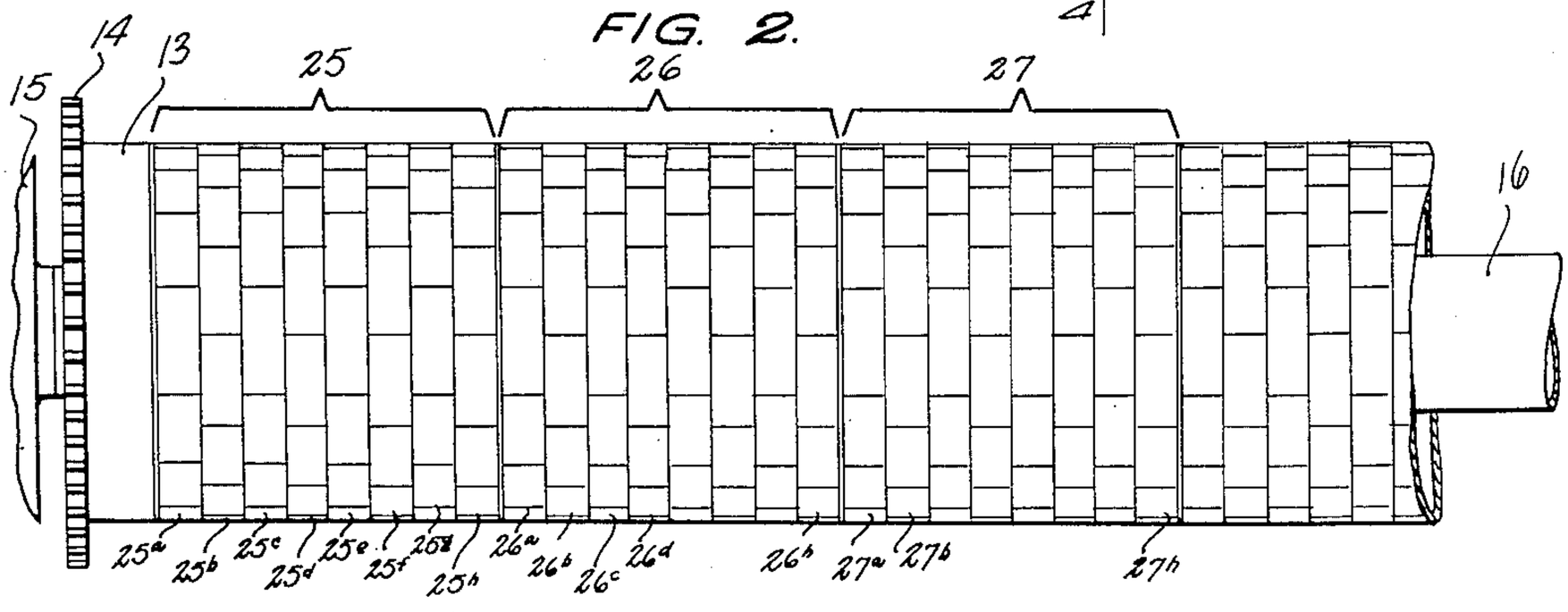

FIG. 3.

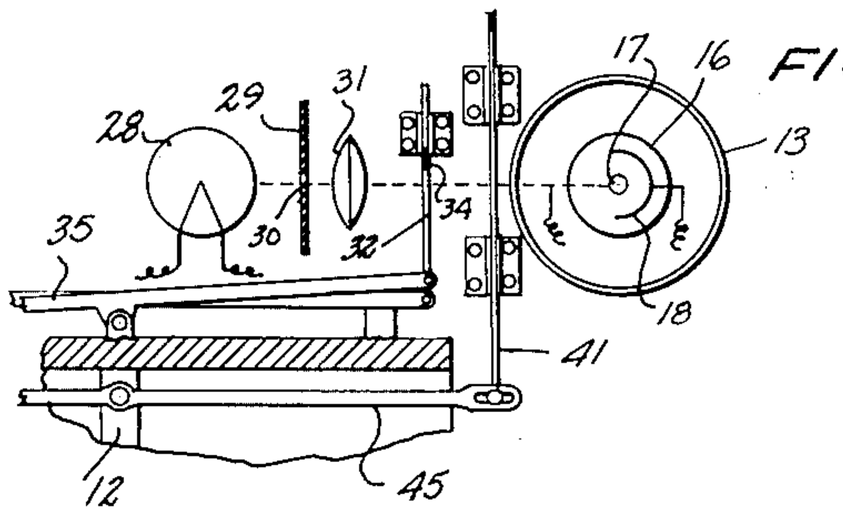

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FIG. 4.

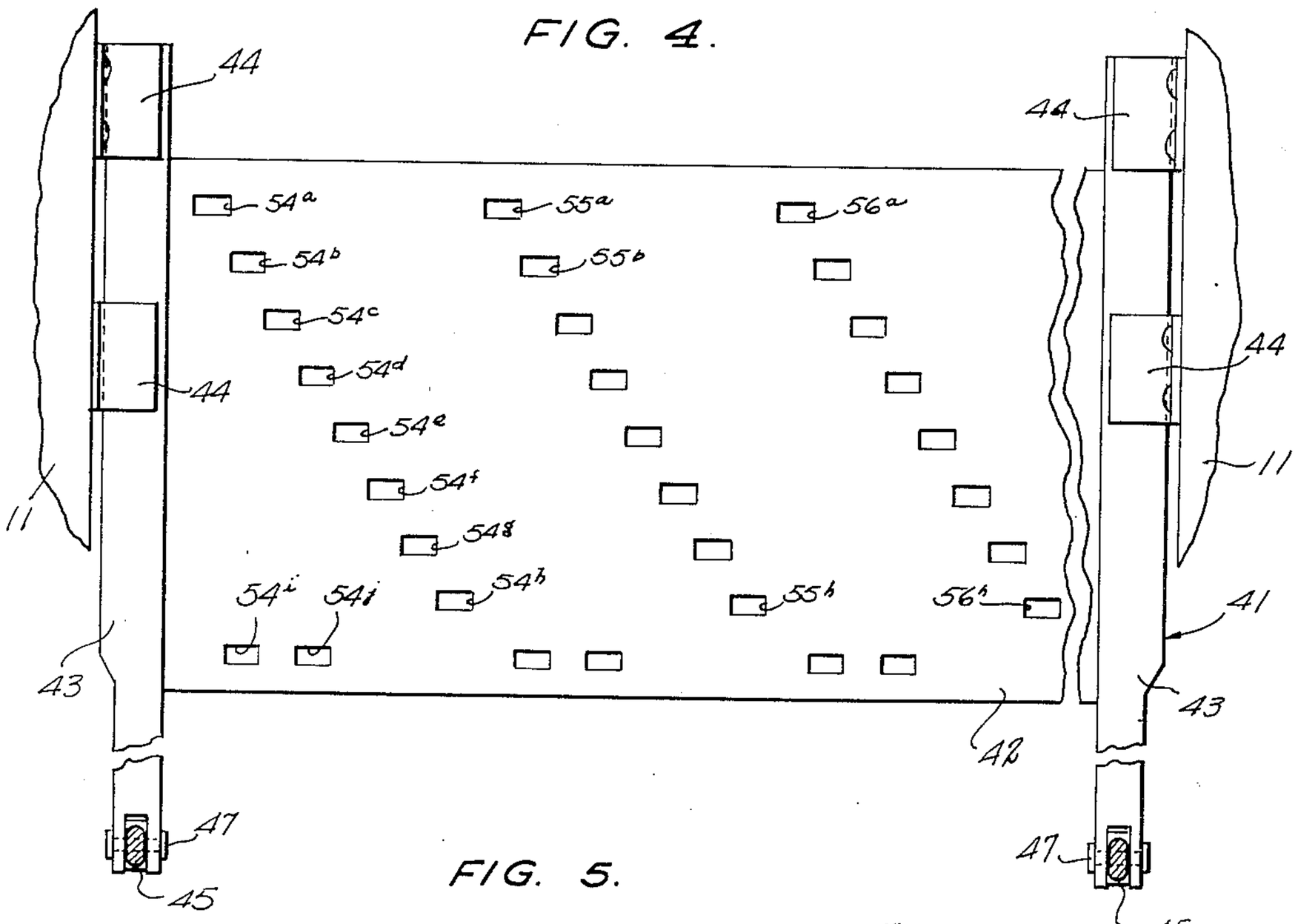
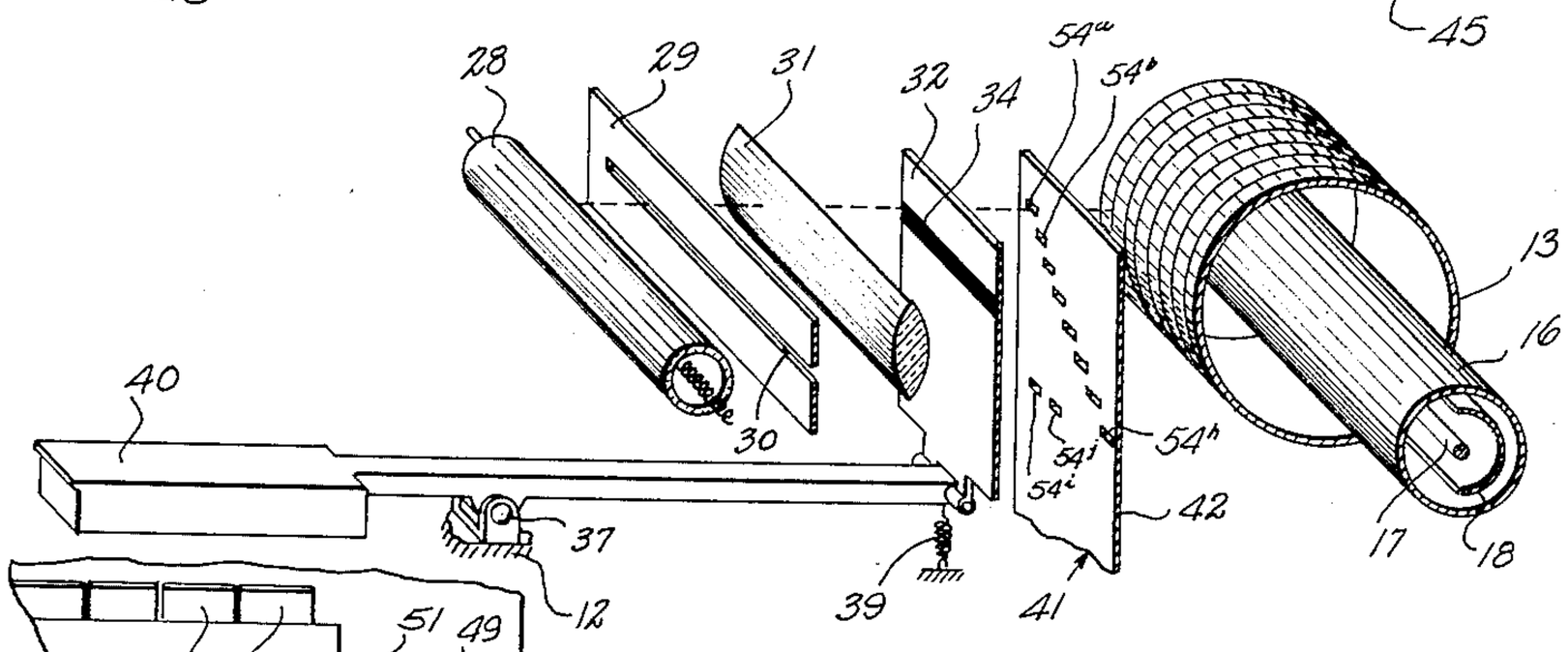


FIG. 5.



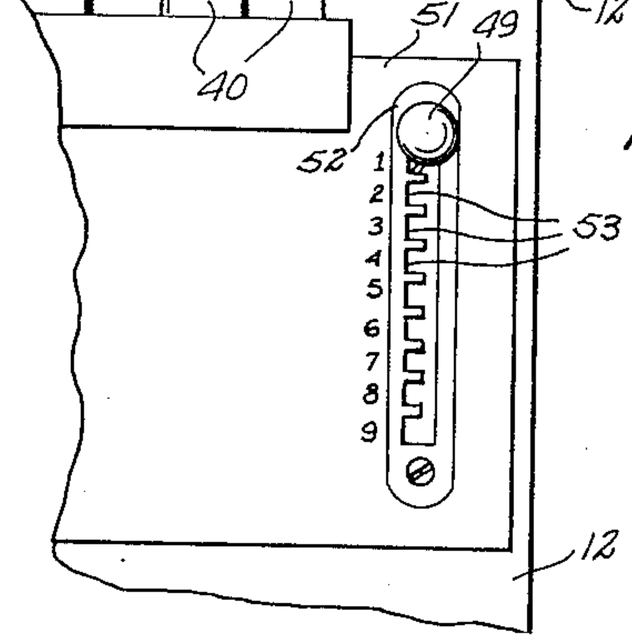


FIG. 6.

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SELECTIVE FREQUENCY SOUND REPRODUCER OF THE SOUND ON FILM TYPE

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4 Claims. (Cl. 84—1.18)

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This invention relates to electronic musical instruments, and more particularly to an instrument of the electronic organ type which is capable of selectively reproducing the recorded tones of any frequency or note desired by the player, not only of organ pipes but of the piano, the violin, the human voice, or of any other tone-producing instrumentality which can be recorded on a sound track.

A main object of the invention is to provide a novel and improved electronic musical instrument which is simple in construction, inexpensive to manufacture, and easy to play, said instrument having conventional keyboard operating means and being arranged so that the tones of one or more individual musical instruments may be selectively produced, as desired by the operator, or combinations of tones of different instruments may be simultaneously produced.

A further object of the invention is to provide an improved electronic musical instrument utilizing recorded tones of various instruments wherein the musical tones are recorded on sound tracks and wherein a conventional keyboard may be utilized to control the selection of tones to be reproduced, the instrument being very compact in size, reliable in operation and sturdy in construction.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a transverse vertical cross-sectional view taken through the upper portion of an electronic musical instrument constructed in accordance with the present invention.

Figure 2 is an enlarged fragmentary elevational view of the sound track cylinder on which the various tones are recorded forming part of the electronic musical instrument of Figure 1.

Figure 3 is a transverse cross-sectional view showing a portion of the structure of Figure 1 and showing a tone selecting plate in elevated position.

Figure 4 is an enlarged cross-sectional detail view taken on line 4—4 of Figure 1, showing the tone characteristic selecting gate in front elevation.

Figure 5 is a fragmentary perspective detail view showing the relative arrangement of parts of the tone selecting and tone characteristic selecting elements of the electronic musical instrument of Figure 1.

Figure 6 is a front elevational detail view of a portion of the musical instrument of Figure 1,

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showing the tone characteristics selecting plate and the manually operated selecting element cooperating therewith.

Referring to the drawings, 11 designates the cabinet of the instrument, said cabinet housing a suitable frame, indicated generally at 12, on which the various internal components of the instrument are supported.

Designated at 13 is a transparent cylinder having rigidly secured to one end thereof a gear 14. Gear 14 is journaled to a bracket 15 secured in any suitable manner to frame 12. Gear 14 is held vertical by bracket 15, thereby supporting cylinder 13 so as to maintain said cylinder in a horizontal position for rotation around its axis. Secured to frame 12 in any suitable manner adjacent the opposite end of cylinder 13 is an elongated photo-electric cell 16 which projects axially through substantially the entire length of drum 13. As shown in Figure 1, the cylinder 13 and the cell 16 extend longitudinally of cabinet 11 and are located in the rear portion of said cabinet. The cathode of the cell, shown at 17 extends axially of cylinder 16 and the semi-cylindrical anode thereof, designated at 18 faces forwardly. The photo-electric cell 16 is supported in a stationary position, while the cylinder 13 is rotatable about the axis defined by the elongated cathode 17 of the cell.

Mounted on the frame 12 below the rotary cylinder 13 is a constant speed motor 19. The shaft of motor 19 is coupled through reduction gears shown at 20, 21, 22, 23, and 24 to the gear 14 of cylinder 13. The reduction gears are rotatively supported in any suitable manner within frame 12 so as to revolve around horizontal longitudinal axes and to transmit torque to gear 14 so as to rotate cylinder 13 at a constant rate.

Imprinted on the transparent cylinder 13 are a multiplicity of successive groups of constant width sound tracks, designated in Figure 2 at 25, 26, 27, etc. Each group comprises an equal number of individual sound tracks, such as are indicated at 25*a* to 25*h*, 26*a* to 26*h*, etc. The sound tracks 25*a* to 25*h* are recordings of the first note of the musical spectrum covered by the device, as played by different instruments. For example, the track 25*a* may be the recording of this first note as played by a flute organ stop, 25*b* may be the recording of the same note as played by an oboe, 25*c* may be the recording of the same note as played by a reed organ stop, 25*d* may be the recording of the same note as played by a violin, etc. The sound track fre-

quencies of the bands in group 26 all correspond to the next note in the musical spectrum, but again, track 26*a* is the recording of a flute organ stop, 26*b* is the recording of an oboe, 25*c* is the recording of a reed organ, etc. Group 27 comprises corresponding individual recordings of the next note in the spectrum. There are 61 groups of sound tracks, corresponding to the 61 notes of a conventional organ manual.

Secured in any suitable manner inside the cabinet 11 forwardly of and parallel to cylinder 13 is an elongated tubular lamp 28. Designated at 29 is an opaque shield member which is secured in cabinet 11 rearwardly adjacent lamp 28. Shield member 29 is formed with an elongated horizontal slit 30 lying in the same horizontal plane as cathode 17 and the filament of lamp 28. Secured in cabinet 11 rearwardly adjacent shield member 29 is the horizontal elongated cylindrical lens 31 positioned so as to focus the light emanating from slit 30 onto the sound tracks. Such light will pass through the sound tracks carried by the rotating cylinder 13 and will be modulated thereby, producing corresponding modulations of the photo-electric current generated in cell 16. The speed of rotation of cylinder 13 is such as to provide the same linear rate of movement of the sound tracks as was employed in recording the tracks, whereby the fluctuations in photo-electric current thus generated correspond exactly to the original sound frequencies. Cell 16 is connected to the input circuit of a suitable audio amplifier, not shown, the fluctuations in photo-electric current being coupled in a well-known manner to the input grid of the amplifier to impress an audio signal thereon. The amplifier is connected to one or more loud speakers which reproduce the amplified sound track frequencies.

Manual selection of the tone group frequencies is obtained by means of vertically movable diaphragm elements 32 located rearwardly adjacent the cylindrical lens 31. There is one diaphragm element 32 for each tone group, a total of 61 diaphragm elements being therefore provided. The diaphragm elements 32 are preferably aligned in a common plane extending parallel to cylinder 13 and are slidably supported for vertical movement between parallel guide bars 33, 33 secured in any suitable manner within cabinet 11 and located above the horizontal plane containing the cathode 17 and the filament of lamp 28. Each diaphragm element 32 comprises a transparent plate having an opaque horizontal band 34 thereon. The lower end of each diaphragm element is pivotally connected to the inner end of a respective key lever 35, as shown at 36, said key lever being pivoted at its intermediate portion to the frame 12, as shown at 37. The frame 12 is provided with an upstanding longitudinal rib 38 which underlies the inner end portions of the key lever 35. Connecting the inner ends of the key levers to the frame 12 are respective springs 39 which bias said inner ends downwardly into abutment with the rib 38. In the normal positions of the key levers 35, the opaque bands 34 carried on their associated diaphragm elements 32 block the passage of light from lens 31 to cylinder 13. When the outer key portions of the key levers, shown at 40, are depressed, the diaphragm elements 32 are elevated removing the opaque bands 34 from the path of the light beam produced by lens 31.

Selection of the desired tone characteristics is obtained by means of a vertically adjustable tone

gate 41 located between the diaphragms 32 and the cylinder 13. Tone gate 41 comprises a longitudinally extending elongated vertical plate member 42 corresponding in length to the cylinder 13 and parallel therewith. At its ends the plate member 42 is provided with vertical bar elements 43, 43 which are slidably received between upper and lower pairs of opposed guide brackets 44, 44 secured to the side walls of cabinet 11. Designated at 45, 45 are respective adjusting levers having slotted ends 46 pivotally connected to the lower ends of the respective bars 43 by means of rivets 47. The levers 45 are pivoted at their intermediate portions to frame 12, as shown at 48, and extend forwardly to positions subadjacent the instrument keyboard, where they terminate in knobs 49. The forward portions of levers 45 pass through vertical slots 50 formed in a front panel 51 secured to frame 12. Secured to panel 51 in overlying relationship to the slots 50 are respective vertically slotted plates 52 through which the levers 45 pass. The slots in plates 52 are formed with a series of vertically spaced notches 53. By adjusting the levers 45 into interlocking engagement with corresponding respective notches 53 of the plates 52, the tone gate 41 may be locked in any one of a plurality of different positions of vertical adjustment.

The levers 45 are made of suitable material such as steel rod stock or the like, having sufficient flexibility to allow the forward portions of said levers to be flexed laterally when moving said levers from engagement from one notch 53 to another.

Referring now to Figures 4 and 5, it will be seen that the plate member 42 is formed with recurrent diagonally spaced groups of apertures, shown at 54*a* to 54*h*, 55*a* to 55*h*, 56*a* to 56*h*, etc. The lateral spacing of the apertures in each group is the same as the lateral spacing between the individual adjacent sound tracks in the respective groups 25, 26, 27, etc. on cylinder 13. The overall width of each group of apertures is the same as the width of the sound track groups. The vertical spacing between adjacent apertures corresponds to the vertical distance through which the plate member 42 is moved when the levers 45 are moved from engagement with one set of notches 53 into engagement with the next adjacent set of notches.

The apertures 54*a* to 54*h* are located so as to be in alignment with the sound tracks 25*a* to 25*h* respectively. The apertures 55*a* to 55*h* are in alignment with sound tracks 26*a* to 26*h* respectively. There are 61 groups of apertures, each group having its apertures aligned with the sound tracks of a corresponding tonal group on cylinder 13. In addition to the individually aligned apertures such as 54*a* to 54*h*, each group of apertures may have sets of two or more apertures, such as 54*i* and 54*j*, each aligned with an individual sound track and located in horizontal alignment.

By adjusting the levers 45 so as to engage corresponding notches 53 in the plates 52, a selected set of apertures of the tone characteristics selecting gate 41 may be brought into alignment with the horizontal light beam produced by lens 31. Therefore when the keys 40 are depressed, the opaque bands 34 controlled by said keys will be raised from obstructing relation to the light beam, as shown in Figure 3, and the beam will impinge on the tone gate 41. Light will travel through those apertures of the tone gate which are in alignment with the light beam, whereby

the light will be modulated by the particular sound tracks exposed by these apertures. The recorded tones represented by the exposed sound tracks will then be generated by the photo-electric cell 16. It will be seen from Figures 4 and 5, that exposure of the individual apertures, such as 54*a* to 54*h*, will result in tones having a single tone quality, such as that of a solo flute organ, oboe, violin, etc. It will be further apparent that simultaneous exposure of plural apertures such as 54*i* and 54*j*, will result in mixed tones, such as a combination of organ and violin, oboe and violin, etc. Any desired number of plural arrangements of horizontally aligned apertures such as 54*i* and 54*j* may be provided in the grouped aperture arrangements of the tone gate.

It is therefore apparent that the device may be operated to provide tone either of a selected solo instrument or of a combination of instruments, and the selection of instrumental tone quality desired is made by adjustment of the levers 45 in the notches 53 of slotted plates 52. The device is otherwise played by depressing the keys 40 in accordance with the tone pitch required in the same manner employed in playing a piano or an organ.

While a specific embodiment of an electronic musical instrument has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In an electronic musical instrument of the character described, a supporting frame, a horizontal elongated photoelectric cell secured to said frame, a transparent cylinder rotatably secured to said frame and surrounding said photoelectric cell, means for rotating said cylinder around its axis at constant speed, a plurality of longitudinally spaced groups of circumferential sound tracks carried on the surface of the cylinder, each group comprising individual recordings of a particular tone as played by various instruments, an elongated light source secured to the frame parallel to said cylinder, a plurality of vertical transparent diaphragm plates movably mounted side by side between said light source and said cylinder, each plate being aligned with a group of sound tracks and having an opaque horizontal band normally blocking the passage of light to its associated group of sound tracks, means for selectively moving said plates vertically so as to remove the opaque bands thereof out of light blocking relation with respect to the cell, and a vertically movable plate element interposed between the light source and the cylinder, said plate element being formed with identically shaped apertures aligned respectively with the respective sound tracks and being arranged in recurrent similar groupings, each grouping comprising a plurality of apertures, wherein the apertures are spaced vertically with respect to each other, each grouping being associated with a particular tonal group of sound tracks.

2. In an electronic musical instrument of the character described, a supporting frame, a horizontal elongated photoelectric cell secured to said frame, a transparent cylinder rotatably secured to said frame and surrounding said photoelectric cell, means for rotating said cylinder around its axis at constant speed, a plurality of longitudinally spaced groups of circumferential

sound tracks carried on the surface of the cylinder, each group comprising individual solo recordings of a particular tone as played by different instruments, an elongated light source secured to the frame parallel to said cylinder, a plurality of vertical transparent diaphragm plates movably mounted side by side between said light source and said cylinder, each plate being aligned with a particular tonal group of sound tracks and having an opaque horizontal band normally blocking the passage of light to its associated tonal group, means for selectively moving said plates vertically so as to remove the opaque bands thereof out of light blocking relation with respect to the cell, a vertically movable vertical plate element slidably supported in said support between said diaphragm plates and said cylinder, said plate element being formed with individual identically shaped apertures aligned respectively with the planes of the respective sound tracks, the apertures being arranged in groupings each comprising a plurality of apertures horizontally and vertically spaced in a constant recurring pattern, said groupings also including additional horizontal rows of apertures aligned with the planes of a plurality of sound tracks associated with the respective groupings, and means for releasably locking said vertical plate element in any one of a plurality of predetermined vertically adjusted positions.

3. In an electronic musical instrument of the character described, a supporting frame, a horizontal elongated photoelectric cell secured to said frame, a transparent cylinder rotatably secured to said frame and surrounding said photoelectric cell, means for rotating said cylinder around its axis at constant speed, a plurality of longitudinally spaced groups of circumferential sound tracks carried on the surface of the cylinder, each group comprising individual recordings of a particular tone as played by various instruments, an elongated light source secured to the frame parallel to said cylinder, a plurality of vertical diaphragm plates movably mounted side-by-side between said light source and said cylinder, each plate being aligned with a group of sound tracks, means for selectively moving said plates vertically out of light blocking relation with respect to the cell, and a vertically movable plate element interposed between the light source and the cylinder, said plate element being formed with identically shaped apertures aligned respectively with the respective sound tracks and being arranged in recurrent similar groupings, each grouping comprising a plurality of apertures, wherein the apertures are spaced vertically with respect to each other, each grouping being associated with a particular tonal group of sound tracks.

4. In an electronic musical instrument of the character described, a supporting frame, a horizontal elongated photoelectric cell secured to said frame, a transparent cylinder rotatably secured to said frame and surrounding said photoelectric cell, means for rotating said cylinder around its axis at constant speed, a plurality of longitudinally spaced groups of circumferential sound tracks carried on the surface of the cylinder, each group comprising individual recordings of a particular tone as played by various instruments, an elongated light source secured to the frame parallel to said cylinder, a plurality of vertical diaphragm plates movably mounted side-by-side between said light source and said cylinder, each plate being aligned with a group of sound tracks,

means for selectively moving said plates vertically out of light blocking relation with respect to the cell, and a vertically movable plate element interposed between the light source and the cylinder, said plate element being formed with identically shaped apertures aligned respectively with the respective sound tracks and being arranged in recurrent diagonal groupings, each grouping being associated with a particular tonal group of sound tracks.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,678,872	Potter	July 31, 1928
1,980,292	Potter	Nov. 13, 1934
1,998,461	Kucher	Apr. 23, 1935
2,142,391	Fuschi	Jan. 3, 1939