March 22, 1932. D. K. GANNETT 1,350,130

TALKING MOVING PICTURE SYSTEM

Filed Oct. 31, 1928

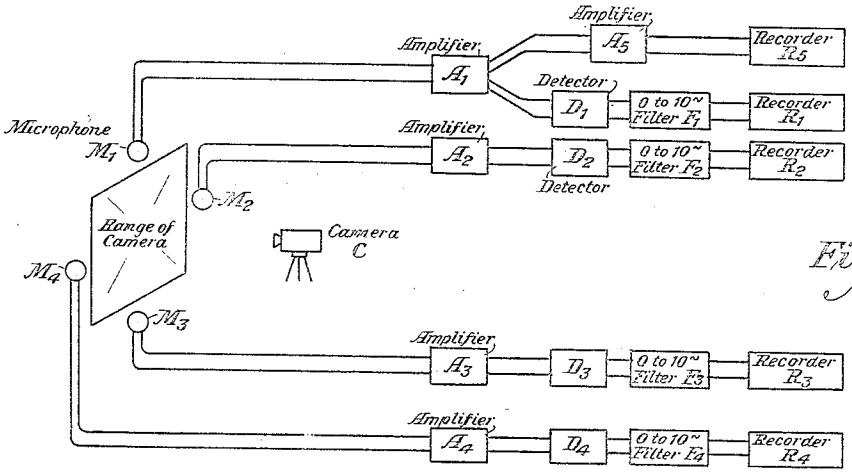

Fig. 1

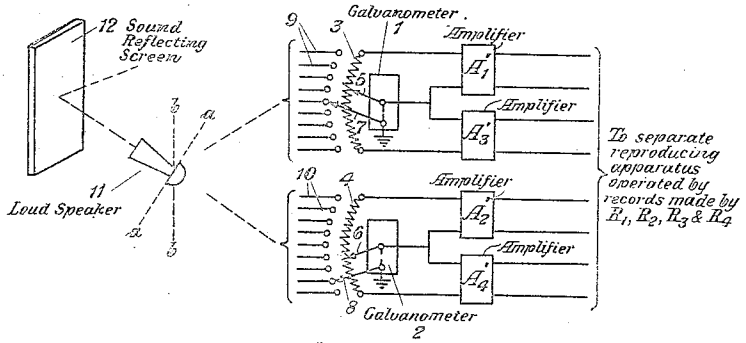

Fig. 2

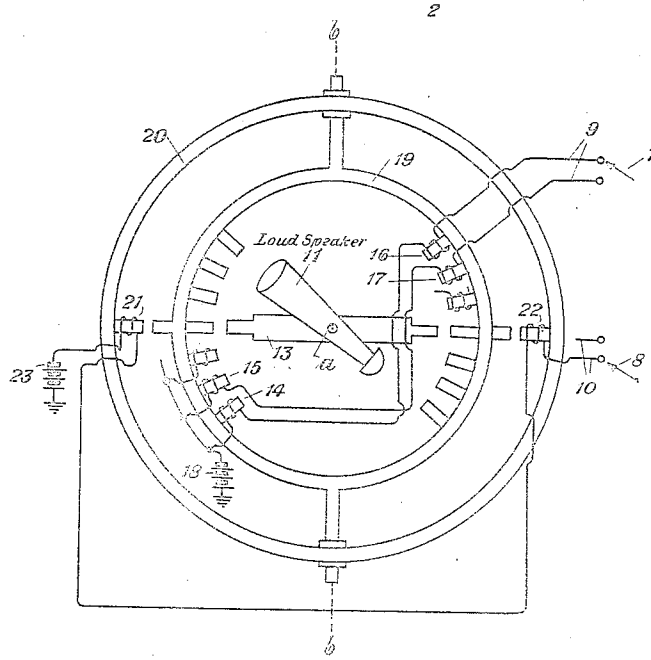

Fig. 3

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UNITED STATES PATENT OFFICE

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TALKING MOVING PICTURE SYSTEM

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This invention relates to talking moving picture systems, and more particularly to a method of and means for reproducing the sound from a location coinciding with the visual source thereof moving about the picture screen.

One of the present defects of certain talking moving picture systems is that the location of the source of sound in the reproducing process is fixed. This tends to destroy the illusion as the spectator is impressed by the fact that the apparent location of the voice does not coincide with the mouth of the moving figure thrown on the screen. The primary object of the arrangements of the invention is to overcome this defect. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawings, in the Figures 1, 2, and 3 of which the invention is illustrated. In Fig. 1 is shown a circuit diagram of the recording process of the invention. Fig. 2 is a diagram of the sound reproducing arrangements. Fig. 3 is a diagram showing in more detail a portion of the arrangements of the reproducing mechanism. Similar reference characters have been utilized to denote like parts in all of the figures.

In the recording arrangements of Fig. 1, there is shown a camera C. At the extremes of the field or range of the camera are placed four microphones. The microphones M_1 and M_3 may be placed at the vertical extremes of the field of the camera and the microphones M_2 and M_4 at the horizontal extremes.

The output of each microphone is connected to an amplifier, such as the amplifiers A_1, A_2, A_3, and A_4. The output of amplifier A_1 will be connected to an amplifier A_5 and thence to a recorder R_5 for making a record of the sound. The method of recording the sound by device R_5 may be any desirable one, such as the phonographic method or the film method. The output of each of the microphones and amplifiers A_1, A_2, A_3, and A_4 is passed through a detector and then a low pass filter having a cut-off of about 10 cycles. The detectors are shown schematically as D_1, D_2, D_3, and D_4. The low pass filters are shown schematically as F_1, F_2, F_3, and F_4. From each detector there is obtained a low frequency wave whose instantaneous value depends on the signal strength picked up by the microphone associated therewith. The four low frequency waves are then recorded at the same time and preferably in the same way as the voice, by recorder devices R_1, R_2, R_3, and R_4. The sensitivity of each of the recording arrangements should be the same.

It is pointed out that in the process of recording as the source of the sound moves about in the field of the picture, the relative strength of the voice waves received by the four microphones varies. As the sound moves from left to right, the sound waves received by microphone M_2 increase in strength. Those received by M_4 decrease. Similarly, if the source of sound moves in a vertical direction, the relative strength of the sound wave reaching M_1 and M_3 varies. Accordingly, the strength of the sound records made by devices R_1, R_2, R_3, and R_4 will be continually varied in accordance with the movement of the source of sound about the field of the camera.

In the arrangements for reproducing the picture, as shown in Figure 2, a solid screen 12 is employed capable of reflecting sound waves. A single loud speaker 11 is also employed. This loud speaker is assumed to have decided directional properties and to be pointed at the screen. The loud speaker is movable about two axes at right angles to each other, such as *a*—*a* and *b*—*b*. The sound wave is produced from the record made by the recorder device R_5 and transmitted to the loud speaker 11. The motion of the loud speaker 11 about the two axes is determined in the following manner. The four low frequency waves as recorded by devices R_1, R_2, R_3, and R_4 are reproduced and transmitted to the amplifiers A_1', A_2', A_3', and A_4'. The low frequency wave from recorder R_1 will be transmitted to amplifier A_1'; the wave from

recorder R_2 to A_2'; that from R_3 to A_3'; that from R_4 to A_4'. The outputs from amplifiers A_1' and A_3' are connected to a self-balancing bridge arrangement in which the galvanometer 1 rotates if there is a difference of volume from the two amplifiers, and at the same time adjusts a ratio arm 5 to balance the arrangement. When a balance is obtained no current flows through the galvanometer. This adjustment takes place very rapidly so that if the relative strength of the low frequency signal from the two records made from microphones M_1 and M_3 varies, the galvanometer follows the change with corresponding adjustments. In thus moving, the galvanometer 1 also switches a contact arm 7, carrying a ground connection over a group of contacts connected to leads designated 9. In a similar manner the low frequency records derived from microphones M_2 and M_4 are caused to actuate a self-balancing galvanometer 2 having a ratio arm 6 and a contact arm 8 with grounded connection, which moves over a group of contacts connected to leads designated 10.

The leads 9 are designed to control the rotation of the loud speaker 11 about the axis *a—a*, and the leads 10 are designed to control the rotation of the loud speaker 11 about the axis *b—b*. This will appear more fully from the diagram shown in Fig. 3. In Fig. 3, the loud speaker 11 is shown mounted upon the member 13. This member 13 rotates about the axis *a—a*. The rotation of member 13 about this axis is controlled by a series of magnets, such as 14, 15, 16, and 17, arranged to be diagonally opposite each other on the circular member 19. For example, if the grounded contact arm 7 engages one of the leads 9, as shown, a circuit will be completed to battery 18, which will energize the diagonally opposite magnets 14 and 16. This will attract the pole pieces of member 13 and rotate the loud speaker 11 about the axis *a—a*. If the grounded contact member 7 should move to the next succeeding lead, the circuit would be completed from battery 18, energizing diagonally opposite magnets 15 and 17 and thereby change the position of loud speaker 11 about the axis *a—a*. The loud speaker 11 is mounted on the flat circular member 19 in such a way that it may be rotated about the axis *b—b* when the circular member 19 rotates about such axis. This rotation is controlled by a series of diagonally opposite magnets, such as 21 and 22, mounted on a spherical member 20. The pole pieces of member 19 are shown positioned with respect to magnets 21 and 22. When the grounded contact arm 8 is in contact, as shown with one of the leads 10, the circuit is completed from battery 23, energizing the magnets 21 and 22 to control the rotation of the loud speaker 11 about the axis *b—b*. Other diagonally opposed magnets, not shown, are arranged in similar fashion on the spherical member 20 and energized by succeeding ones of the leads 10 to further control the rotation of member 19 and loud speaker 11 about the axis *b—b*.

As a result of the combined movements about the two axes, the sound is thrown against the screen at a point which moves about in a manner corresponding to the movement of the object which produced the sound in the original recording process. The sound is then reflected from the screen to the spectator and appears to originate from the proper location.

While the invention has been disclosed as embodied in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in many other widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In a talking moving picture system the combination of a producing system comprising a plurality of microphones arranged at various positions with respect to the center of the field of the camera, means for making an audible record from one of said microphones, means for simultaneously making low frequency records from all of said microphones, and a reproducing system comprising a loud speaker having directional properties, means for actuating said loud speaker from said audible record, and means for controlling the directional properties of said loud speaker by said low frequency records.

2. In a talking moving picture system the combination of a producing system comprising a plurality of microphones arranged at various positions with respect to the center of the field of the camera, means for making an audible record from one of said microphones, means for simultaneously making low frequency records from all of said microphones, and a reproducing system comprising a moving picture screen capable of reflecting sound, a loud speaker having directional properties pointed at said screen for reproducing said audible record, and means for controlling the directional properties of said loud speaker by said low frequency records.

3. In a talking moving picture system a moving picture screen upon which pictures may be shown and capable of reflecting sound, a plurality of devices for recording the movement of the visual source of sound on said screen, a loud speaker having a variable direction pointed at said screen for sound reproduction, and means for continuously changing the direction of said loud speaker with respect to the boundaries of said screen in accordance with the record of said devices.

4. In a talking moving picture system a moving picture screen upon which pictures may be shown and capable of reflecting sound,

a plurality of low frequency records recording the movement of the visual source of sound on said screen, a loud speaker having directional properties pointed at said screen for sound reproduction, mechanism for revolving said loud speaker about two axes at approximately right angles to each other, and means for controlling said mechanism in accordance with the impressions on said low frequency records.

5. In a talking moving picture system the method of recording sound emitted by a moving source which comprises simultaneously picking up a plurality of portions of the emitted sounds at different locations which are fixed, detecting each of the various portions of the emitted sounds picked up, selectively transmiting only so much of the various detected sounds as have frequencies lying within a predetermined subaudible range, and recording the subaudible frequencies selectively transmited.

6. In a talking moving picture system the method of reproducing speech sounds so that the locations of these sounds will coincide with the visual source thereof moving on the screen which comprises simultaneously picking up a plurality of portions of the emitted sounds at different locations which are fixed, detecting each of the various portions of the emitted sounds picked up, selectively transmitting only so much of the various detected sounds as have frequencies lying within a predetermined subaudible range, recording upon different records the various subaudible frequencies selectively transmitted, and controlling the directional properties of the speech sounds to be reproduced in accordance with said records.

In testimony whereof, I have signed my name to this specification this 29th day of October, 1928.

DANFORTH K. GANNETT.