June 11, 1935. S. WATANABE 2,004,453

METHOD OF RECORDING SOUNDS

Filed Oct. 20, 1932

Fig. 1

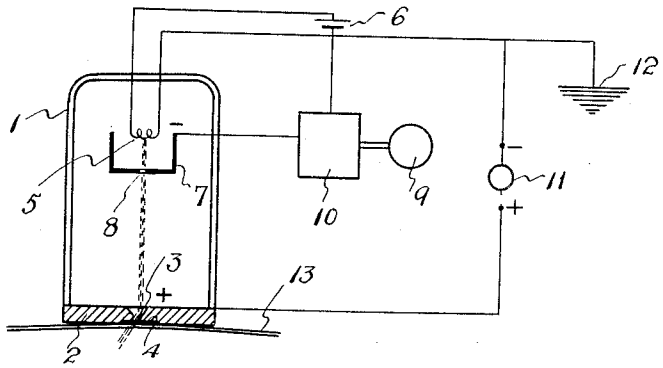


Fig. 2



Fig. 5

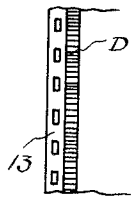


Fig. 7

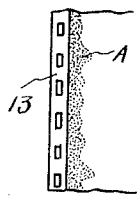
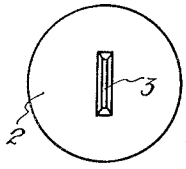


Fig. 3



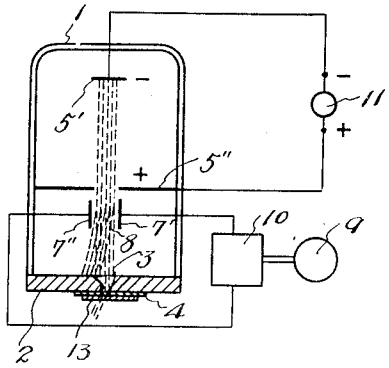
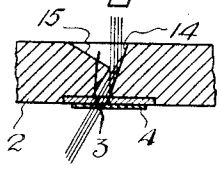


Fig. 6

Fig. 4



INVENTOR.
S. Watanabe
BY Marks & Clerk
ATTORNEYS.

Patented June 11, 1935

2,004,453

UNITED STATES PATENT OFFICE

2,004,453

METHOD OF RECORDING SOUNDS

Shumpei Watanabe, Koishikawa-Ku, Tokyo, Japan

Application October 20, 1932, Serial No. 638,801
In Japan November 10, 1931

2 Claims. (Cl. 179—100.3)

This invention relates to the recording of sound upon a moving strip of light-sensitive material and, more particularly, to a method of recording sound by employing X-ray producing device.

According to this invention, the method consists in controlling the cathode rays by microphone voltage, and the controlled cathode rays in the form of X-rays derived from said cathode rays being driven through a narrow slat into the space outside the vacuum tube where they are applied to the light-sensitive film.

The object of this invention is to obtain superior sound records with higher accuracy by a simple and easy operation.

Referring to the accompanying drawing in which the preferred form of the invention is shown:—

Fig. 1 is a diagrammatic view of a device for carrying out the invention into effect;

Figs. 2 and 3 are details of the control plate and bottom plate in plan;

Fig. 4 shows in an enlarged scale a fragmental section of the bottom plate;

Fig. 5 shows the sound track produced by said device;

Fig. 6 is a diagrammatic view of a modified form of the device; and

Fig. 7 shows the sound track produced by said modified form of the device.

According to this invention, for recording sound waves a cathode ray producing device is employed, and the cathode rays produced therein are controlled by the oscillating voltage supplied by a microphone and amplified, then the controlled cathode rays in the form of X-rays derived from the cathode rays are driven through a narrow slot into the space outside the vacuum tube where they are applied to the moving light-sensitive film. The invention will now be set forth more in detail with reference to the accompanying drawing.

In the device shown in Fig. 1, a vacuum tube or box 1 is formed of electric insulating material, such as glass. This vacuum box is provided with a metallic bottom plate 2 having a narrow slot 3 formed therein. Said narrow slot 3 is covered with a thin leaf of aluminium or mica 4 having thickness of about one thousandth millimeter. 5 is a hot cathode filament provided in the vacuum box 1 in a position opposite to said slot 3. 6 is a battery for heating said filament 5. 7 is an electrostatic control plate interposed between the filament 5 and the slot 3, and is provided with a narrow rectangular aperture 8. 9 is a microphone. 10 is an amplifier. 11 is the source of current of high tension earthed at 12. Said amplifier 10 is connected to the filament 5 and the control plate 7, and the high voltage source 11 is connected to the filament 5 and the metallic bottom plate 2.

13 is a light-sensitive film adapted to be moved across and beneath said narrow slot 3 by means of a suitable means keeping contact with the leaf 4.

In the operation of said device, by giving voltage of about 10,000 volts between the filament 5 and the bottom plate 2 from the source 11, cathode rays will be emitted from the filament 5 through the aperture 8 in the control plate 7 toward the bottom plate 2. When the microphone 9 receives music sounds or any sound waves to be recorded the oscillating current voltage produced by said microphone is amplified by the amplifier 10 and reaches the control plate 7, and the cathode rays passing through the aperture 8 will be controlled by said microphone voltage. When the cathode rays are reflected toward the slit 3 in the bottom plate 2 after striking upon the inclined surfaces 14 and 15 lying above the slit 3, they will become X-rays. The cathode rays thus controlled is driven in the form of X-rays through the narrow slot 3 into the space outside the vacuum box 1 where they are applied to the record surface on the moving film 13, whereby a sound recording may be effected according to so-called variable density method as shown at D in Fig. 5.

In the modified form of the invention shown in Fig. 6, a cold cathode plate 5′ and anode plate 5″ are oppositely arranged and are fed from the high voltage source of current 11, producing cathode rays. The direction of the cathode rays passing through the space 8′ between the control plates 7′ and 7″ toward the slot 3 in the bottom plate 2 are vibratory deflected longitudinally with respect to the narrow slot 3 by the oscillating voltage from the microphone 9 being applied to the control plates 7′ and 7″ through the amplifier 10, whereby the portion of the cathode rays driven through the narrow slot 3 changes in length, and this results in the usual variable area record A on the film 13 shown in Fig. 7.

From the foregoing it will be seen that according to the invention that, neither vibrators or oscillators, nor fluorescent plates are used so that the whole system has no inertia, both mechanical and optical, and also that inasmuch as the cathode rays are controlled by the microphone voltage and the controlled cathode rays are applied to the film outside the vacuum tube, the cathode

rays being thrown in the form of X-rays, the degree of the action of the cathode rays on the light-sensitive film may be adjusted by varying the voltage across the source 11, and consequently that the number of stages of amplification may be considerably decreased as compared with the existing system for recording sound using light.

What I claim is:

1. Apparatus for recording sound on a light sensitive member comprising a cathode ray tube having means for producing a pencil of cathode rays provided with a metal window forming a slit having inclined surfaces through which the cathode rays are ejected from the tube in form of X-rays, a thin leaf covering said slit, a light sensitive member moving in contact with said thin leaf, electrostatic plates in said tube arranged opposite to the pencil of rays and means for applying to said plates a potential difference which varies in accordance with the sound waves to be recorded.

2. Apparatus for recording sound on a light sensitive member comprising a cathode ray tube having means for producing a pencil of cathode rays provided with a metal window forming a slit having inclined surfaces through which the cathode rays are ejected from the tube in form of X-rays, a thin leaf covering said slit, a light sensitive member moving in contact with said thin leaf, a plurality of electrostatic plates in said tube arranged at opposite sides of the pencil of rays and separated in a direction parallel to said slit and means for applying to said plates a potential difference which varies in accordance with the sound waves to be recorded.

SHUMPEI WATANABE.