

Sept. 6, 1938.

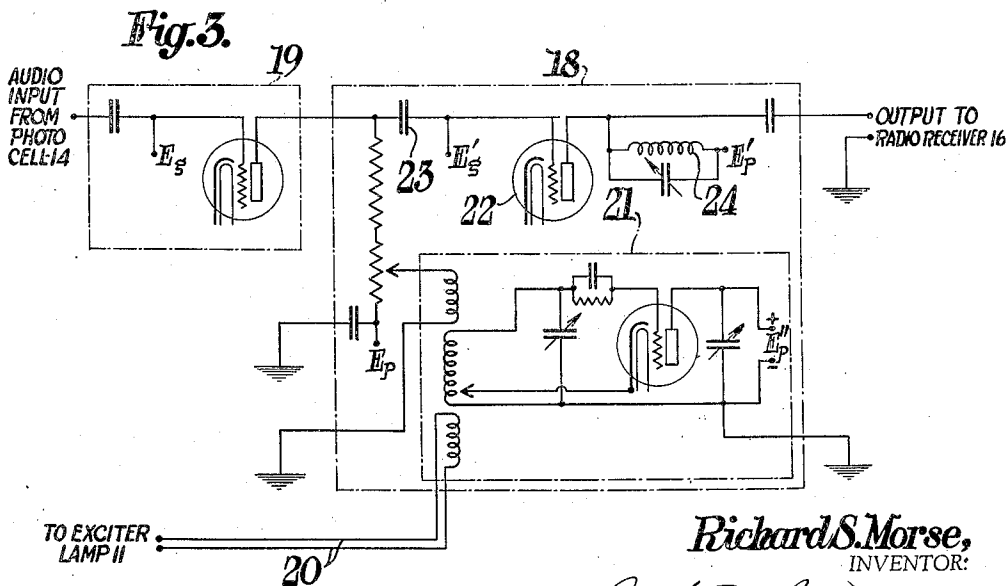
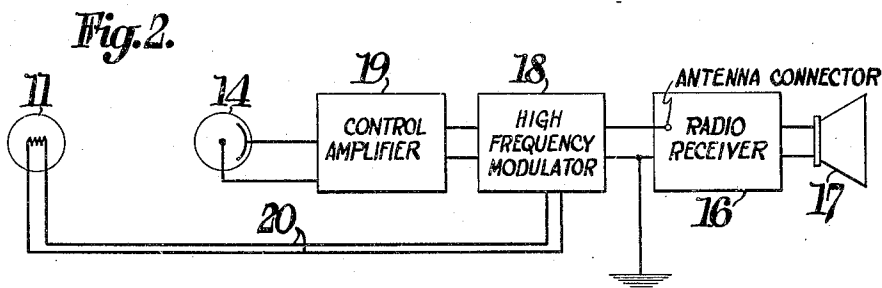
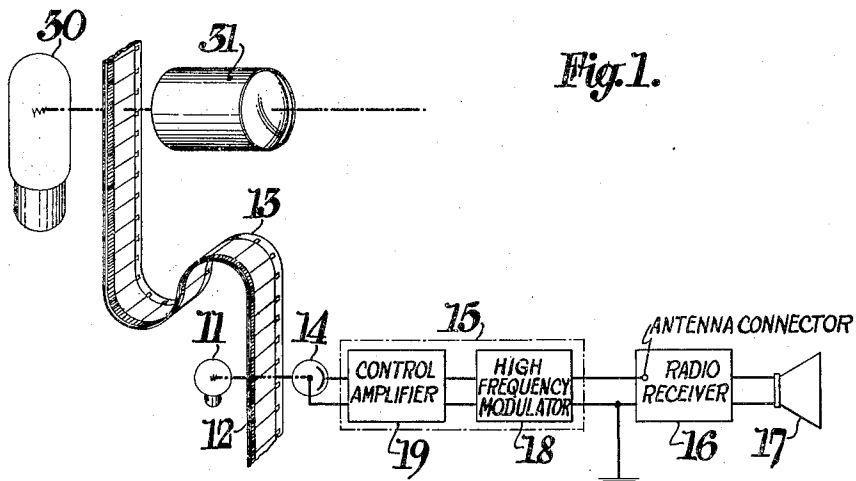
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2,129,227

SOUND REPRODUCING APPARATUS

Filed Oct. 14, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

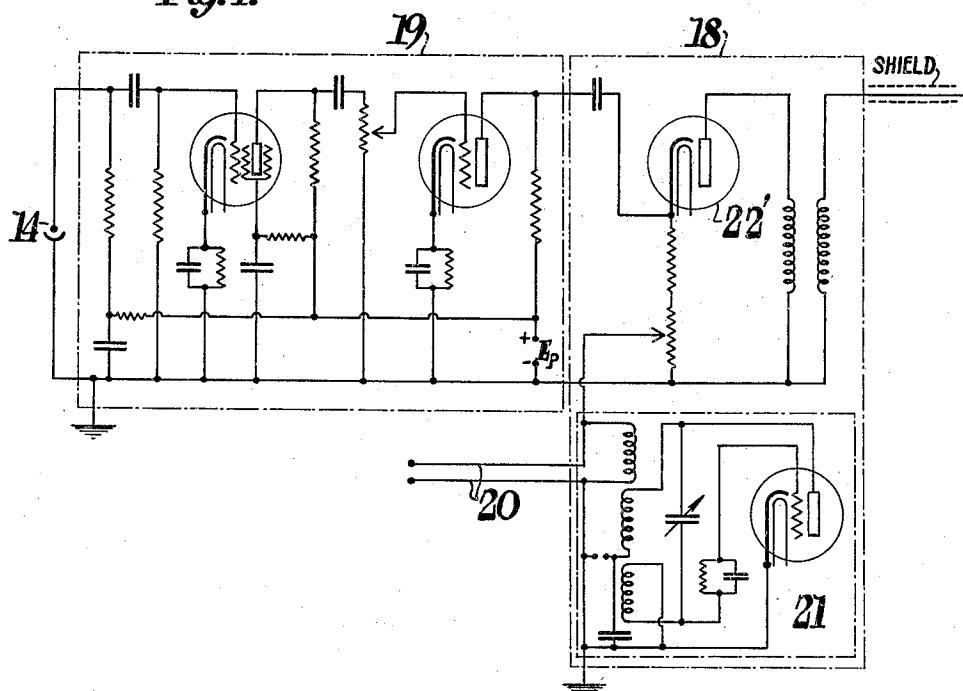
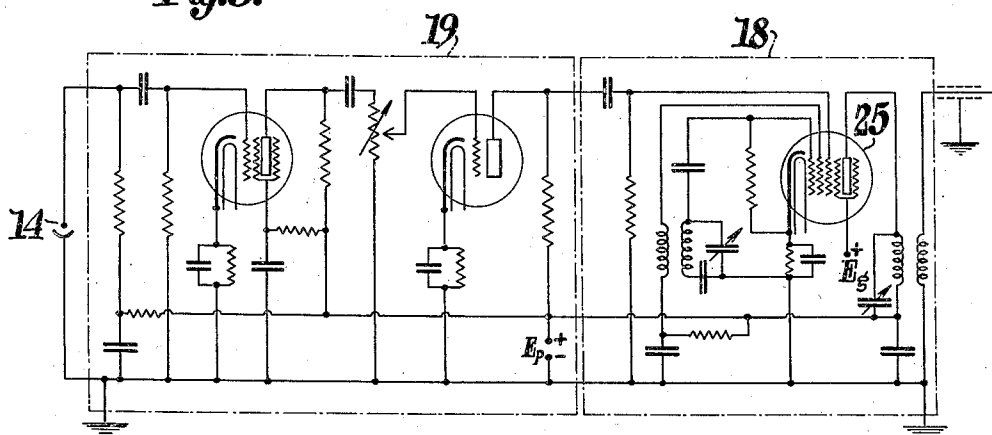


Fig. 5.



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UNITED STATES PATENT OFFICE

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SOUND REPRODUCING APPARATUS

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Application October 14, 1936, Serial No. 105,558

2 Claims. (Cl. 179—100.11)

This invention relates to the reproduction of sound. More particularly it relates to means for reproducing sound from sound-on-film records in connection with motion pictures.

5 In the projection of sound motion pictures a beam of light from a so-called exciter lamp is passed through the sound track which is recorded along one side of the film band and the light is modulated thereby. A photoelectric cell re-
10 ceives this modulated beam and transforms it into modulated electrical energy which in turn is amplified to operate a loud speaker. This invention relates particularly to the means of amplifying this electrical energy and the pro-
15 duction of sound therefrom.

Radio receiving sets are very common and one of them is likely to be available in any home or other location where amateur sound motion pictures are to be shown. It would be very con-
20 venient to be able to use the electrical amplification and the loud speaker of a radio receiver in conjunction with a sound motion picture projector. Thus duplication of equipment with its accompanying unwarranted cost would be elimi-
25 nated.

It is an object of this invention to provide an arrangement for using a radio receiver to amplify the output of the photoelectric cell of a sound motion picture projector and to produce
30 sound from the radio loud speaker.

Some radio receivers are equipped with phonograph jacks or equivalent means to allow the introduction of audio frequency current (such as the output of a microphone or a suitably ar-
35 ranged phonograph) into the circuit in such a manner that only the final audio stages of amplification are used. However since all radio receivers are not so equipped and since it would be desirable to use all of the amplification which
40 is available in the receiver, I prefer to introduce the output of the photoelectric cell into the receiver at the usual antenna connector. It is therefore a particular object of this invention to provide a means of accomplishing this.

45 As is well known, a radio broadcast signal may be considered as a radio frequency carrier wave modulated by the audio frequency intelligence which is being transmitted. It is an object of this invention to provide a carrier frequency
50 upon which the photoelectric cell output may be imposed, so that it will simulate a radio broadcast signal and will be suitable for reception by a radio receiver through its antenna connector.

It is well known in the art to use a high fre-
55 quency current as the exciter lamp supply in

order to eliminate any audio frequency variations in illumination which would affect the photoelectric cell in addition to the modulations caused by the sound track. It is a special object
5 of one form of this invention to provide a circuit arrangement for using the exciter lamp supply to provide a high frequency current or carrier to be modulated by the photoelectric cell output and to be transmitted to the antenna connector
10 of an ordinary radio receiver as discussed above. The carrier wave, whether it is furnished by the exciter lamp supply or not, should have a frequency within the range for which ordinary home receiving sets are tunable.

Other objects and advantages of this invention
15 will become apparent from the following description when read in connection with the accompanying drawings in which:

Figure 1 illustrates a form of the invention wherein a high frequency current is supplied,
20 modulated by the photoelectric cell output and then introduced through the antenna connector to a radio receiving set.

Figure 2 is similar to Figure 1, and in addition indicates schematically the use of the ex-
25 citer lamp supply as the source of high frequency for the carrier wave.

Figure 3 is a skeleton circuit diagram illustrating one general form the invention may take.

Figure 4 is the circuit diagram of one particular form of the general circuit arrangement illustrated in Figure 3.

Figure 5 is a circuit diagram showing another form of the invention in which a conventional type of oscillator provides the carrier frequency
35 but does not have the feature of also being utilized as the exciter lamp supply.

As shown in Figure 1, a sound motion picture film 13 bearing a sound track 12 is moved in a well-known manner past a lamp 30 and a lens
40 system 31 which form part of an ordinary system for projecting the pictures. The film 13 is also moved so that its sound track 12 passes between a suitable exciter lamp 11 and a photoelectric cell 14, so that the light received by the
45 photoelectric cell 14 is modulated according to the sound track 12 in a well-known manner. The photoelectric cell 14 together with its accompanying circuit 15 produces a correspondingly varying electric current which may be amplified to operate a loud speaker. The circuit
50 15 includes a source of high frequency 18 which provides a carrier wave to be modulated by the output of the photoelectric cell 14 through its amplifier circuit 19. This modulated carrier wave
55

is suitable for reception by the antenna connector of a radio receiver 16 which together with its loud speaker 17 completes the set-up.

Figure 2 is similar to Figure 1. In this case, however, the carrier frequency source 18 is of a type which is also suitable as a source of energy for the exciter lamp 11 (connected by leads 20 to the high frequency source 18).

In Figure 3, a suitable amplifying circuit 19 receives the output of the photoelectric cell and supplies the audio frequency component to the condenser 23. The exciter lamp 11 receives its high frequency supply through leads 20 from the oscillator circuit 21. This high frequency is also introduced through suitable impedance to the condenser 23. Any suitable means 22 (shown as a triode with grid modulation in this figure) for forming a modulated wave receives the two waves from the condenser 23. Thus the unit 18 (labelled "High frequency modulator" in Figures 1 and 2) comprises the oscillator 21, the modulating means 22, the condenser 23 and a suitable accompanying circuit. A load 24 provided in the output of the modulation means 22, may consist of an inductance which for maximum output may be tuned to the carrier frequency. The advantages and disadvantages of such tuning are well known to those skilled in this art. Although, for the sake of clarity I have shown specific arrangements for each portion of this skeleton circuit, it is obvious that equivalent means may be adopted in each case. For example, the oscillator circuit 21 or the modulator 22 may have any conventional form.

Figure 4 is one particular form of the arrangement shown in Figure 3. The amplifier circuit 19 includes two stages of amplification. The modulator tube 22' is shown as a diode and thus has the ability of giving low output with low distortion. For convenience the photoelectric cell 14 and its accompanying circuit 19 may be incorporated in the projector. The circuit 18 including the exciter lamp supply 21 and the modulator 22' may be mounted in a separate unit. The exciter lamp 11 will of course be in the projector and leads 20 are provided for connecting it to its power source 21. A radio receiver completes the equipment. If a radio receiver is not available or if for any reason it is desirable to have a separate amplifier and loud speaker unit for the projector, a conventional type of unit including the loud speaker, the amplifier and the

exciter lamp supply 21 but omitting the modulator 22' may directly replace the radio receiver and the unit containing circuit 18.

Figure 5 is similar to Figure 4 except for the form of circuit 18. The high frequency oscillator 21 and the modulator 22' of Figure 4 are combined in the circuit of the pentagrid converter tube 25 of Figure 5. Many equivalent oscillator modulator arrangements will immediately suggest themselves to those skilled in the art. In each figure Ep and Eg indicate plate and grid potentials.

I have shown only a few of the arrangements of my invention which are, however, sufficient to illustrate its principle and means of practicing it. It is to be understood that I do not wish to be limited to the specific circuits shown, but that my invention is of the scope of the appended claims.

What I claim is:

1. A sound motion picture projector comprising a motion picture film bearing a sound track, optical means to project the motion pictures from said film and means for reproducing sound from said sound track including a source of light to illuminate said sound track, a source of high frequency current to supply said source of light, a photoelectric cell adapted to receive light modulated by said sound track, means for adapting part of the output of said source of high frequency to form a carrier, means for modulating said carrier by the output of said photoelectric cell and means for introducing said modulated carrier into an ordinary radio receiving set having a loud speaker, said high frequency being within the range to which the radio receiving set is tunable.

2. In a device for the reproduction of sound from optical sound records the combination of a source of light, a film band bearing a sound track, a photoelectric cell adapted to receive light modulated by said sound track, a source of high frequency current to supply energy for said source of light, means for adapting some of the output of said source of high frequency to form a carrier wave, means for modulating said carrier wave by the output of said photoelectric cell, and means for introducing said modulated carrier wave into the antenna connector of an ordinary radio receiving set.

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