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RECORDING AND REPRODUCTION OF SOUND WAVES

Filed Nov. 10, 1927

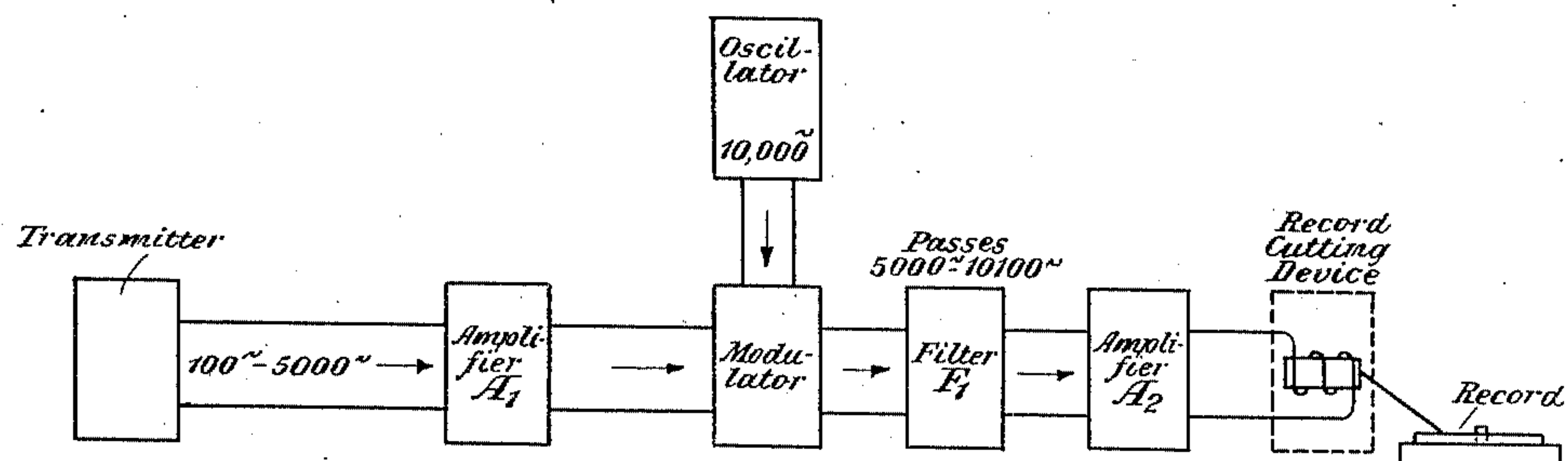


Fig. 1

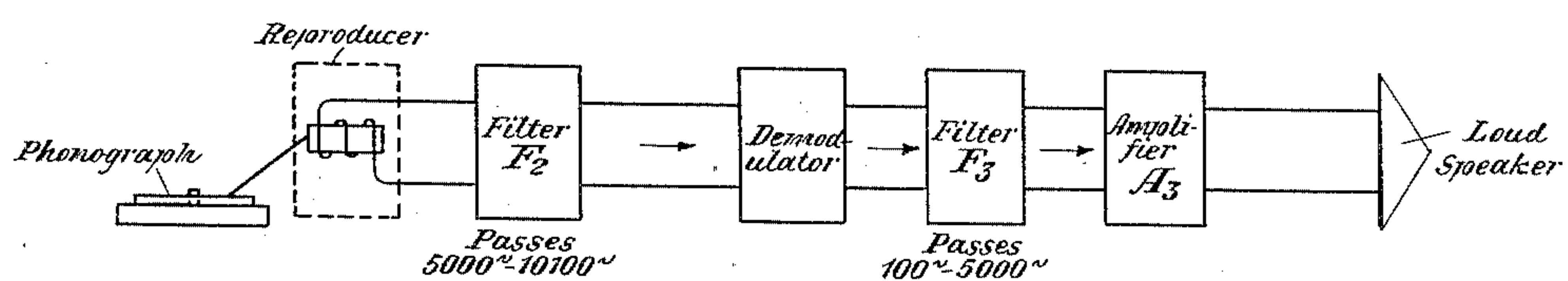


Fig. 2

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UNITED STATES PATENT OFFICE.

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RECORDING AND REPRODUCTION OF SOUND WAVES.

Application filed November 10, 1927. Serial No. 232,451.

This invention relates to the recording and reproducing of sound waves, and more particularly to methods and means for recording sound waves electrically on a record and electrically reproducing the waves with a phonograph.

In recording speech and music involving a frequency band of 100 to 5,000 cycles on a phonograph record, and reproducing the speech and music from the record, a difficulty in obtaining reproduction of satisfactory quality is encountered at the reproduction end of the system, where noise is introduced because of the physical contact between the needle and the record. The principal object of this invention is to eliminate this noise or "needle scratch".

The advantage found in the attainment of this object, and various other advantages of the invention, will appear in the following description.

The apparatus and the methods of this invention are modifications of the apparatus and methods disclosed in my copending application filed as of even date herewith and given Serial No. 232,450.

It has been found experimentally that most of the noise known as "needle scratch" occurs below a frequency of approximately 5,000 cycles. In general, the method employed by the applicant in accordance with the present invention for avoiding such noise consists of modulating a carrier wave with the voice or other signal to be recorded and reproduced, cutting the record with the carrier and a side-band, reproducing the carrier and side-band and demodulating at the reproducing end to restore the original signal.

The invention will be more clearly understood when the following detailed description of a desirable embodiment thereof, and the recording and reproduction methods involved, is read with reference to the accompanying drawing. The drawing shows schematically the apparatus and circuit arrangements by which the applicant's object is accomplished. Figure 1 of the drawing shows the recording end of the system, while Fig. 2 shows the reproduction end.

With reference to the details of the drawing, there is transmitted from a transmitter or other signal source signals covering a frequency range of 100 to 5,000 cycles, for instance. These signals are passed through an amplifier A_1 and into a modulator, where they

are caused to modulate a carrier of 10,000 cycles from an oscillator. The output of the modulator is then passed into a filter F_1 , which passes frequencies from 5,000 to 10,000 cycles, for instance, thus passing the carrier and a side-band and excluding substantially all other frequencies. The carrier and the side-band may then be amplified in an amplifier A_2 , and by means of any suitable record-cutting device the record is cut with the carrier and side-band frequencies.

At the reproduction end of the system an electrical phonograph and reproducer sets up in the circuit the carrier and side-band frequencies at which the record was cut. In the reproduction, however, there may be introduced the "needle scratch" frequencies, which, as stated above, lie for the most part below 5,000 cycles. In order to eliminate these noise frequencies a filter F_2 is introduced into the circuit, this filter passing only the frequencies from 5,000 cycles to, say, 10,100 cycles. These carrier and side-band frequencies are then fed into a demodulator, and the original signal is restored. A filter F_3 may be introduced, as indicated in the drawing, which passes only the frequencies from 100 to 5,000 cycles, thus eliminating the carrier and any other undesirable frequencies which may be present. The resultant waves may then be passed through an amplifier A_3 and on to a loud speaking receiver.

While the invention has been specifically described for the purpose of illustration, it is to be understood that its scope is not limited by such description but is defined in the appended claims.

What I claimed is:

1. The method of recording and reproducing sound waves which consists in modulating a carrier wave with the original waves, recording the carrier and a side-band produced by said modulation, reproducing the carrier and the side-band, eliminating after reproduction all frequencies outside the range of the carrier and the side-band, and demodulating the combined carrier and side-band to restore the original waves.

2. The method of recording and reproducing sound waves varying in frequency over a band of approximately 100 to 5,000 cycles per second which consists in modulating a carrier wave with the original waves to produce a side-band having a lower limit of ap-

proximately 5,000 cycles per second, recording the carrier and said side-band, reproducing the carrier and the side-band, eliminating after reproduction all frequencies outside the range of the carrier and the side-band, and demodulating the combined carrier and side-band to restore the original waves.

3. In a system for recording and reproducing sound waves, means for combining the original waves with a carrier wave, means for recording the carrier and a side-band produced by said combination, means for reproducing the carrier and the side-band, means for separating the carrier and the side-band frequencies from any other frequencies produced in said reproducing means, and demodulating means for restoring the original frequencies.

4. In a system for recording and reproducing

ing sound waves varying in frequency over a band of approximately 100 to 5,000 cycles per second, means for converting the original sound waves into electrical waves, means for combining said electrical waves with a carrier wave to produce a side-band having a lower limit of approximately 5,000 cycles per second, means for recording the carrier and said side-band, means for reproducing the carrier and the side-band frequencies, means for separating the carrier and the side-band frequencies from any other frequencies produced in said reproducing means, demodulating means for restoring the original frequencies, and means for reconverting the resultant waves into sound.

In testimony whereof, I have signed my name to this specification this 9th day of November, 1927.

CHARLES H. FETTER.