NEW MOTION PICTURE APPARATUS

During the Conventions of the Society, symposiums on new motion picture apparatus are held, in which various manufacturers of equipment describe and demonstrate their new products and developments. Some of this equipment is described in the following pages; the remainder will be published in subsequent issues of the Journal.

THE RESONOSCOPE*

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Since the beginning of music there has been a vital need for a device that will provide an accurate means of tuning musical instruments. As the science of music has progressed, this need has become more urgent. The "resonoscope" is one

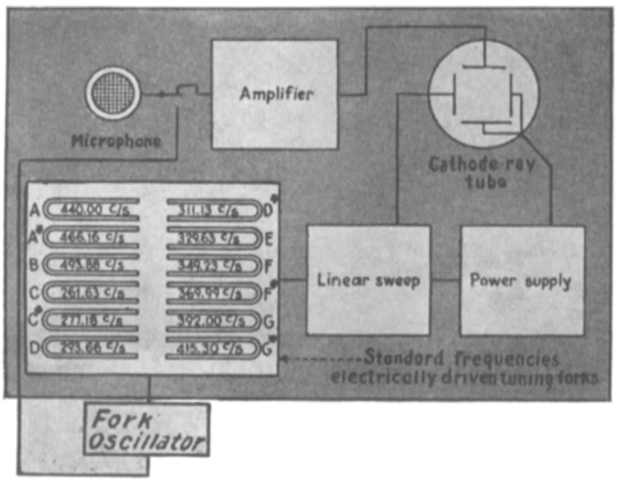

FIG. 1. Schematic diagram of the resonoscope.

answer to this demand and because of its simplicity of operation it is particularly useful to musicians and artists as well as to tuners and engineers. To those who are familiar with the design and function of cathode-ray tubes and cathode-ray oscillographs, the instrument will appear as a special application of the cathode-

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ray tube. However, much development was necessary before the device reached its present state of perfection.

The resonoscope consists of a special cathode-ray oscillograph, an instrument which records oscillations of electric currents, and a standard set of musical frequencies consisting of the twelve notes of the chromatic musical scale. These frequencies which are produced by twelve electrical tuning forks, are used to synchronize an oscillator which provides the horizontal sweep for the cathode-ray tube. A microphone and voltage amplifier picks up music or a single musical tone and the output of this amplifier is connected to the vertical plates of the cathode-

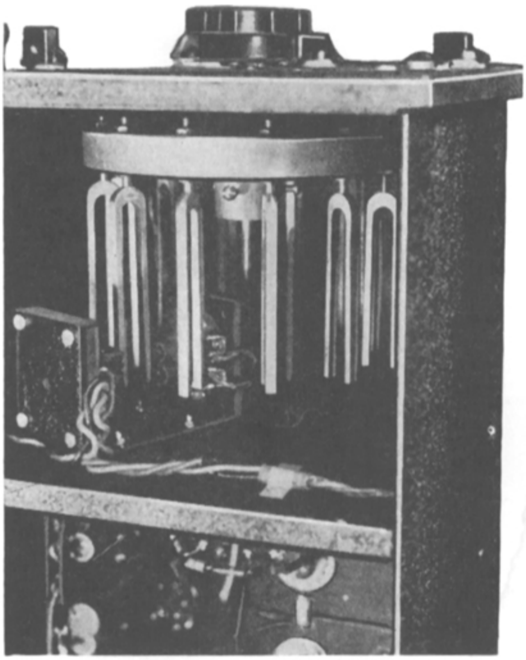

FIG. 2. Internal view of the tuning forks.

ray tube. Fig. 1 shows the arrangement of the various elements of the resonoscope.

This gives a visual picture of the wave-form of the music notes under observation. If the musical note is of the same pitch as the predetermined standard being used, or any harmonic of it, the wave will appear to stand still on the screen of the cathode-ray tube. If the note is flat, or lower in pitch than the horizontal sweep standard, the wave will appear to move to the left. If the note is higher in pitch, or sharp, the wave will move in the opposite direction. This indicates to the musician whether he is playing in tune, sharp, or flat. The speed with which the

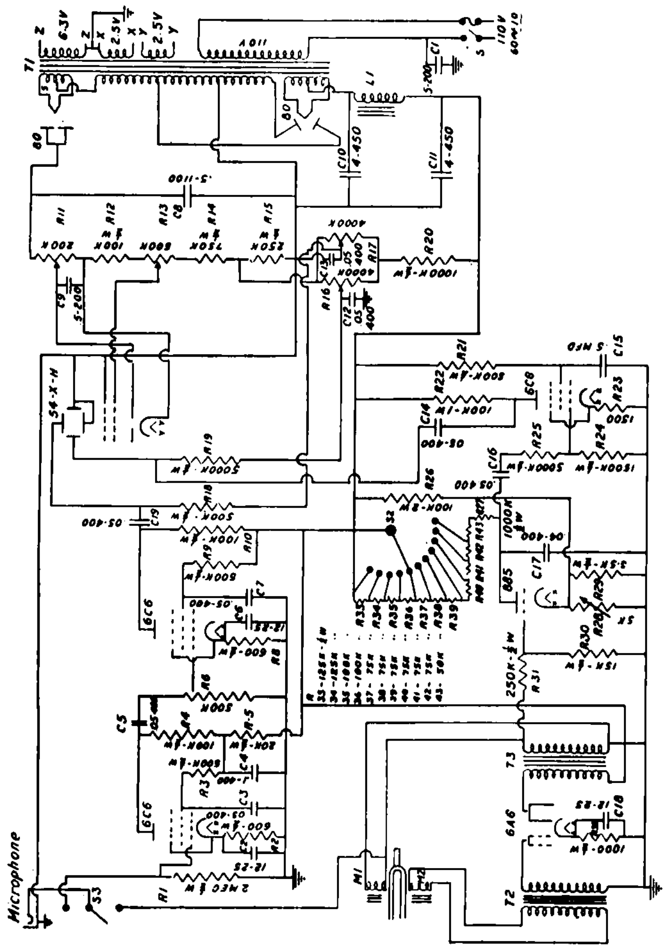

FIG. 3. Wiring diagram.

wave moves across the screen is a direct indication as to what extent the instrument is out of tune.

Any of the twelve standard frequencies used in the instrument may be selected, one at a time, by simply turning the control knob on the front of the panel to the frequency or note desired. These twelve frequencies represent the twelve notes of the scale and each setting of the control will accommodate all octaves of that particular note. Fig. 2 shows the arrangement and method of mounting the standard tuning forks in the instrument.

The resonoscope is so designed that the horizontal sweep circuit is automatically changed in frequency to compensate for the change in frequency in going from one

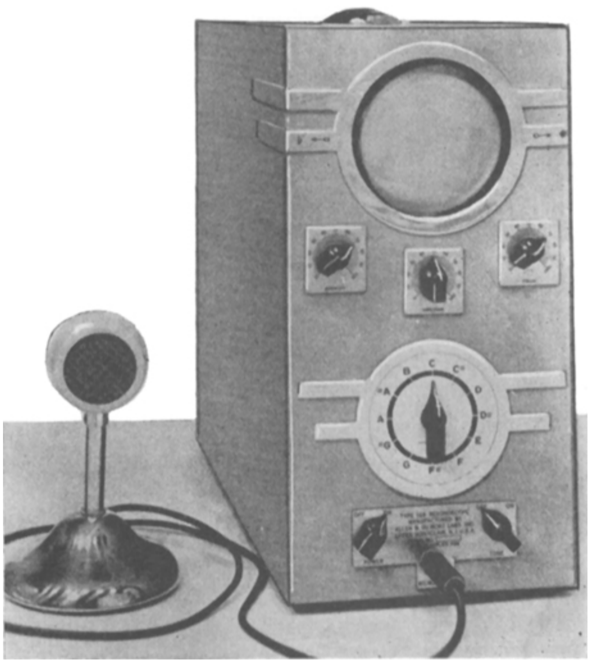

FIG. 4. The resonoscope.

note to another. This allows the sweep circuit to be easily synchronized at all times by the standard frequency of the tuning forks and assures the observer that the number of waves on the screen of the cathode-ray tube is a direct indication of the octave being played or tuned. The frequencies are calculated for the tempered scale, which is universally used for all types of tuning.

The pitch of the note A is 440 cycles per second, which is the most widely accepted pitch standard for tuning. Although 440 cycles per second is the frequency used in the standard resonoscope, any frequency may be substituted as desired. To provide a high degree of accuracy, a frequency counter or pitch standard was installed in the DuMont Laboratories for testing the resonoscope in production. The tuning fork employed was checked at frequent intervals against the 440-cycle tone signal transmitted daily by the Bureau of Standards through station WWV. The tuning forks were electrically driven and their respective frequencies picked up electrically, amplified, and made available for any circuit. In the case of the frequency counter, the given standard frequency from the master tuning fork is caused to beat against an unknown frequency of a tuning fork or musical instrument under test. The beat note, or frequency difference, causes the dial of an electromagnetic counter to indicate the number of cycles of difference between the standard and the test tones in any given interval of time. The cathode-ray oscillograph provides a visual indication of the beat frequency and shows whether the test tone is sharp or flat with regard to the standard. The test tone is picked up electromagnetically in the case of the tuning fork, or by means of the microphone in the case of a musical instrument. The main purpose of the frequency counter is to check the resonoscope or cathode-ray musical pitch standard and comparators. The equipment is capable of counting down to one cycle difference per minute. Fig. 3 is a detailed wiring diagram of the complete instrument.

To the non-technical musician who has little or no interest in the theory and operation of the resonoscope, it suffices to say that the resonoscope is so constructed that any one can operate it and use it in tuning musical instruments about as simply as one can tune in a station on a radio receiver. The front of the instrument showing the cathode-ray tube and the controls is shown in Fig. 4.

The only other practical instrument the authors know of for determining pitch is a rather elaborate device which works on the stroboscopic principle, developed by C. G. Conn, Ltd. of Elkhart, Indiana, known as the "Chromatic Stroboscope." This device is also useful for tuning musical instruments and gives a visual indication as to what extent a note is sharp or flat.

Because the instrument makes the pitch "visual" as well as audible, it is extremely valuable in developing a more accurate sense of pitch, and makes it possible to determine the degree of sharpness or flatness. When used for voice analysis, the actual form of the voice waves reproduced on the viewing screen makes it possible to observe the harmonic content of the voice. If the student is adept in holding a note at constant pitch and amplitude, a photograph may be taken for further reference and study. The instrument also gives an indication of both the pitch and vibrato.

Manufacturers of musical instruments have found the resonoscope a useful aid in producing and testing their instruments. Manufacturers of string instruments can use the resonoscope to test the character of the string. For experimental purposes with musical instruments, pitch changes and variations in timber resulting from the use of various metals, constructions, shapes, and sizes can be observed with the instrument. It also provides a means of determining how well an instrument retains its pitch. The resonoscope has been used extensively in tuning and voicing the pipe organ, and, in the recording field, for measuring flutter in film, disk, and magnetic tape recording and reproducing equipment.