3.15 TUBELESS AUDIO OSCILLATOR. When a germanium diode is connected in the "back direction" (that is, with its cathode to the positive dc power supply terminal) in a suitable circuit, it will oscillate, provided the applied dc voltage is high enough to reach the negative resistance region in the reverse-conduction curve of the crystal.

An audio oscillator circuit applying this principle is shown in Figure 3-15. The constants of this circuit are such that the frequency of oscillation is approximately 1200 cycles. The frequency may be increased by decreasing the capacitance of the capacitor, and may be lowered by increasing the capacitance. This circuit delivers an output of about 30 volts r.m.s. across a pair of 2000-ohm headphones.

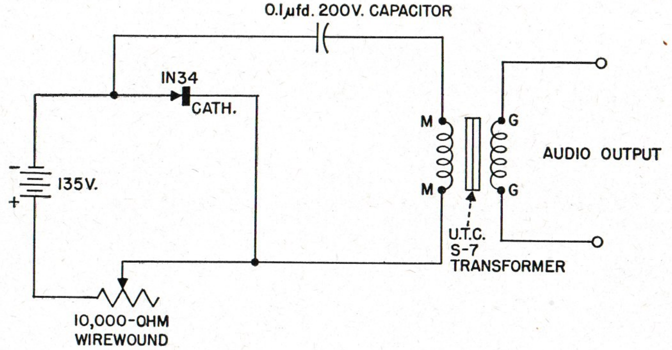

Figure 3-15. TUBELESS AUDIO OSCILLATOR

Adjustment of the oscillator is very simple: Rotate the 10,000-ohm potentiometer until the point is reached at which the circuit breaks into oscillation. Then, reduce the potentiometer setting slightly.

This oscillator is suitable only for intermittent use, such as it might receive in signal injection or signal tracing in audio amplifier testing, or as a code practice oscillator. Sustained operation of the crystal in its oscillating negative resistance condition produces appreciable internal heating and will ultimately destroy the unit. Nevertheless, this circuit will be found extremely useful, especially for applications requiring a miniature instrument.

3.16 CRYSTAL DIODE WAVE SHAPER. In various forms of radio and electronic testing, it is desirable to have a signal consisting either of positive peaks only, negative peaks only, or square waves. Pulse generators for producing special signals of these types are complicated equipment and therefore costly.

The circuit illustrated in Figure 3-16 takes a sine-wave signal, which may be obtained easily from an audio oscillator or from a stepdown transformer operated from the ac power line, and converts it into either one of the special signals described above. While pulses obtained in

this manner are not perfect, they will be suitable for a wide variety of experimental work.

Operation of the circuit is based upon the *clipper* or *limiter* principle. When both switches are open, the output voltage of the device has the same sine-wave shape as the input signal (See pattern A). When switch S_2 is closed and S_1 opened, the first crystal diode and 1½-volt cell clip the negative peaks from the input signal and deliver an output signal consisting almost entirely of positive peaks (See pattern B). When

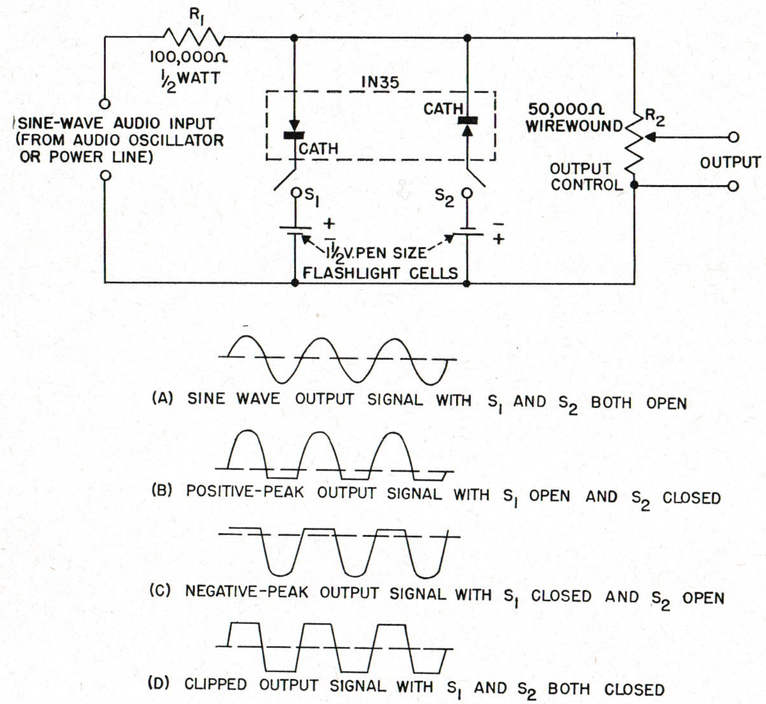

Figure 3-16. CRYSTAL DIODE WAVE SHAPER

S_1 is closed and S_2 open, the second diode and cell clip the positive peaks from the input signal and deliver an output signal consisting almost entirely of negative peaks (See pattern C). When both S_1 and S_2 are closed, positive and negative peaks are both clipped and the output signal is very nearly a square wave. (See pattern D). Best squareness will be obtained when the input signal is at least 30 volts r.m.s.

Potentiometer R_2 is an amplitude control for adjusting the strength of the output signal to suit individual conditions.

When the device is not in use, both switches must be thrown to their *open* position to prevent battery drain through the crystals.