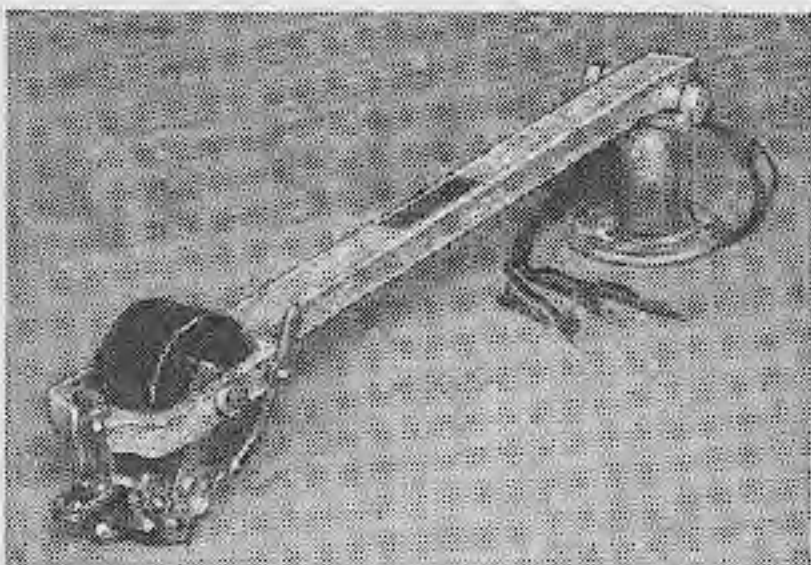




The recording machine shown in the center of the photo is that designed and built by the Universal Microphone Company and handles full-sized records. The lead-screw propells the recording head across the record so that it can cut the grooves as it moves along. The magnetic pick-up is shown at the rear of the machine and the headphones serve as a monitor.

● THERE is a fertile field in short wave radio which has not, so far, been paid much attention by the average listener. This field is home-recording of programs from short-wave stations. Home-recording offers many possibilities, novel and useful. How many times has a short-wave "fan" wished to convince skeptical friends of his prowess in bringing in "foreign" programs on his short-wave set, only to find that with visitors present, receiving conditions are "hopeless" so far as foreign reception is possible?

With home-recording the embarrassment suffered by the "fan" can be dispensed with, for, even if conditions are poor the triumphant listener can bring forth a record of a "foreign" station which he made *when reception was good*. In the face of such proof a skeptic has no alternative but to admit defeat. In addition to satisfying one's ego, home-recording offers the means to capture, for permanency, some interesting event or some item of sentimental or humorous value to the listener. A



Special Universal recording head for the more "ambitious" short-wave fan; this head actually cuts the groove in the record, a lead-screw propelling it across the disc.

Recording of short-wave programs is rapidly becoming more popular; practical hints are given here on how to do this. Recording apparatus is available to suit practically every purse; you can start in by simply using an ordinary magnetic pick-up and pre-grooved records. Record that "foreign" station and prove to your friends that you actually received it!

case in point was the recent marriage of the son of the King of England to Princess Marina of Greece. The entire ceremony was broadcast on *short waves* to the "whole world" from Daventry. The listener who was foresighted enough to make a recording of this event has a unique souvenir for the years to come. A third possible use of home-recordings is to use them as verification seeking letters. Instead of copying down the items heard and writing in for a verification, make a home recording of the program on a small disc and send the disc, together with a special needle and instructions for playing it. The station will not only be satisfied with your "proof" of reception, but will be pleased to get a first-class idea of how their station is being received abroad. The cost of such a "veri" is higher than merely writing it on paper,

but it is sure to achieve results, since 99 per cent or more of all s-w stations use phonograph records on their programs and will find it a simple matter to play back the record. In one authenticated case in which a listener in Chicago made a record of a musical program from Australia and sent the record to the station, the listener was surprised to hear the same station several months later playing his record over the air and mentioning the fact that he had sent it to them! The ingenious experimenter can doubtless develop many more uses for home-recording. The ideas mentioned in this paragraph are given solely as the starting point for individual initiative.

#### Several Methods of Recording Programs

There are several methods of making



The RCA Victor store type recorder, model R92, is equipped with "mike" amplifier and motor.

phonograph records at home which are suitable for use with equipment available to the average layman. As with everything else there is equipment to meet everyone's purse. The more expensive equipment, as would be expected, gives superior results but even with simple, inexpensive equipment results may be secured which will please even the most skeptical. The simplest method makes use of an ordinary electro-magnetic phonograph pickup which is used to reproduce standard records through the amplifying system and loud-speaker of the ordinary radio set. Many listeners have phonograph pickups which may be used but if the listener has none one can be procured from a radio supply house or dealer at a price of from two to fifteen dollars, depending upon the quality. The pickup must be of the magnetic type; crystal or condenser type pickups are not suitable. To make a home-recording with this equipment the pickup is used as a recording head (a recording head is a device which converts electric impulses from a radio set into mechanical motion, which is in turn impressed on a soft record in the form of grooves on the surface of the record). A blank *pre-grooved* record is required. There are two types of recording discs available, *pre-grooved* and *un-grooved*. The *pre-grooved* record is supplied with *unmodulated* grooves to permit the recording head to follow a spiral path when recording. The recording head modulates these grooves so that when the record is "played back," music, etc., will be heard. The *un-grooved* record is superior in that there is less *needle scratch* heard when playing a finished record and more faithful reproduction is obtained. The *un-grooved* record requires a *feed-screw* mechanism to cause the recording head to travel over the surface of the record while recording; it is naturally a more expensive mechanism. (It is described in greater detail in a later paragraph.)

**Simplest Method**

The pickup is connected to the *output* of the radio set through a suitable "matching" transformer, a special recording needle is placed in the pickup and the *pre-grooved* disc is placed on the turntable of the phonograph. When a program is tuned in on the short-wave set and the volume turned up to a little more than average room volume, the needle in the recording head will vibrate to the electrical impulses from the radio set. The recording head is placed at the beginning of the record. A weight must be placed on the recording head while recording; the proper weight for recording on aluminum blanks is about 10 to 14 ounces, on composition blanks (such as RCA Victor home-recording blanks) the proper weight is around 10 ounces. When the turntable is started and the record is rotating at the proper speed (78 r.p.m.) place the recording head on the starting groove of the record. The program that is being received on the receiver will be recorded on the disc, providing that the volume is sufficiently great.

The composition type of record requires a much louder signal for a good recording than does the aluminum. For this reason an amplifier with a undistorted output of at least 2 watts is necessary. A larger amplifier is preferable for superior results; this amplifier should be capable of delivering a

(Continued on page 618)

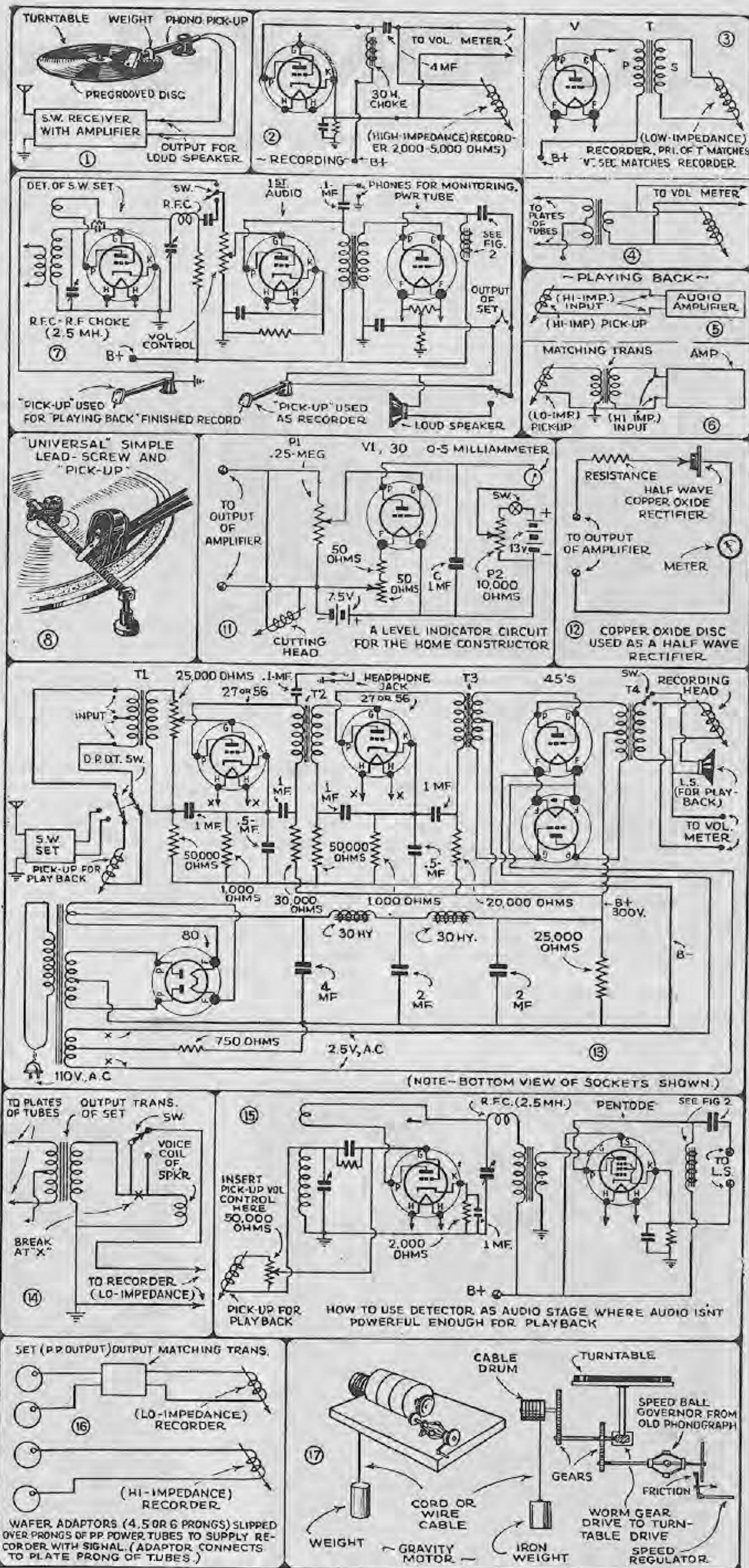


Fig. 1—Using magnetic pick-up and "pre-grooved" disc for recording short-wave programs. Figs. 2, 3, and 4—Various hook-ups for "recording." Figs. 5 and 6—"Playing back" hook-ups. Fig. 7.—Use of two magnetic pick-ups for "recording" and "play-back." Fig. 8.—Simplest "Universal" lead-screw and recorder pick-up arm. Figs. 11 and 12—Volume "meter" hook-ups. Fig. 13—Complete power amplifier for "Recording" and "play-back." Fig. 14—Switching "recorder" and "speaker." Fig. 15—Using detector as audio stage "booster." Fig. 16—Using "wafers" to attach recorder to audio output tube. Fig. 17—"Gravity" motor for recording.

## Record Foreign Programs

(Continued from page 587)

signal which will fully load up the last stage to its rated output. A careful check on the *volume level* should be kept while recording, for if the signal is too strong the needle will jump from one groove to another, and if the signal is not strong enough a weak record will result. A little experimentation at different volume levels and with slightly different weights on the recorder will soon show the experimenter the best arrangement. Fig. 1 shows the arrangement of the equipment for this simple recording set-up. It is important that the recorder's impedance is matched to the impedance of the output of the receiver. This can be done by several methods as illustrated in Figs. 2, 3, 4. For "playing back" the finished record, the pick-up is connected to the *input* of the audio system of the set (see Figs. 5, 6) a special play-back needle is inserted in the pick-up and the record is then played in the ordinary manner. No weight is used on the pickup when *playing back*.

Fig. 7 shows a complete set with provision made for "cutting in" the pickup for *playing back* and for recording.

### Best System Uses Feed-Screw

A more expensive method of recording uses a *feed-screw* mechanism and *un-grooved* records. The feed-screw guides the recording head and grooves the disc while recording. This method is more satisfactory in that better quality recordings with less *needle scratch* are obtained. Recording can be done on either aluminum, celluloid or acetate-coated aluminum. For general use aluminum and coated aluminum are most satisfactory. These two types require entirely different types of needles for recording. Recording on aluminum requires a weight of about 10-14 ounces on the recorder, while recording on the coated aluminum requires but 1 or 2 ounces pressure. The coated record gives a higher degree of fidelity with slightly more surface noise.

When the aluminum records are *played back* it is necessary to use a fibre or cactus needle. The acetate-coated aluminum records require either a fibre, cactus or an acetate-steel needle for playing back. The composition records are played back with the special blunt red-shank needle made especially for them. This needle may be used for recording on the pre-proved composition blanks as well as for *play-back*. Figs. 8 and 9 show how a feed-screw mechanism is used for recording. In playing the finished record it is *not* necessary to use the feed-screw, as the record is then grooved properly. The recording head should not be used for playing back. A separate pickup is necessary for playing back. The cheapest recorder with feed-screw in the open market costs around \$25. To this must be added the cost of the pickup (unless the experimenter already has one). (Fig. 9.)

### Strong Motor Needed for Recording

In all recording it is essential that the turntable motor, whether it be of the spring, electric or gravity type, should possess sufficient power to permit the turntable to revolve at a *steady* speed while recording. Considerably more power is required for this than in ordinary playing back of records due to the fact that the recorder is weighed down and is also forming grooves in the record. A commercially available unit consisting of a powerful electric motor and turntable, a recording head and feed-screw, a separate pickup and a volume indicating meter, all mounted in a special case is illustrated in Fig. 10. Such equipment will range in price from about \$55 to \$200.

A *volume-indicating* meter is a very useful and important accessory in recording. It can be in the form of a vacuum tube voltmeter (see Fig. 11) or may be a 0-1 milliammeter with a small meter type oxide rectifier in series with it, together with a series resistor (see Fig. 12). The series resistor value should be near the value of the impedance of the cutting head. For

example with a 4000-ohm recorder a 3000-ohm resistor will be found suitable. The vacuum tube voltmeter while more expensive to build is more satisfactory as it draws no current from the recorder. The oxide rectifier type on the other hand will reduce the output of the recorder when connected across it and make necessary an increase in the volume level of the amplifier to compensate for it.

### Recording Needles

In recording, sapphire needles or sometimes diamond point needles are used. In recording on ungrooved aluminum a sapphire needle which makes an angle of between 25 and 28 degrees with the vertical is used. For recording on pre-grooved aluminum and composition discs, a sapphire needle with slightly duller point is used. For recording on acetate-coated and celluloid records, a very hard sapphire point (chisel point) needle, making an angle of 2 degrees with the vertical is used. These needles are supplied with bent shanks to secure the proper angle.

### Details of Powerful Amplifier

For those who do not possess a sufficiently powerful amplifier for *recording* the circuit of a suitable amplifier with all values is given in Fig. 13. The *output* of the detector of the s-w. set is connected at the *input* of the *amplifier*. The recorder is connected to the output of the amplifier; in *playing back* the pickup is connected to the amplifier *input* in place of the s-w. set by a switch, and the loud-speaker is connected to the output of the amplifier. When *recording*, the speaker may be disconnected and a pair of headphones plugged in the phone jack of the amplifier for listening or "monitoring."

The average phonograph pickup has a high impedance and may be connected across the primary of the output transformer for *recording*. Some recording heads are of high impedance also and may be similarly connected. If the pickup used for recording is of the low impedance type (10 to 500) ohms, or if a low-impedance recording head is used it will be necessary to secure a *matching transformer* to connect the recorder to the output of the set or amplifier (see Figs. 3 and 4). If the experimenter is using a powerful receiver which requires no additional amplifier and which contains a dynamic speaker, it may be possible for him to ascertain from the manufacturer the impedance of the voice coil of the loud speaker. (This generally ranges from 1-20 ohms.) Knowing this impedance it should be possible to secure a pickup for use as a recording head, or a special recording head, whose impedance is identical to the voice coil of the speaker. If this is the case the recording head may be connected in place of the voice coil of the speaker and a perfect match secured. It should be noted in this case that the voice coil of the speaker must be disconnected while the recorder is connected, in order to obtain best results. Fig. 16 shows how to use wafer adapters for attaching or connecting recorders to pins of output tubes. (See Fig. 14.)

## Short Wave Scouts

(Continued from page 595)

- lays WCAU—heard daily, in evenings.
- W3XAU—Philadelphia, Pa.—31.28 meters—relays WCAU—heard daily in afternoons.
- W8XAL—Cincinnati, Ohio—49.50 meters—relays WLW—heard in mornings and near 12 p.m.
- W8XK—Pittsburgh, Pa.—13.97 meters—relays KDKA—heard irregularly in morning.
- W8XK—Pittsburgh, Pa.—19.72 meters—relays KDKA—heard regularly in mornings.
- W8XK—Pittsburgh, Pa.—25.27 meters—relays KDKA—heard regularly at 5 p.m.
- W8XK—Pittsburgh, Pa.—48.86 meters—relays KDKA—heard daily every evening.
- W9XAA—Chicago, Ill.—49.34 meters—relays WCFL—heard irregularly on Sunday.
- W9XF—Chicago, Ill.—49.18 meters—relays WENR—heard daily every evening.
- CJRX—Winnipeg, Canada—25.5 meters—Canadian Radio Commission programs—heard evenings.