

# Home Recording of Radio Programs and Speech

By R. D. WASHBURN

**Y**ESTERDAY you bought your phonograph records; today, you make your own. That is, you do so if you have purchased one of the new radio sets which include that little 4-way switch marked "radio, phonograph, radio-recording, home-recording."

In fact, the wonders of home-recording are now available also to anyone purchasing one of the recently-marketed home-recording "kits," intended for use in conjunction with a standard radio set and phonograph.

An example of the complete ensemble of radio, phonograph, and home-recording equipment, is illustrated in Fig. A. This is the Radiola "86" (electrically equivalent to the General Electric "H71"; Westinghouse "WR-7"; Graybar "900"); its radio chassis is wired substantially as shown for Radiola "80" in Data Sheet No. 29 (November, 1930, issue of RADIO-CRAFT). In addition to a tone output control, there are the following units: hand microphone, phonograph turntable and motor, electromagnetic pickup, and a switching system whereby the same pickup (equipped with a special blunt needle) may be shifted, from the usual reproducing position at the *input* of the audio amplifier, to the *output* of the audio amplifier for recording.

As previously mentioned, a kit of necessary additional parts may be obtained for home-recording where the radio set and the phonograph are already available. Such a set of components is illustrated in Fig. B.

## Pioneer Electrical Recording

This is a far cry from the famous home-recording work of Charles E. Apgar, the "pioneer home-recorder," who, in October, 1913, recorded his first radio transmission; "press" from the Herald station. An elec-

trical amplifier, working on the principle of the microphone, was used in this work. A picture of the apparatus is shown in Fig. C.

Two years later, Mr. Apgar's records, made for the United States Government, resulted in putting WSY, the huge code station at Sayville, L. I., off the air; after it was seen that irregularities existed in its wartime transmissions to station POZ

**H**OME-RECORDING is the latest adjunct to radio and has already reached a commercial stage such that the radio dealer and the independent Service Man can now cash in on this new feature.

Home-recording is likely to take the country by storm, as soon as the public awakens to its possibilities. Parents would like to preserve the voices of their children—and children in turn will be anxious to preserve the voices of their parents and grandparents; so that the spoken word will remain after the little folks have grown up, or the old have gone.

A good deal of money can be made by installing such home-recording sets in homes; and the present article—the first of an authoritative nature to appear in any radio publication—brings together under one head the better-known recording apparatus now on the market.

in Nauen, Germany. It is interesting to observe the comment of Dr. Karl Georg Frank, general manager of the Atlantic Communication Company (Telefunken), under date of July 18, 1915: "The statement



Fig. A

The "Radiola 86" combination radio-phonograph with home-recording attachment and tone control; a 4-way switch selects the service. The young lady is making an "audio snapshot."

that Mr. Apgar can record messages sent out by wireless on a phonographic cylinder is hardly worth discussing. That is physically impossible. I have never heard of its being done. If Mr. Apgar has accomplished it he should get his idea patented and perhaps we will buy it." (!)

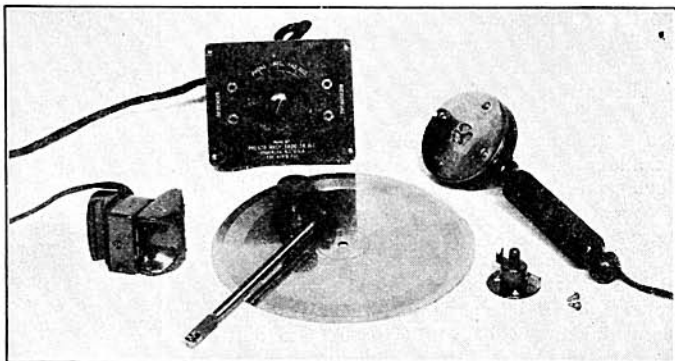
That the "physically impossible" now may be accomplished by anyone is a result of the following present-day developments: audio power amplifiers; an electromagnetic pickup which may be connected to the output of an audio amplifier, and thus driven as a recorder (as well as to the *input*, for reproduction); inexpensive metal and cellulose record blanks.

Of course, it has always been possible to make personal recordings, of a sort, simply by shouting through a megaphone and into the "flare" of an ordinary phonograph. That type of recording was done with the earliest phonographs. But "electrical recording," now so convenient to everyone, results in greatest volume and quality with least "needle scratch."



Fig. B

The "Presto" home recording kit (pictured in detail at right); the recording head is being put in operating position. A popular make of modern radio is the "accessory."



A complete kit of parts for use with any radio-phonograph combination; this includes a heavy recording head (leather V-way at left of needle-holder); hand microphone; ungrooved Emerson-Wadsworth double-faced record blank; feed-rod and center-post clamp; end-rest; and, in the background, the 4-way circuit-changing switch-box, provided with tip-jacks for recorder and microphone leads.

### Method of Operation

Naturally, the better is the audio amplifier, the better will be the recording and the reproduction; and, where a radio program is the subject of perpetuation, the greater will be the need for near-perfection in the R.F. and detector units.

The choice of microphones used for personal recordings, too, is a most important consideration. Replacing a low-priced "mike" with one of better design will result in much better records.

In this connection it might be mentioned that microphone technique, as practiced by the most successful artists on the air, is a desirable study when the best results are wanted. Even a poor "mike" may be made to do wonders, in the hands of a person who understands its characteristics and use.

The circuit arrangements used by different instrument makers are not identical in every instance; but the general scheme of each recording system is shown in Fig. 1. Where an automatic switching system is not used, the following circuit variations may be noted. The tip jacks J1 are provided on most sets, in which they are marked "Phono. Pickup," or just "Phono." Two other tip jacks, J2, should be connected to take the output of the last stage of A.F.

Now we are ready to put the home recorder into operation. The first thing to be decided is whether a radio program or a personal recording is to be made. If the choice is for radio, the R.F. chassis is adjusted for best response from the selected station; while, if the recording is to be personal, a microphone is wired into the input circuit of the detector or first A.F.

Next, a phonograph pickup or a specially designed recorder is connected to the output of the audio amplifier, at J2; and the turntable started. Whether the recorder is to be connected to the primary or the secondary of the output transformer will depend upon the design of the "recorder."

### Types of Pickups

For instance, the 3-lb. "Presto" recorder is specially designed to connect across the low-resistance voice coil of a dynamic reproducer, as shown in the illustration. The "Audak" phonograph pickup is obtainable with an 18-oz. weight fastened to it for recording, and this pick up (now to be used as a recorder of the high-resistance type) is to be connected across a high output impedance, such as the primary of an output transformer. Whether pickups of other makes require to be weighted for recording is best determined by trial. The R.C.A. pickup, is weighted for recording, but the weight is only about eight ounces.

On completion of the record, the set may be detuned, in the one instance, or the "mike" disconnected, in the other; and the recorder is then disconnected from J2.

If this same recorder is now to be used as a reproducer or phonograph pickup, it is connected to the tip-jacks J1; otherwise, a standard pickup, provided in some instances, is connected here and the record played back.

Obviously, a switch may be arranged to make these circuit changes when shifting from recording to play-back; or this may be accomplished manually by shifting leads. The switch idea has been applied by R.C.A.;

the single pickup being used as a "duplex." The switch for circuit-changing is used also in the "Sentinel Chromatrol"; a special electromagnetic "recording head" is carried along a threaded rod for the purpose of cutting a groove in each blank record and inscription, and a regular phonograph electromagnetic pickup is used for play-back.

A complete kit product is the "Presto" illustrated on the cover of this issue. An electromagnetic "recording head" is carried on a threaded rod for grooving and inscribing ungrooved records.

An interesting feature, which lends greatly to the convenience in use, is the manner in which the recording head is arranged to engage the threaded rod. A pad of leather separates the head from the rod; but, at the same time, the threads sink into this

cause little difference in quality of the recording. As the illustration shows (Fig. B), a small box, having a switch marked "Phono.—Mic.—Radio—Rec." is supplied for switching circuits; a hand microphone, with off-on switch, is also provided.

Several models in the "Audak" line of pickups are recommended by the makers as suitable for recording purposes, when the suspension arm is loaded with an 18-oz. weight. The "Musichrome" unit, made by the same concern, is suitable for use where a radio is available but not a phonograph; for it includes a self-starting induction motor, turntable, and electromagnetic pickup. These are housed in a small walnut cabinet, measuring 11 x 11 x 7 in. high, and ready to be connected to a separate power amplifier or to a radio set.

### Records and Their Use

At the present time there are available record blanks of pre-grooved metal, un-grooved metal, and pre-grooved cellulose ("non-breakable," flexible black cardboard-like ones with a waxy surface). Some of the metal records (zinc, aluminum, or aluminum alloy) are single- and some double-sided; the cellulose discs are double-sided. The cellulose records, which will shortly be available in every town and hamlet in the country, through the efforts of the R.C.A., cost but a few cents. Like the metal records, their playing time is about one to three minutes; since they have a diameter of six to seven inches.

If the pickup suddenly cuts across the record, or keeps repeating at one point, it is probable that either the pickup is not properly placed, the wrong needle is being used, the record was not dusted off (to remove foreign particles) before the recording was started, or the audio system was allowed to overload the recorder and cause too great a lateral cut on a loud note.

If the reproduction of records made with weighted recorders is off-pitch, it is an indication that the motor is overloaded; and it will be necessary to speed up the turntable for the next recording. A little practice will indicate the correct positions of the turntable speed control for recording and for play-back. A "stroboscope" is another and more accurate solution of this problem; as this device will indicate exactly the instant when the turntable has reached its standard speed of 78 r.p.m.

Some of the records may be played back (ordinarily, 20 to 50 times) with the same



Fig. C

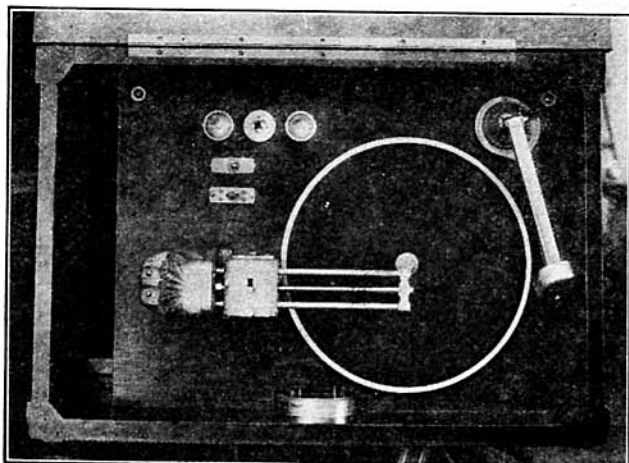
Mr. Charles E. Appar, the "radio detective," home-recording high-speed telegraphy from POZ in 1915. In appearance, the mechanism is similar to the familiar office dictaphones for stenographers; except that an electrical output is used in inscribing the wax "cylinders."

leather, grip it, and cause the head to be pulled along. Consequently, to remove the head for play-back with the regular pickup it is necessary only to lift it off the rod and set it aside; the acme of ease.

The winding of the recorder's electromagnetic, which is of low resistance, should be connected across the voice coil of a dynamic reproducer. Variations, within rather wide limits, are said by the manufacturer to

Fig. D

The "Sentinel Chromatrol." The 3-bar feed is supported at the center of the turntable, and moving the knob in the center of the recording head raises the needle from the record. Recessed switches in the top of the mounting board control the circuits for play-back, which is accomplished through the pickup shown in the upper right-hand corner. This assembly may be obtained complete with radio and remote control; at the moment, the "last word."





needle that was used for recording; others require a different needle, "soft," blunt, or fiber, for play-back.

A number of uses, both amusing and practical, for these records, should suggest themselves to the "home recordist."

For instance, it will be amusing to mail personal recordings to friends in lieu of a letter; and it would be most practicable to record "ideas" as they occur to you. In fact, these little "audio snap-shots" might prove very valuable at a later date.

The boy friend now can send the girl friend a *real* love letter.

Visitors will be delighted to make a short "personal recording" for you. And it is possible to record a radio program or personal act, more lengthy than a single record will hold; perhaps through the use of two turntables, two pickups duplexed for recording, and a potentiometer for "fading" from one to the other (as described in the

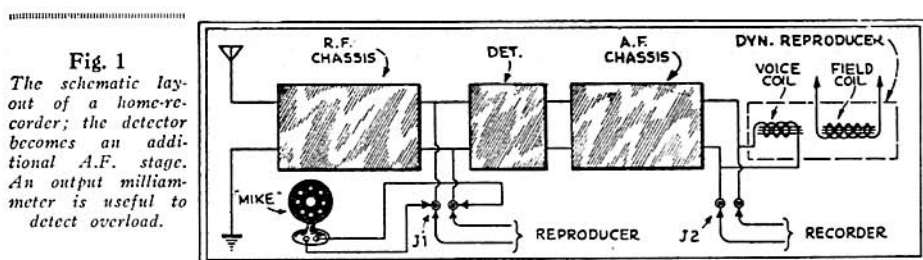


Fig. 1  
The schematic layout of a home-recorder; the detector becomes an additional A.F. stage. An output milliammeter is useful to detect overload.

March, 1930, issue of RADIO-CRAFT, page 455).

If you are using a public-address adopter of some sort (see the details of an excellent design published in the October, 1930, issue of RADIO-CRAFT, page 218), you may now make your own carefully-worded sales record for what might be termed "spot broadcasting," and rig it up with one of

these repeating mechanisms to play the record continuously in your absence.

Instead of sending to your radio prospects an ordinary circular letter concerning one of your special offerings, indicate to them that you are modern in your ideas and methods by sending them a personal recording, with the admonition, "Try this on your radio-phonograph."

## New Antennas "Directional" at High Angle

THE fairly-established theory of short-wave propagation, that the transmitted wave from a station divides into two parts—one following the curve of the earth, and the other traveling into the sky, whence it is again reflected from the Heaviside layer—has been extensively utilized in practical (commercial) telegraphy and telephony. For the very short waves used in communication between the two Americas, or between either and Europe, and from Europe to the Far East and Australasia, directional transmitting antennas have been erected, which serve as gigantic reflectors to concentrate the emitted waves in the direction of the special receiving stations, thousands of miles away. At the receiving stations, similar antennas have been erected, to pick up the received wave in proper phase on a great many wires. While the efficiency of these reflectors cannot be compared to that of a mirror in focusing light, they greatly increase signal strength. It is true that, because of their great size, they are not flexible. Once placed, an antenna covers only a certain sector; for each line of communications, a pair must be constructed, one at each end. But they have made possible reliable service at comparatively low cost.

With ultra-short waves, below five meters in length, the "ground wave" is practically eliminated; and, since the sky wave is apparently not reflected back to earth, it must be received on the way out to the horizon. With waves slightly longer, while the ground

wave does not cling to earth, the sky wave comes down again; and thus stations of low power are received at great distances.

Experiments have been made on short waves, to change the angle at which the wave is sent up into the sky, and thereby alter its "skip distance" (see Fig. 1); but the principle has only lately been borrowed from the short waves for use on the regular broadcast band.

In the new broadcast plant of the Westinghouse Co. at Saxtonburg, Pennsylvania, which incorporates Station KDKA and its associated short-wave transmitters, a novel idea has been applied—that of the "spray" antenna. The purpose of this is to eliminate, so far as possible, the ground wave; and to send out broadcasts in such a man-

ner that, while the field is weakened in the immediate locality of the transmitter (where it would be normally too strong for the comfort of the listeners) it is strengthened over a larger area. The principle is illustrated

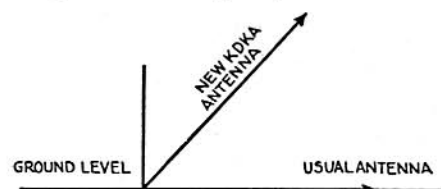
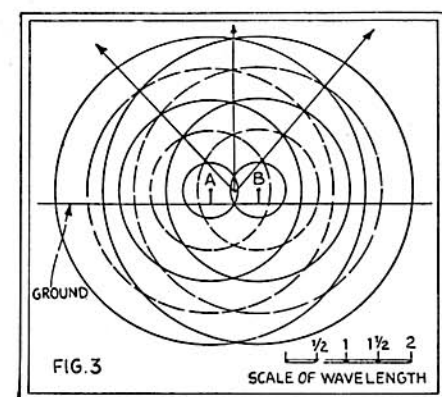


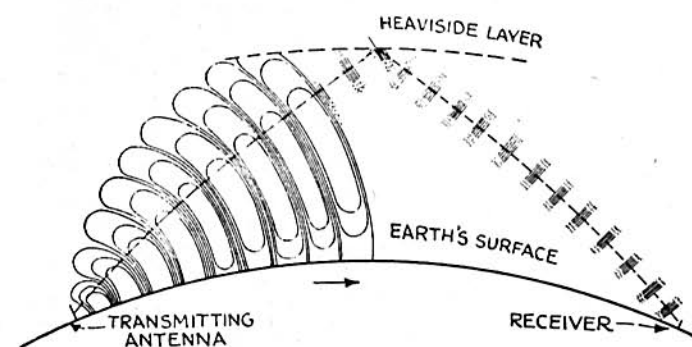
Fig. 2  
The purpose of the "spray antenna" is to project the sky wave at the angle to the horizon which will give the largest service area.



Above, a representation of the "spray" field; with antennas about a three-quarter-wavelength apart, the phases will be found strengthened between the angular lines.

Fig. 1 (left)

The progress of a radio wave and its division into a "ground" and a "sky" wave is indicated here; it is the "sky" wave which gives distant reception.



fundamentally in Fig. 2; it may be compared to elevating the muzzle of a gun in order to make it carry further.

Both short- and long-wave spray antennas are used; the latter are larger in dimensions, necessarily, because of the longer radiators required. The system contains eight 100-foot wooden masts, spaced in a circle about 700 feet in diameter, which suspend a cage top running around them. These eight sections of the antenna are energized from the center, by individual feeder lines running to each pole. The result is that the lower parts of the radio wave, which travel inward from each cage strike each other, and tend to cancel; while the upper parts of the waves travel out into space at an angle to the horizon, re-enforced in phase. The whole suggests the common circular garden sprinkler in its action—whence the name.

In the short-wave structures the same principle is followed, except that, for technical reasons, the eight distinct antenna lines are perpendicular, each on its mast, and connected to the feed-line at its center. The new system is the invention of Dr. Frank Conrad.

The new system will be tested especially by the fact that KDKA is to use more power, for special tests, than has ever before been put into a broadcast antenna.