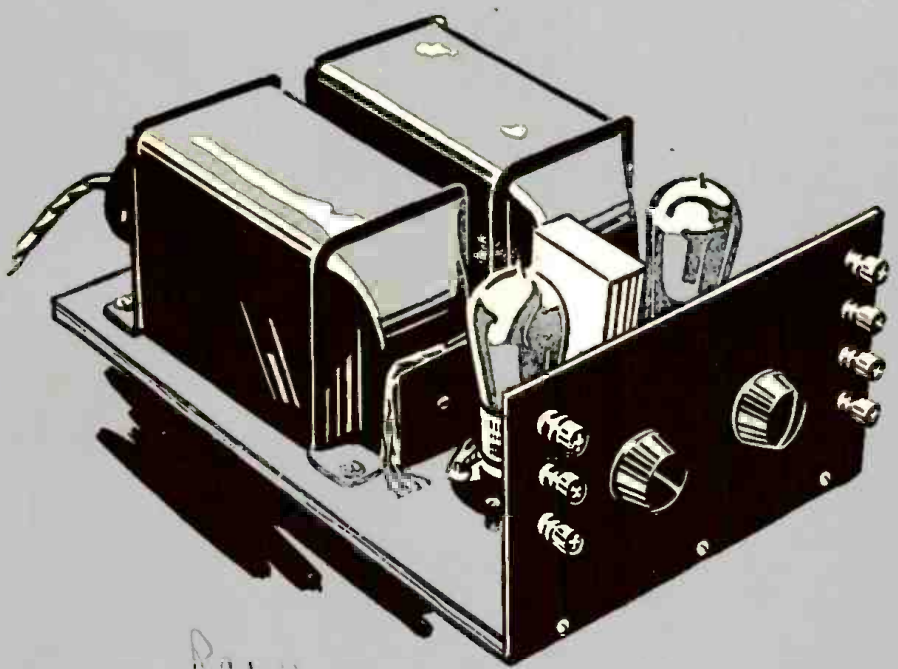
Popular Radio

JANUARY · 1928 ★

25¢



How to Make —

Hi-Q Six Power Supply
1928 Browning-Drake
Victoreen Superheterodyne
New Harkness Counterfonic
Latest Push-Pull Amplifiers

AMER TRAN - AMER TRAN - AMER TRAN - AMER TRAN

Fidelity of REPRODUCTION

AMERTRAN *Presents a new completely assembled audio unit*

The AMER TRAN *Push-Pull Power Amplifier*

$60.00
Without tubes East of the Rockies

Sets a new standard of quality in audio amplification

The AmerTran Push-Pull Power Amplifier is a new completely assembled two-stage unit. It contains a first stage AmerTran DeLuxe followed by AmerTran Input and Output Transformers for Power Tubes. When operated from a power source supplying sufficient voltage (such as the new AmerTran A B C Hi-Power Box), the input to the speaker is almost perfect, and fidelity of reproduction is limited only by the ability of the speaker. Distortion, from tube harmonics and A C hum, is reduced to a minimum. The energy output to the speaker is increased, especially at the lower musical frequencies. This means greater clarity of tone at low or high volume.

The amplifier is easily connected to the detector of any good receiver, replacing its audio amplifier. It is equipped with four sockets, two for power tubes, and a four-prong and a five-prong socket in the first state for either a standard amplifying tube of the UX-201 A type, or a UY-227 A C tube. Using the latter tube, the amplifier can be entirely A C operated.

Connects to the detector of any good set

AmerTran Push-Pull Amplifier as a complete unit is licensed under patents owned or controlled by the Radio Corporation of America and must be sold complete with tubes. It is built in several types, depending on the type of power tubes preferred. Type 2 AP-10 is designed for 210 tubes and type 2 AP-71 for 171 tubes. The difference is only in the Push-Pull output transformers.

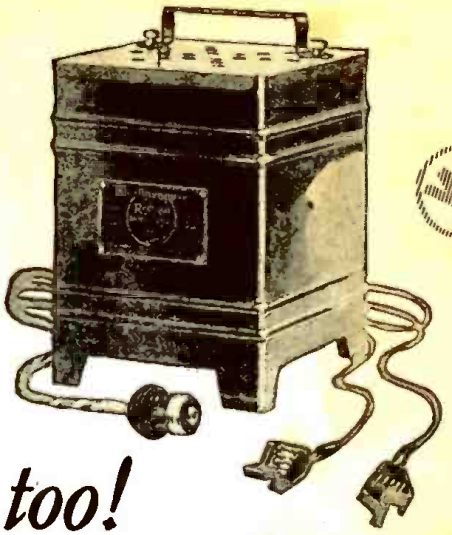
This completely wired licensed AmerTran Push-Pull Amplifier is on display and demonstration at stores displaying the sign "Authorized AmerTran Dealer." Send for complete literature on this new AmerTran Unit.

AMERICAN TRANSFORMER CO.
178 Emmet Street **Newark, N. J.**
"Transformer Builders for Over 26 Years"

AMER TRAN - AMER TRAN - AMER TRAN -

With the Rectigon Home Charger

you can trickle charge too!



THE Rectigon Battery Charger gives you two charging rates—you can use it both as a "trickle" charger or for high-speed charging of wet "A" and "B" cells. Under ordinary conditions, Rectigon's trickle rate will replace all the "A" power your set uses. Then, when unusually long hours of reception have so weakened the battery that a trickle charger can't restore it, just shift over to Rectigon's high rate terminal and store away a full charge quickly.

2 Ampere Rectigon
~~$18.00~~
now
$14.00

5 Ampere Rectigon
~~$28.00~~
now
$24.00

Rectigon is made by workmen who know radio—the organization that put the first broadcast entertainment on the air. Rectigon is safe, compact, simple—has no moving parts to break and wear out—uses no liquids of any kind. Will do no harm if you absent-mindedly tune in, or if the house current fails, while charging. Get Rectigon, the *two-rate charger*, at your dealer's.

Westinghouse Rectigon Battery Charger

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY. EAST PITTSBURGH, PA.
Offices in All Principal Cities ' *Representatives Everywhere*
Tune in with KDKA—KYW—WBZ—WBZA

Rectox—for trickle charging only. Just attach the leads to your "A" battery and connect Rectox to the light line. Left permanently on charge at either ½ or ¾-ampere charging rate, it keeps your battery powerful and peppy. No messy acids, no moving parts. At your dealer's.

Besides Rectigon and Rectox for better battery charging, Westinghouse also makes Micarta panels and tubing for better insulation, and radio testing instruments for better reception.

WESTINGHOUSE ELECTRIC

Popular Radio

EDITED *by* RAYMOND FRANCIS YATES

FOUNDED 1911

VOLUME XIII January, 1928 NUMBER 1

CONTENTS

DEPARTMENTS

VOLUME XIII JANUARY, 1928 NUMBER 1

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Printed in U. S. A.

LAURENCE M. COCKADAY, *Technical Editor*

CHARLES L. DAVIS, *Managing Editor*

When I first started making real important money I used to go down to the bank, draw out a roll—and just thumb it over in my office and grin! That's how good it felt to get success and big money, after years at a low-paid job.

Success and Big Money Were For Others, Not Me

Believe It or Not, That Was What I Thought of Myself—Just Twelve Short Months Ago

I'M telling you, just one year ago I'd never seen a hundred dollar bill in my life outside of a bank.

You'd think I'm kidding you if you saw the fine Radio business I own now. But it's gospel truth. Just twelve months ago I was only a poorly paid clerk, and I thought success had passed me by.

All my crowd in those days—the fellows I met in the pool-hall and at the bowling-alleys—said a fellow had to *have* money to make money. They claimed there was no chance for a fellow whose family didn't have money or some business to start him out in. And I'd decided they must be right.

I guess at that time I had just about given up hope. I thought there must be some kind of a mystery about making a lot of money. But I was due for a big awakening.

Did I get it? Oh, boy! Read my story and judge for yourself.

IT all started one day last summer, when Helen, the girl I wanted to marry, was leaving for the seashore. Of course I went to the station to see her off.

As I stepped on to the station platform Bob Oakes and Wilmer Pratt had just rolled up in their cars. They climbed out with their arms full of bundles—books, expensive candy, flowers, all sorts of things. Well, sir, I wished I could have swallowed in one gulp the little box of drugstore candy I had bought for Helen—it certainly looked pitiful beside all that stuff.

We three stood there talking to Helen until train-time, while Helen's mother looked me up and down. Like any young girl's mother would, she had my financial standing already sized up within thirty-five cents. Cheap suit, cheap hat, she took it all in. And you could see on her face all the time what a lot of nerve she thought I had to give Bob and Wilmer a run for Helen.

Well, to make a long story short, Helen was nice, but her mother stood there looking scornful whenever she glanced my way, and she hardly spoke to me at all. I felt about as welcome as the measles, and as uncomfortable as the itch. I began to wish that I and my cheap suit and cheap hat could sink through the floor, but I stayed there and stuck it out.

WHEN Helen's train finally left, I slunk home, ashamed and humiliated. I went upstairs to my room and sat there with a lump in my throat, getting hotter and hotter and more ashamed of myself. Then I began to see red and redder.

Finally I jumped up and banged the table. "I'll show 'em." I growled through clenched teeth. "There *must* be some way for a man to make *real money!*" An idea suddenly flashed through my head.

Hastily I began thumbing the pages of a magazine on the table, searching for an advertisement that I'd seen many times, but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome book, telling about opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully and when I finished I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months I've had a Radio business of my own! At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any of the score of lines they prepare you for. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money, own a good car, stand high in my town, can borrow money at the bank any time I might want it. I'm getting some real *fun* and *enjoyment* out of life, not just *existing* from pay-day to pay-day.

And—just listen to this! Bob was in my place only the other day, and asked me for a job! Wilmer is still getting along pretty well on his father's money, but he'd trade places with me any day.

And Helen? Well—the honeymoon will be spent in Honolulu, starting two months from tomorrow!

HERE'S a real tip. Think it over—are you satisfied? Are you making enough money, at work that you like?

This new Radio game is a live-wire field of golden rewards. The work in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study school in the world—will train you inexpensively in your own home to know Radio from A to Z, and to increase your earnings in the Radio field.

Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. The information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address: J. E. Smith, President, National Radio Institute, Dept. 1-K, Washington, D. C.

J. E. SMITH, President,
National Radio Institute,
Dept. 1-K, Washington, D. C.

Dear Mr. Smith:

Please send me your 64-page free book, printed in two colors, giving all information about the opportunities in Radio and how I can learn quickly and easily at home to take advantage of them. I understand this request places me under no obligation, and that no salesmen will call on me.

Name.....

Address.....

Town.....State.....

Age.....

A Page With The Editor

Judging from the appearance of many of our contemporaries, it would seem that the trick circuit is once again coming into its own. They are described with the usual fiery superlatives and with plenty of claims that would not bear very penetrating scrutiny.

* *

The Editorial Staff of Popular Radio has no reason to regret the action it has taken in publishing the details of any receiver it has sponsored. To win its spurs, a new circuit is put through a series of most extensive tests in our laboratory, and unless it emerges from this exacting examination whole and triumphant, it is not considered fit for editorial treatment.

* *

Not once has this publication violated the faith of its readers in describing the construction of receivers that do not meet the fundamental requirements of engineering. Popular Radio would rather describe one good receiver than a half dozen poor ones.

* *

Derek Shannon, that brilliant young English radio experimenter who has contributed to Popular Radio previously, has recently constructed a special receiver with which to listen to the transatlantic telephone conversations. Believing that this fascinating diversion would be of some interest to our readers, the Editor has asked Mr. Shannon to describe his equipment—which he has obligingly promised to do. The article will probably be published in the February or March issue of the magazine.

* *

It is surprising how many young men who know radio are turning their talents into real money these days. Only the other day an enterprising set builder came into the office of Popular Radio and proudly displayed a bank account that ran well into the thousands. He built (with modest assistance) 147 receivers last year, with an average profit of $55 on each one. Incidentally, he had standardized on a Popular Radio circuit.

* *

It is amazing the way the ranks of the professional set builders in the United States are growing. It is now estimated that from 30,000 to 40,000 men are engaged in making radio sets for public use. They not only make them at a very substantial profit, many of them owning their own businesses, but they offer a type of intelligent service that as yet no manufacturers of receivers have been able to duplicate. Making a radio set for public use is one thing, and giving it intelligent service is another thing.

It is estimated that the profits that will be built up during 1928 by professional set builders will run into many millions of dollars, and Popular Radio is glad to know that it is helping many men to realize substantial sums and to build businesses from which they can derive a good livelihood in years to come.

* *

It is hoped that the new department, "In the Professional Set Builder's Shop," will be of benefit to those who make radios for profit. The Editor welcomes contributions of set builders who are moved with the lofty desire to help their brother workers. Manuscripts for this corner should either tell how to save money or how to do a better job in less time.

* *

"The Professional Set Builder's Shop" is the first attempt that has been made by any radio publication to extend a helpful and understanding hand to the man who makes money building *good* radios.

* *

It seems that all the real radio fans are now building short-wave adapters for their receivers. Short-wave reception is ideal in many respects, for it permits the fan to avoid interference and to receive over distances that are amazingly great. Popular Radio has been alert to the growing interest in this field, and during the coming months it will publish a number of extremely valuable articles telling how ordinary radio receivers may be equipped to receive on very short wavelengths. This opens up a fascinating new world of experimentation and adventure.

* *

After a number of months of experimentation, the Federal Radio Commission has accomplished very little of a practical nature. The bald facts of the case are that confusion in the lower wavelengths has been aggravated to no small extent, and that there has been little, if any, perceptible improvement even in the upper registers of the dials. One cannot help but wonder if Federal control of wavelengths is going to be any more successful than was the Federal control of the railroads. The Radio Commission is now planning the obvious step of reducing the number of stations—which, after all, seems to be the only solution to the problem and which, admittedly, can be done only by a Federal body.

* *

The double-grid valve threatens to bring many important changes in radio during the coming year. Its introduction has met with an immediate response from those who are quick to see its startling possibilities. In an early issue of Popular Radio there will appear the complete description of a set utilizing this revolutionary valve. Measurements show that the amount of high-frequency amplification that may be had from these valves is far and above that which may be obtained from any known system of amplification in use at the present time.

* *

There are approximately 90,000,000 of the world's inhabitants now receiving broadcast programs. About 18,000,000 receiving sets are now in use for all these listeners, and it would require approximately 200,000,000 sets to service all of the people within the world's reception areas, according to Lawrence B. Batson, of the Department of Commerce.

These figures are a healthy denial of some of the rumors that radio has reached the saturation point.

* *

Rumor has it that many of the manufactured AC receivers are not doing so well in the hands of the novices who purchased them. In one case that Ye Editor knows of they are coming back to the "Receiving Department" as fast as the "Shipping Department" sends them out. AC sets are fine, but they must be made by manufacturers who know their volts, amperes *and condensers!*

* *

The Editor's manuscript file is simply bulging with all sorts of good material waiting to find its way into these merry pages. The February number will carry the details of a corking good new receiver, and there will be twenty or more other articles of exceptional value to experimenters.

Raymond F. Yates

Assemble Radio's Finest Reproducer In One Hour at Home

Expressions such as these are to be heard everywhere. G.R.P. 3-ft. Cone Speakers arouse enthusiasm because they create a new standard of tone quality. Brings complete, enjoyable reproduction within everyone's reach.

I built my first G. R. P. Cone Speaker about six weeks ago. The tone is beyond description, especially the bass notes which are seldom reproduced in either the air column or smaller cone speakers. *Dr. A. A. P., Chicago, Ill.*

—o—

The G. R. P. Speaker certainly is an A-1 proposition. Thank you for all you have done to insure my family and me real radio enjoyment. *W. G., Montclair, N. J.*

—o—

I am certainly well pleased with the results. It renders the most perfect reproduction that I have so far heard. I feel well paid for the time, money and effort expended. *A. W. L., Freemont, Nebr.*

—o—

I believe I now have the best cone speaker that I have ever heard. It has a wonderful tone and brings out musical instruments much better than any horn or cone I know of. *M. R. F., Stroudsburg, Pa.*

—o—

When finished I hung it on the wall, plugged in and went after a station, and I soon got a thrill. I struck a fine concert orchestra playing. It was the most beautiful music you would want to hear. The speaker certainly is a wonder and I am delighted with it. And. I wish to say right here if I could not get another, $100 would not buy it. *G. E. S., Far Rockaway, L. I.*

—o—

I have assembled the 3-foot cone and have compared it with high-priced merchandise in my own home. Its performance is wonderful! Please find enclosed Money Order in your favor for which please ship via Express another G. R. P. *H. M. R., Jacksonville, Fla.*

G·R·P
3 FOOT
CONE SPEAKER
Build It Yourself

Easiest to Build of any 3ft. Double Cone Speaker

Here is the finest loud speaker that it is possible to own. No sum of money can buy better tone quality, greater sensitivity or a wider range of reproductive ability. It reproduces the very deepest bass notes on their fundamental frequencies; it mellows the high notes; middle register tones are fully reproduced; it is natural in tone—not merely low-pitched so as to make it *seem* as if the bass notes are being reproduced.

With all its outstanding and unequalled tone quality the G. R. P. 3-foot Cone Speaker is extremely moderate in price—only $13.50 for the DOUBLE cone and but $10.50 for the SINGLE.

Anyone Can Assemble It

The low prices for G. R. P. 3-foot Cone Speaker Kits are made possible because the speaker is shipped unassembled. Tremendous savings in transportation cost and damages reduce the cost of the finest speaker so that it is no higher than a very ordinary, low-priced reproducer. The resemblance, however, ends with the price.

G. R. P. 3-foot Cone Speaker is so simple to assemble that anyone can do it. Absolutely no experience necessary. By following the simple, illustrated directions a novice can produce a speaker equal both in tone quality and appearance to the highest priced factory built speaker.

No. 3 G.R.P. Kit for 3-ft. DOUBLE Cone
Absolutely complete in every particular including G. R. P. Unit
Nothing else to buy **$13.50**

Slightly more in Far West and Canada.

No. 4 G.R.P. Kit for 3-ft. SINGLE Cone
Most complete, lowest priced Single Wall type Cone Kit; finest tone quality **$10.50**

Endorsed by Leading Experts

Noted radio authorities, engineers, acoustic experts and musicians enthusiastically praise the G. R. P. 3-foot Cone Speaker. Just a very few are *Cockaday* of Popular Radio, *Hurd* of the Christian Science Monitor, *Kenneth Harkness, W. H. Sinclair, Hercules Cavallo* and a host of others.

Enjoy Real Tone Quality

Don't deny yourself the pleasure of real tone quality any longer; and don't feel that you must pay an outrageously high price for real tone quality.

Get a G. R. P. 3-foot Cone Speaker Kit today, assemble it yourself in an hour or less and enjoy the delights of complete reproduction.

—o—

Good dealers everywhere either have or can get the G. R. P. 3-foot Cone Speaker Kit that you want. Or we will ship it to you direct, f.o.b., N. Y. C., on receipt of price.

—o—

Refuse imitations and substitutes of the genuine G. R. P. 3-foot Cone Speaker Kits.

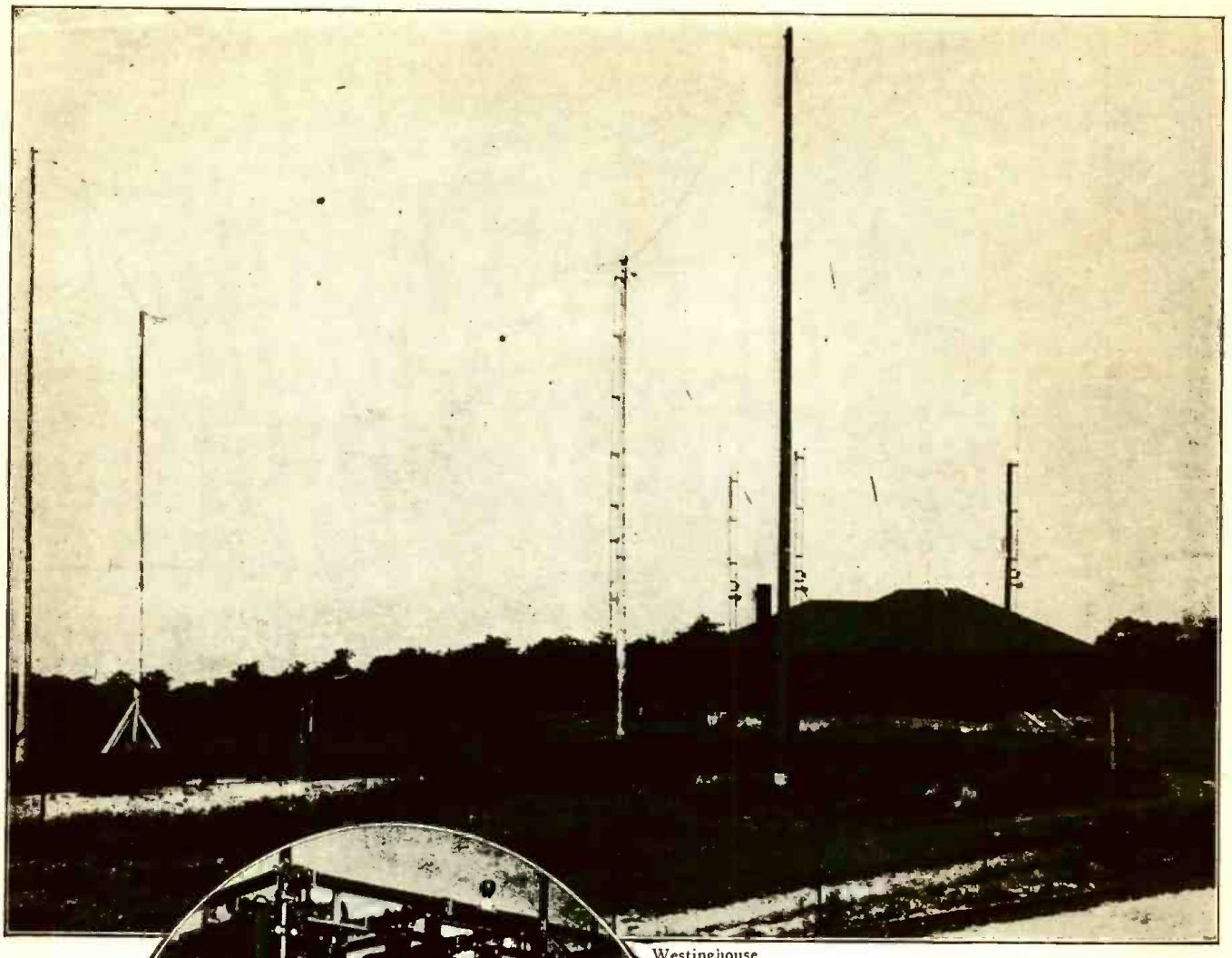
Send 10 cents for *"How to Build Seven Practical 3-foot Speakers."*
A wonderful book by Clifford Denton. Regular price 50 cents.

PENN RADIO SALES CO., *Sales Agents for*
G. R. P. PRODUCTS CO., INC. **104 Fifth Ave., Suite 4100, New York City.**

A Necessary Part of the Radio Industry

"In my estimation POPULAR RADIO is one of the most reliable and helpful magazines published in the interests of the radio novice, the amateur and the professional set builder. It is conservative without being stale, technical without being text-bookish. Any sane observer of radio conditions must regard POPULAR RADIO as a vital and necessary part of the radio industry."

SECRETARY
HAMMARLUND MFG. CO.



Westinghouse

Millions of Broadcast Listeners Have Never Heard This Powerful Station

Here is a broadcasting station whose programs are picked up daily in South America and other foreign countries, and yet few of our broadcast listeners have ever heard it. This is one of the short-wave stations owned and operated by the Westinghouse Electric Company of East Pittsburgh, Pa., and it is used to re-broadcast KDKA'S programs (8 to 10 P.M. nightly, except Sundays) on a special wavelength of 26 meters. Naturally, these programs are not available to the owners of standard broadcast receivers, since these receivers will not tune much below 200 meters. The picture above shows the special antenna system used in the experimental station, while the oval shows Mr. E. B. Langdon, manager of the station, adjusting the transmitter during recent attempts made to broadcast to Australia. This station has been in operation for several years, and yet many Americans do not know that it exists.

Popular Radio

VOLUME XIII January, 1928 NUMBER 1

GET READY TO LISTEN TO

36 Stations You Never Hear

The new world of radio reception that is waiting for every fan and broadcast listener

HOW would you like to tune in tonight on a new Radio Utopia, where interference is non-existant, where static is at a minimum and programs are of the highest quality? How would you like to experience the new thrill of receiving over distances that you have heretofore thought impossible, but which now await only the idle twisting of a knob? Do you know that this fascinating radio world—this new crop of wavelengths — is immediately available to you, and that you can, by means of a very simple and inexpensive addition to your present receiver, bring to your fireside music of other lands?

At the present time there are in America no less than thirty-six broadcasters that you never hear—that are hopelessly beyond the wavelength range of your present receiver. The wavelengths employed by these strangers to your loudspeakers range from 26.3 to 109 meters, and the entertainment offered is every bit as good as that of the average broadcasters. As a matter of fact, WGY, WJZ and KDKA broadcast on short waves constantly, using their regular program features which are radiated simultaneously on their regular wavelength and the more or less private wavelengths of the several experimental short-wave transmitters.

Fishing for short waves is a fascinating radio recreation full of new thrills and a new incentive for conquest. Inter-continental reception at last becomes a daily possibility with the far-flung waves of several continental stations easily within range of present-day receivers provided with the necessary auxiliary equipment. Not only this, but the chattering, active channels of the amateur telephone stations await the turn of your dials. Truly, this is a new wonderland of radio.

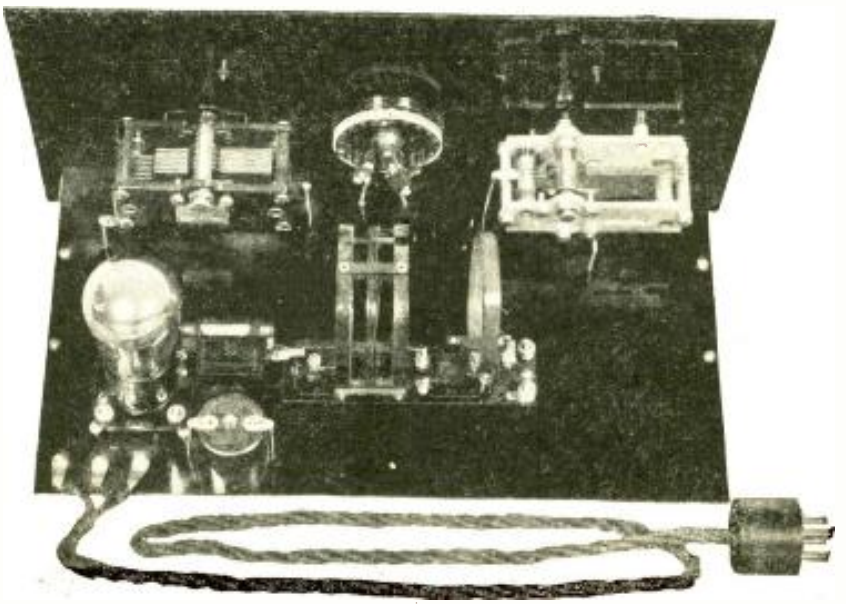
"What new equipment will I need?" you ask. Only a short-wave tuner with an oscillating detector so arranged that you simply plug it into the detector socket of your present receiver and, Presto! you have the key to another radio heaven, where you can escape the boredom and interference of conventional broadcasting.

The next issue of POPULAR RADIO will begin a series of articles telling you how easily, how quickly and how cheaply you can equip yourself to enjoy the rich amusement offered by short-wave transmission. This instructive series will not only tell you how to assemble auxiliary equipment, but also how you may construct simple and inexpensive short-wave sets complete in themselves.

It is POPULAR RADIO'S belief that the development of the use of short waves will become of increasing importance and the final solution of the broadcasting problem lies in

more aggressive exploitation of wavelengths that are not now available to present broadcast receivers. This opinion is shared by many radio engineers, who see in the more or less futile efforts of the Federal Radio Commission the necessity for further research in the low-wave area of the radio spectrum. It has been definitely shown that static is less prevalent on the shorter waves and that distance may be covered with little power.

Reception on these lower wavelengths opens up to the radio novice and experimenter a vast new area for exploitation and research. It is little wonder that radio fans are rapidly becoming enthusiastic listeners on the short wavelengths, and that there is a growing feeling in engineering circles that radio is on the eve of important changes.



AN INSTRUMENT FOR NEW RADIO DISCOVERIES

By plugging this simple unit into any standard broadcast receiver, the radio listener can bring into his receiving range all the absorbing radio traffic that goes on at the short wavelengths—amateur conversations, transatlantic calls and short-wave broadcasts.

36 Strangers to Your Dial

KDKA, 8 XK and 8 XP, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

WGY (eight calls), 2 XAC, D, E, F, G, H, K and W. General Electric Company, Schenectady, N. Y.

WBZ, 1 XAE, Westinghouse Company, Springfield, Mass.

WHAM, 8 XAC, Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

WABC, 2 XE, Atlantic Broadcasting Company, Richmond Hill, N. Y.

WEEI, 1 XAG and 1 XAF, Edison Electric Illuminating Company, Boston, Mass.

WJZ, Radio Corporation of America, Bound Brook, N. J.

WRAH, 1 XY, Booth Radio Laboratories, Tilton, N. H.

WRNY, 2 XAL, Experimenter Publishing Company, Coatesville, N. J.

WOR, 2 XAQ, Bamberger Company, Newark, N. J.

WRMU, 2 XAC, yacht Mu 1, Grebe Company, of New York.

WAAM, 2 XBA, WAAM, Inc., Newark, N. J.

KJBS, 6 XAR, J. Brunton & Sons Co., San Francisco, Cal.

KFWB, 6 XBR, Warner Brothers Studio, portable, Los Angeles, Cal.

KNX, 6 XA, *Los Angeles Express*, Los Angeles, Cal.

KFSG, 6 XBA, Air Fan Radio Corporation, Los Angeles, Cal.

KHJ, 6 XAU, *Times-Mirror* Company, Los Angeles, Cal.

KFWH, 6 XAK, F. W. Morse, Chico, Cal.

KFQZ, 6 XAL, L. E. Taft, Hollywood, Cal., portable.

KFVD, 6 XBX, McWhinnie Electric Company, Venice, Cal.

KNRC, 6 XAF, Clarence B. Junea, portable.

KGGM, 6 XAI, Los Angeles Radio Club, Los Angeles, Cal.

KFQV, 6 XBH, W. E. Riker, Holy City, Cal., portable.

WRAH, 1 XAA, Stanley N. Read, portable, Providence, R. I.

KFBC, 6 XBE, W. K. Azbill, San Diego, Cal.

KRLO, 6 XAN, Freeman Lan, Los Angeles, Cal.

KJR, 7 XC, 7 XO, Northwest Radio Service, Seattle, Wash., portable.

KWJJ, 7 XAO, Wilbur Jerman, Inc., Portland, Ore.

KFPY, 7 XAB, Symons Investment Company, Spokane, Wash., portable.

WEAO, 8 XJ, Ohio State University, Columbus, Ohio.

WLW, 8 XAL, Crosley Radio Corporation, Harrison, Ohio.

WHK, 8 XF, the Radio Air Service Corporation, Cleveland, Ohio, portable.

WNAL, 9 XAB, R. J. Boswell, Omaha, portable.

KOIL, 8 XU, Mona Motor Oil Company, Council Bluffs, Iowa.

The Hi-Q "B" power-pack fits easily in the Superior console cabinet for the Hi-Q receiver, shown at the left, and once installed it may be completely forgotten, as it requires absolutely no readjustment or upkeep.

Constructing and Operating the Hi-Q "Six" Power Supply

With "B" power from the lighting lines, the Hi-Q "Six" is a receiver that should satisfy the most critical fan. The unit described here is easy to construct, and is especially designed to supply silent "B" voltages to the Hi-Q receiver, as well as "A" and "C" voltages for the 171 power valve of the set.

By RAYMOND FRANCIS YATES

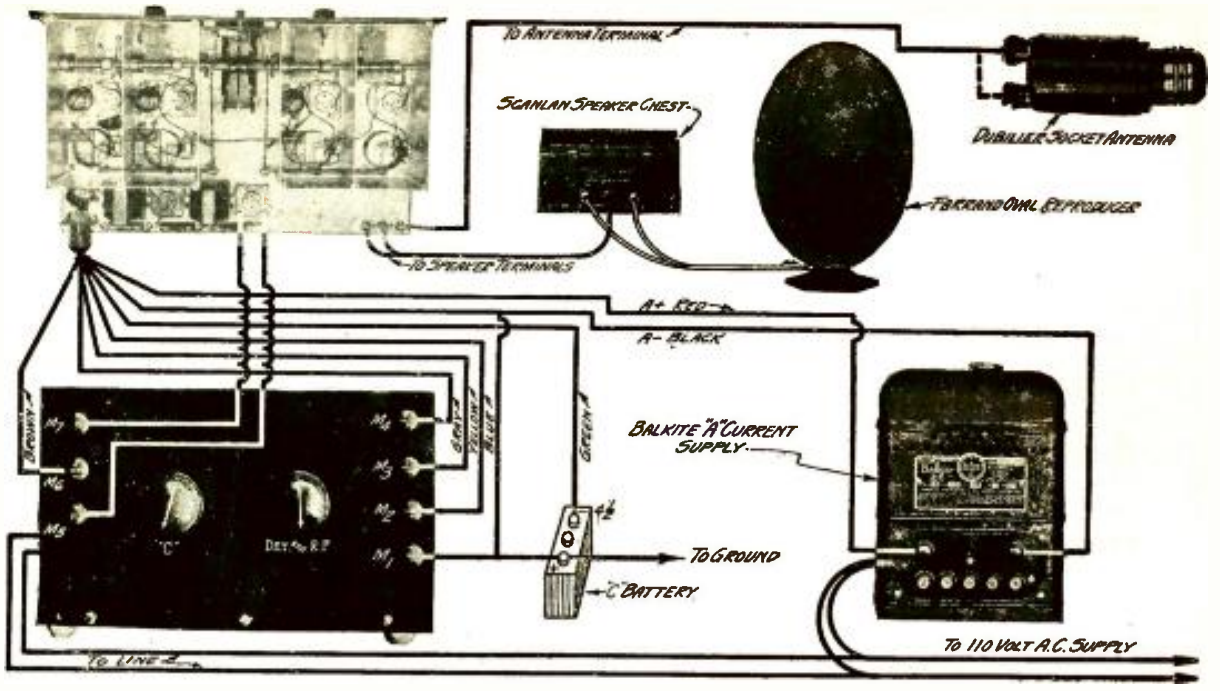
THE new Hi-Q power-pack has been designed to fulfill certain definite requirements in connection with the Hi-Q "Six" receiver, for the accomplishment of batteryless supply of "B" voltages.

It is a carefully engineered unit in which all the parts have been especially constructed in order to get the best operation possible. The unit will supply complete "B" voltages for the receiver, as well as "A" power and "C" voltage for the last valve in the set, which is a 171 type.

For the purpose of obtaining stable and efficient operation, the unit is equipped with a variable control for the "C" voltage and a variable control for the "B" voltages of the high-frequency valves.

A regulator valve is also employed for maintaining exact potentials for all the other parts of the circuit.

The power block is attached to the house-lighting lines, with a plug for adjusting the entire AC power for line voltages from 105 to 120 volts, thus further insuring correct operation. The complete power-pack may be assembled and placed in operation, once the parts and accessories have been obtained, with less than an hour's work. The wiring is easily done by even the most inexperienced set builder by following the instructions on the work sheet and diagram accompanying this article.



AN EXCELLENT POWER HOOK-UP FOR THE HI-Q

FIGURE 1: *In the hook-up shown here the Hi-Q receiver is operated entirely from the AC lighting lines, with the exception of the small, semi-permanent "C" battery. The units shown here were found by tests to give excellent results when hooked up as indicated by the heavy black lines.*

How to Assemble the Hi-Q Power-Pack

After all the instruments and materials have been procured, the parts should be mounted on the baseboard, L. In Figures 3 and 4 the arrangement of these parts is shown.

The power block, A, and the condenser block, B, should be mounted side by side in the positions indicated in these figures. Then the two sockets. C and D, should be mounted in position by means of two wood screws each.

Next the resistance and mounting, E, and the fixed condenser, F, should be placed in the correct position and screwed down to the baseboard with two wood screws to each instrument. These positions are also indicated in Figures 3 and 4.

The next job will be to mount the resistor units, H and I, on the right side of the front panel, K, in the holes already drilled for them. These two units are fastened together by the manufacturer and are mounted with a single hole mounting. Then the variable resistor, J, should be mounted in the hole at the left of the front panel, K. Then the seven binding posts, M1, M2, M3, M4, M5, M6 and M7, should be mounted in their respective positions on the front panel, K, as shown in Figures 3 and 4. This makes the assembly work complete, except for the mounting of the tapped resistor, G. This is fastened to the top binding post, M4, by the extension lug. and screwed tight with two nuts on the back of the binding post. The other end of this resistor is held by the wiring when that is being done. The front panel itself may then be fastened by three wood screws screwed through the three holes and into the edge of the wooden baseboard, L.

This done, four rubber feet may be attached to the four corners of the baseboard on the bottom side.

How to Wire the Unit

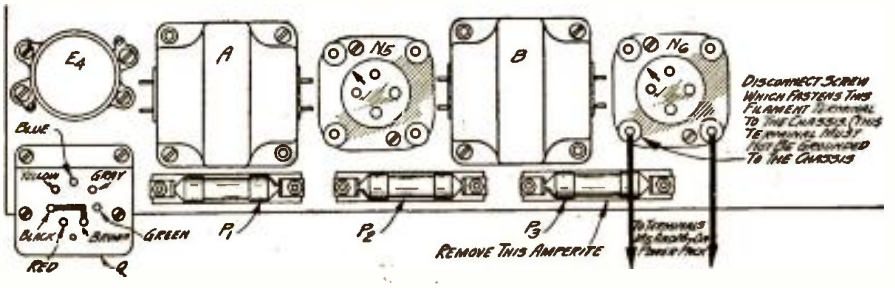
It is recommended that all wiring on this unit be done with a stranded insulated wire, such as celatsite.

In wiring up, refer constantly to the picture wiring diagram in Figure 4.

In this diagram all of the instruments and parts are outlined in black lines, while the wiring itself is shown in heavy blue lines. Start by tracing a single lead from its start to its finish, on the diagram, continuing through until every connection has been made. The dotted blue lines in the diagram indicate where the wiring is run underneath the wooden baseboard, L. Where the wiring runs from the top of the baseboard to the bottom of the baseboard holes are to be drilled, and these positions are also indicated in Figure 4. When the wiring has been completed, carefully check over every wire and see that no single item has been missed and that no other mistakes have been made.

There are also a few slight changes necessary in the wiring of the Hi-Q receiver in order to install the power-pack. These changes are shown clearly in Figure 2. A wire should be run be-

(*Continued on page 61*)

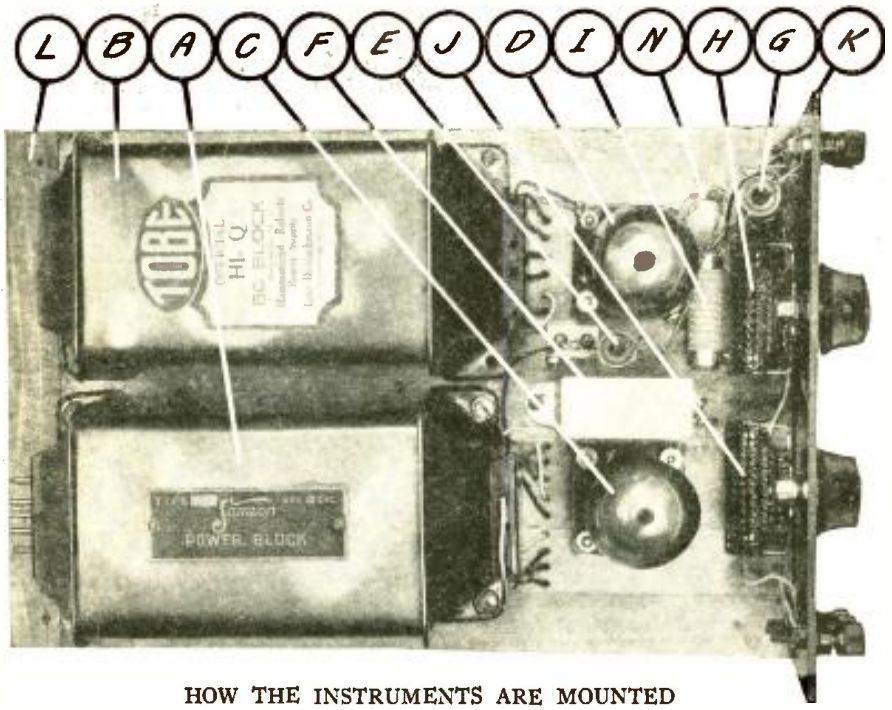


THE CHANGES NECESSARY IN THE RECEIVER

FIGURE 2: *This diagram gives the few additions to the wiring of the receiver necessary in installing the power unit. A short wire is attached between the black and brown terminals of the Yaxley plug. One amperite is removed, and two separate wires are brought out for the filament supply to the last valve.*

POPULAR RADIO WORK SHEET

The Hi-Q Power-Pack



HOW THE INSTRUMENTS ARE MOUNTED

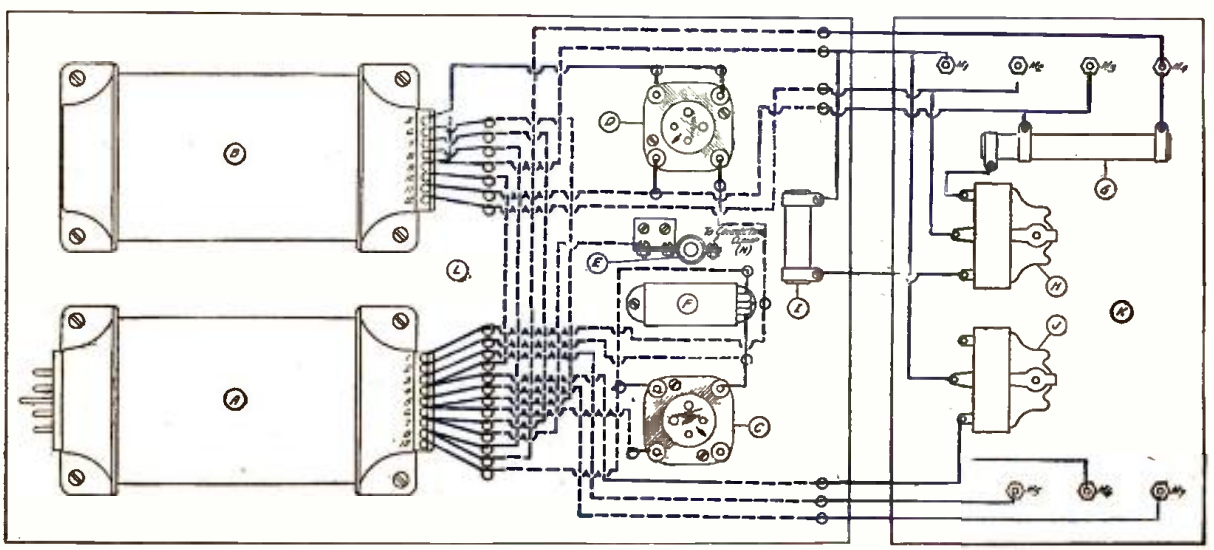
FIGURE 3: *The spacing of the instruments on the baseboard should conform exactly to the layout shown above.*

List of Parts for Building this Unit

Cost of Parts—*Not over $59.00*

A—Samson power block, type 713;
B—Tobe Hi-Q "BC" condenser block;
C and D—Benjamin Cle-ra-tone sockets;
E—Electrad Truvolt resistor, No. 3;*
F—Tobe precision buffer condenser, .1 and .1 mfd., No. 411;
G—Electrad Truvolt No. 1 tapped resistor;*
H and I—Electrad Truvolt No. 2 combination resistor, H referring to the variable resistor element and I referring to the fixed resistor element of this unit;*
J—Electrad Truvolt No. 4 variable resistor;*
K—Micarta drilled and engraved front panel, 9 by 5½ inches;
L—Wooden baseboard, 13½ by 9 by ½ inch;
M1, M2, M3, M4, M5, M6 and M7—Eby binding posts;
N—Special Fahnestock valve connector for Raytheon voltage regulator valve, type 7.

* These four units are packed as the Electrad Hi-Q Truvolt resistance kit.



HOW TO WIRE THE UNIT

FIGURE 4: *The instruments are outlined in* BLACK; *the wiring above the baseboard is shown in solid* BLUE, *and that below the baseboard in dotted* BLUE.

Kadel & Herbert

BRINGING THE OUTSIDE WORLD TO SING SING

It is probable that there are few more popular spots in Sing Sing Prison than the radio receiver control booth, shown above, where the broadcast voices from the outside world are brought into the dreariness of prison routine. It is operated by the prisoners themselves during the early evening hours.

WARDEN LAWES TELLS ABOUT

RADIO AT SING SING

FROM AN INTERVIEW WITH
LEWIS E. LAWES, *Warden of Sing Sing Prison*

RADIO has had a soothing and beneficial effect upon human life in many of its vicissitudes. In the hospitals it has a distinct therapeutic value, bringing cheer and encouragement to those who are temporarily or permanently incapacitated. Its influence on home life is immeasurable, and no one will know the good it has accomplished until some super-sociologist discovers a way of calculating its effect.

But what about radio in the prisons? Surely there must be some opportunity for it to work its miracles in our penal institutions, where life is, of necessity, reduced to a state of deadening monotony and restricted activity. If radio sounds good to the ears of a free man, it must sound good to the man behind the walls and bars.

Moreover, it is bound to affect a man spiritually and emotionally who is considered an enemy of society, and whose hopes and ambitions must be at low ebb. In my experience at Sing Sing, I find that radio is beneficial in more ways than one. It has a constructive effect upon the prisoners, many of whom will eventually return to society. It broadens their minds and keeps their thoughts in clean and constructive channels, which is infinitely better than allowing them to stagnate in that ominous depression that prevails in the cell. Those prisoners who are returned to society will, I am sure, be better men for having had the opportunity of experiencing this daily contact with the outside world. After all, nothing is a greater anodyne to a tired soul or a depressed mind than music. And radio is able to supply that, along with its inspiring messages from men of success and affairs.

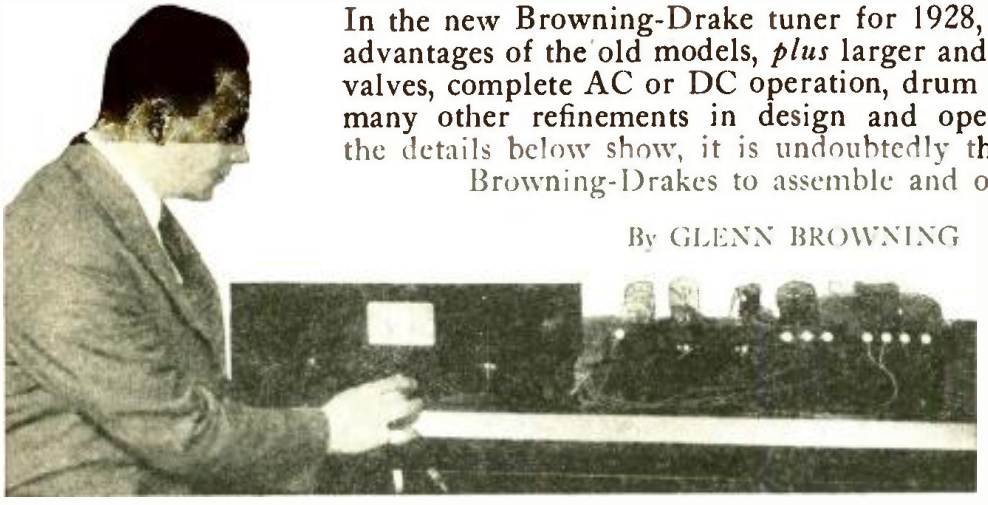
I find, also, that radio is one of the most effective means of promoting good discipline among the prisoners at Sing Sing. While radio entertainment is not a special privilege, it is denied to those who are under discipline for some infraction of the rules of the institution. Broadly speaking, I would say that from our point of view, when radio entertainment is denied a man, it is not done simply to deprive him of enjoyment, but to help promote the discipline of the place. It is something that the prisoners like and something that can be denied them unless they are in good behavior. I say this without for one moment losing view of the fact that it has a sociological value of great importance.

The radio receiver at Sing Sing was installed by the prisoners themselves and is maintained through the permission of the prison authorities. The program material allowed to reach the prisoners is carefully supervised so as to exclude anything that might have a detrimental or unfavorable appeal. An attempt is made to keep the material received inspiring and of a high cultural value. The receiver itself is usually manipulated by an old and tried "trusty."

It is interesting to note an excerpt from a letter received by a radio station from an inmate of another prison. It shows how keenly these men criticise the things that they hear, and how alert they are to discover character and personality as it is revealed by the voices of the men who manage the "Mikes" at our broadcasting stations:

"From the voices of certain ones seems to emanate a cold, cultured smirk; others give the impression of a slap on the back and an ether-disturbing har! har! We know some stations that always seem to hand us a neighborly grin; from one place a certain chuckle is as sure a guide as the station's letters. But once in a while we hear a voice so kindly, so understanding, so tolerant that it brings with it the Friendly Smile. A few that come to my mind: Major Bowes and Roxy from New York; B. J. Fahner and Pete McArthur from WOC."

Here's the 1928 Browning-Drake!



In the new Browning-Drake tuner for 1928, you get all the advantages of the old models, *plus* larger and more powerful valves, complete AC or DC operation, drum dial tuning and many other refinements in design and operation—and, as the details below show, it is undoubtedly the easiest of all Browning-Drakes to assemble and operate.

By GLENN BROWNING

At the left the Browning-Drake tuner is shown with the AmerTran push-pull amplifier in a power hook-up of splendid quality. The details of this hook-up are described on page 77 of this issue of POPULAR RADIO.

FUNDAMENTALS in radio design have not changed much in the past few years, contrary to the belief of the general public, and receivers which were originally based upon sound electrical principles have remained practically unchanged. The original Browning-Drake circuit of 1924 has had very few changes made in its essential principles. However, it has been found advisable, from time to time, to change the mechanical design so that the receiver might be brought up to date in appearance and also to incorporate electrical improvements which have developed in the last few years.

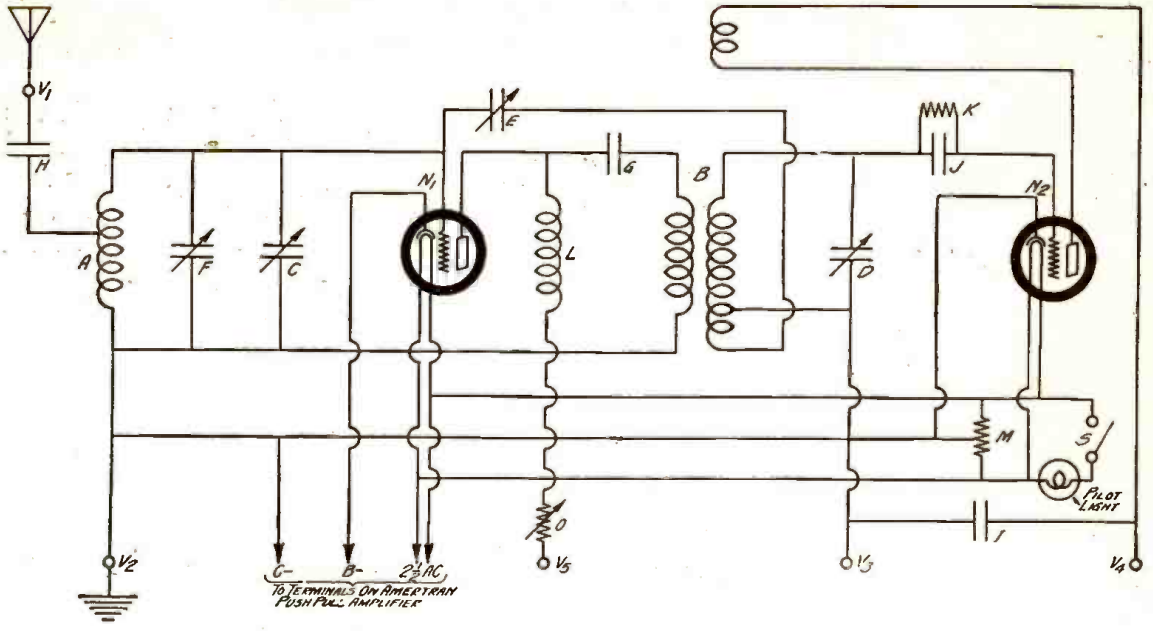
Due to the fact that many fans are desirous of using power amplifiers which incorporate either 171 type valves in push-pull arrangement or 210 type valves, in order to get a large amount of undistorted energy delivered to the reproducer, it is thought advisable to describe in this article a two-valve Browning-Drake tuner combined with the new AmerTran power-pack amplifier. This makes a fine combination, inasmuch as a tremendous undistorted volume may be delivered to the reproducer.

The Browning-Drake circuit consists essentially of one stage of tuned-high-frequency amplification, with a specially built slot-wound high-frequency transformer which was developed by the writer and Dr. F. H. Drake. This is combined with a regenerative detector, the stage of high-frequency amplification being neutralized. The resulting combination makes a tuner which is both easy to build and sufficiently sensitive to enable the operator to receive almost all signals which are above the noise level.

The antenna circuit incorporated in the Browning-Drake receiver is a conductively coupled one; that is, the antenna lead connects directly to a tap on the antenna coil through a .0001 mfd. condenser. This system has proven extremely efficient, inasmuch as it has a much more even response over the entire broadcast band of frequencies than any other simple circuit tested by the author. Another advantage is that good signal strength may be secured when using even an extremely short antenna. One disadvantage, however, is that it is extremely difficult to make the two condensers on the receiver run together when both long and short antennas are being used alternately. Dr. Drake and the writer have, for the past season, been working on what might be termed a "single control" for this circuit and have so designed the receiver that the tuning condensers employed may be attached to one shaft and controlled with a drum-type illuminated dial without making any other adjustments for certain types of antennas. The receiver described, however, employs what is termed a "trimmer condenser" in parallel with the first tuning condenser. The operator will find that, in most cases, it will be necessary to make slight adjustments on this for different stations.

Another change which has been made is that a neutralization system has been developed in order that a large valve may be used as the high-frequency amplifier. The neutralization system, as will be noted from the schematic wiring diagram in Figure 1, consists of a number of extra turns added on the secondary of the high-frequency transformer, with the end connected to the rotor plates of the neutralizing condenser, the stator plates then being connected to the grid of the first vacuum valve. It has also been found advisable, even with this system of neutralization, to keep all high-frequency currents out of the "B" supply. Consequently a condenser of .5 mfd. capacity is placed in the line which runs to the primary of the high-frequency transformer, and a parallel feed is employed which incorporates a high-frequency choke connected directly to the plate circuit of the vacuum valve, the other end going to a variable resistance and then to the "B" supply. Perhaps some of the readers may wonder why a .5 mfd. condenser was used in this parallel feed system, inasmuch as it would seem that high-frequency currents could readily pass through as small a condenser as a .006 mfd. It is true that the high-frequency currents can pass through a .006 condenser, but the .006 has a large impedance to all low-frequency currents, and it is known that if a plate impedance is added in a high-frequency amplifier valve detection of signals occurs in this valve and it does not act solely as a high-frequency amplifier. Therefore, keeping this in mind, various sizes of condensers were experimented with, and it was found that a .5 mfd. condenser was about as small as could be used in the place indicated above without seriously impairing the operation of the first vacuum valve.

Shielding is, for the first time, being recommended for the kit set circuit. The previous official kit set was made as sharp as possible, but when located within a radius of a few miles from broadcasting stations it was found that such a large amount of signal was picked up on the coils and the wiring of the set that it was extremely difficult to receive distance while the locals were on. When located as much as four or five miles from broadcasting stations, the receiver operated very satisfacto-



THE HIGH-FREQUENCY CIRCUITS OF THE RECEIVER

FIGURE 1: *In this schematic diagram of the Browning-Drake circuit the high-frequency amplifier and detector valves are shown wired for AC operation, in conjunction with the new AmerTran push-pull amplifier and power-pack described on pages 20-22 of this issue.*

rily, however. The set builder may now choose whether to shield the receiver completely or not, and he should govern his choice by his local receiving conditions. If he is located in an extremely congested section, he should, by all means, completely shield the two-valve tuner; on the other hand, if he is located in the country, this would be an added expense and is unnecessary. In order to facilitate the use of shields and not make the tuner too cumbersome, it was found necessary to cut the tuning coils down from the 3-inch form to a 2-inch form. The shielding, in all cases, must be kept a distance of 1 inch away from the low potential end and a distance 1½ inches away from the high potential end of the coils, in order that their efficiency be not reduced.

The kit for the new Browning-Drake might be termed a "single-mount unit," as the instruments it employs—two Browning-Drake condensers, driven by the single illuminated drum dial, together with the two coils necessary for the circuit—are all mounted to make a single unit. In fact, it is only necessary to secure the foundation unit, which consists of front and base panel and mounting hardware, to make a tuner which may be used with any type of low-frequency amplifier. Furthermore, it may be constructed for operation with either AC or DC vacuum valves.

How to Assemble the Receiver

Although the two-valve tuner is quite easy to assemble, with the aid of the accompanying work sheet and diagrams, a few constructional tips might be given to advantage. There are two long leads in the set which carry high-frequency currents; one runs from the .5 mfd. condenser in the plate circuit of the high-frequency valve to the primary of the high-frequency transformer, and the other runs from the end of the high-frequency transformer to the rotor plates of the neutralizing condenser.

These two connections should be kept away from all other leads. Other high-frequency connections, such as that from the stator plates of the condenser to the grid of the vacuum valve, should be run as directly as possible.

In order that the set builder may use shielding if his location is such as to demand it, a metal sub-panel is employed.

The grid-leak on the detector valve is suspended by a stiff wire from the stator plates of the second tuning condenser directly to the grid connection on the valve.

Using AC Valves in the Set

If the set builder desires to use the new type AC valves, he should provide himself with two five-prong sockets, as well as one center-tapped resistor of about 50 to 100 ohms. He should also secure two 227 type AC valves. These are heater type valves and require a step-down transformer which supplies 2½ volts to heat their filaments. The filament connections should be made by means of two wires twisted together. This is extremely necessary if there is to be no AC hum in the completed receiver. All the twisted pairs also should be run underneath the sub-panel. The high-frequency valve should have from 3 to 4½ volts of negative "C" battery bias. No binding posts are put on the sub-panel for this connection, as it is best to run them out in a cable, preferably using two different colored wires twisted together.

The set builder will find that if he is extremely careful in constructing the receiver for use with these valves he will get no hum whatsoever. It is sometimes necessary, instead of connecting the cathode directly to the center point of the filament circuit, to put in a 22 or 45-volt bias, as recommended in the instructions which accompany the valves. The writer, however, found that in the majority of cases this was not necessary and that the cathode can be connected directly to the center tap of the resistor which is connected across the filaments. A little experimenting on this point is well worth while.

Balancing the Set With AC Valves

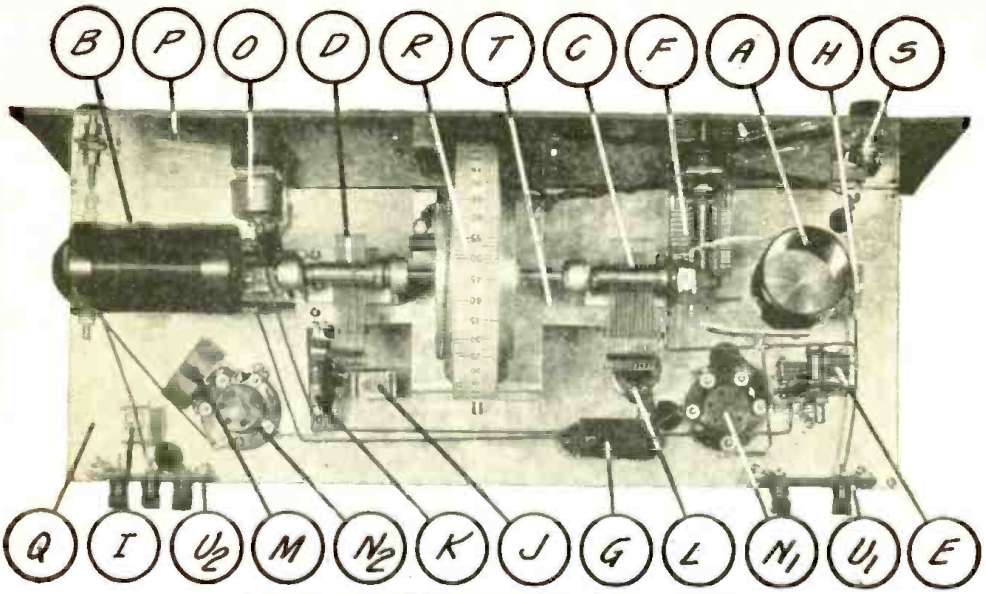
In case the set builder chooses to use AC valves with the two-valve Browning-Drake kit set, the balancing or neutralizing of the set should be done as follows:

The Clarostat, which is used as a volume control, should be turned clockwise as far as it will easily go. Set the condensers at a low value, say 20 on the scale. Turn the tickler coil down until the second circuit is oscillating. This may be determined by

(*Continued on page 75*)

POPULAR RADIO WORK SHEET

The 1928 Browning-Drake



HOW THE INSTRUMENTS ARE MOUNTED

FIGURE 2: *The mounting of the instruments is much simplified by the fact that the sub-panel comes ready drilled with mounting hardware.*

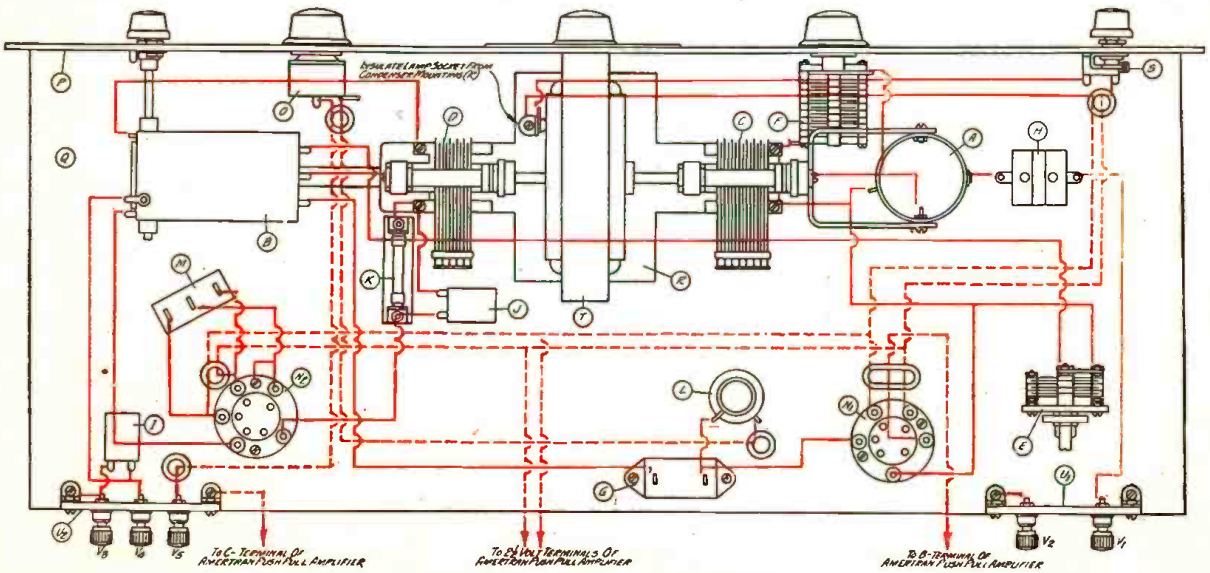
List of Parts for Building This Receiver

Cost of Parts—*Not over $55.00*

Browning-Drake single-mount kit, containing:
- A—Browning-Drake antenna coil;
- B—Browning-Drake high-frequency transformer;
- C—Hammarlund midline variable condenser, .00045 mfd.;
- D—Hammarlund midline variable condenser, .0003 mfd.;
- R—Browning-Drake illuminated drum dial;
- T—Aluminum bracket, mounting brackets and hardware;

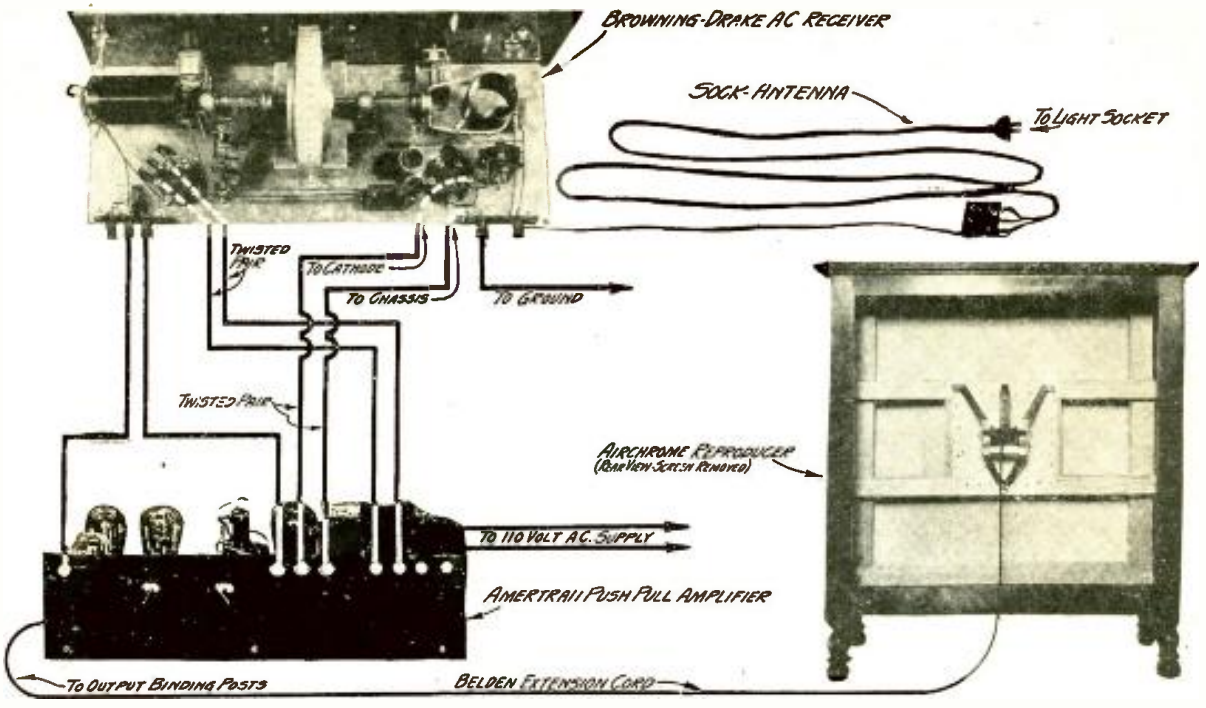
E—Browning-Drake special neutralizing condenser;
F—Browning-Drake variable midget condenser, .000135 mfd.;
G—Aerovox or Tobe .5 mfd. special blocking condenser;
H—Aerovox fixed condenser, .0001 mfd.;
I—Tinytobe fixed condenser, .001 mfd.;
J—Tinytobe fixed condenser, .00007 mfd.;
K—Tobe Veritas grid-leak, 6 megohms, equipped with a standard Lynch mounting;
L—Browning-Drake high-frequency choke coil;
M—General Radio center-tapped resistor, 100 ohms;
N1 and N2—Benjamin Cle-ra-tone 5-prong sockets;
O—Clarostat variable resistor;
Browning-Drake foundation unit, consisting of:
- P—Built and engraved front panel;
- Q—Drilled aluminum sub-panel complete with mounting hardware;

S—Yaxley offset filament switch;
U1 and U2—Micarta binding-post strips;
V1, V2, V3, V4 and V5—Eby binding posts;
Wire, solder, etc.



THE WIRING OF THE RECEIVER

FIGURE 3: *The instruments are in* BLACK. *The wiring above the sub-panel is indicated in solid* RED *lines, and that below the sub-panel in dotted* RED *lines.*



A COMPLETE SET-UP FOR THE AMPLIFIER

FIGURE 1: *In this combination hook-up the new power-pack amplifier is shown connected to the 1928 AC Browning-Drake. All of the connections are shown in* BLACK *lines, including the connection to the Tidmarsh light-socket antenna, the AC lighting lines and the new balanced-tension reproducer.*

Push-Pull Amplification! "ABC" Power!

The AmerTran Amplifier

The remarkable unit described in this article not only furnishes an ideal form of distortionless low-frequency amplification for any high-frequency pack, but supplies ALL the operating voltages for any set that employs AC valves

By LAURENCE M. COCKADAY

IT is agreed by radio engineers and experts that the push-pull method of low-frequency amplification gives the best results for a power stage to work directly into a reproducer. For this reason radio fans and set builders who are trying to keep up to the minute with their radio receiving apparatus should be interested in the latest and most powerful amplifier of this type.

The complete amplifier that is described in this article consists of one stage of low-frequency amplification using a high-quality transformer with an AC valve, followed by a second stage embodying the latest improvements in push-pull amplification, with two 210-type power valves and a very efficient output transformer, operated entirely from the 110-volt, 60-cycle lighting lines, without the use of batteries.

The unit also supplies AC filament current for five 226-type AC valves and three 227-type AC valves for operating almost any type of receiver, such as the new Browning-Drake high-frequency pack or the LC-2E high-frequency pack, with which the amplifier is desired to be used. The unit supplies, as well, the "B" and "C" voltages for the complete high-frequency pack and for the first and second low-frequency amplifier stages. In other words, the new unit is a complete "ABC" power-pack and low-frequency power amplifier for any receiver that can be equipped with AC valves.

Special consideration has been given to the frequency range of the new amplifier so that it will reproduce with the greatest possible accuracy all frequencies in the range of audibility.

How to Assemble the Push-Pull Power-Pack Amplifier

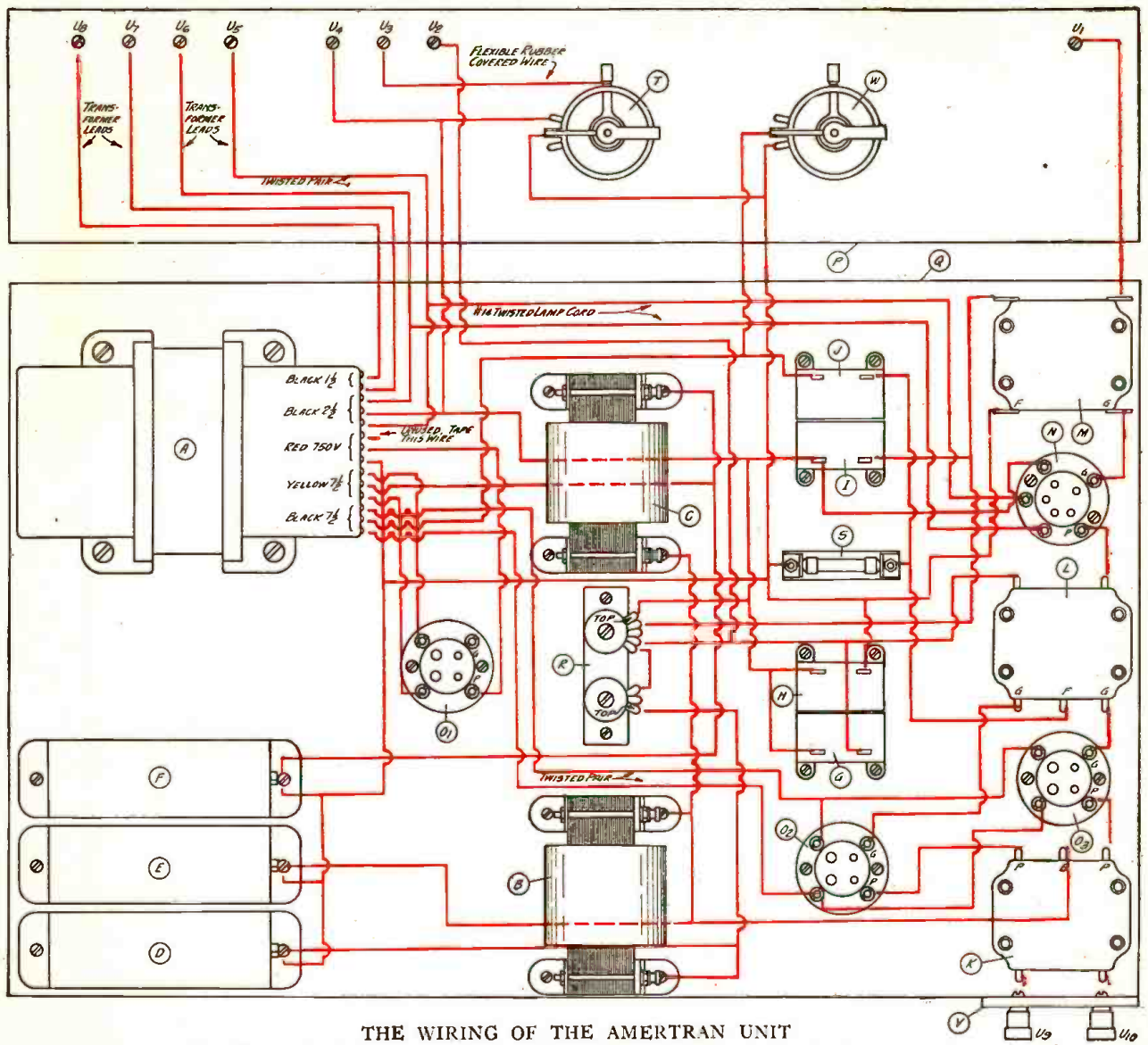
The first job is to prepare the wooden baseboard, Q. This should be cut to the size of 12 by 18 by ¾ inch thick, out of hardwood stock, preferably oak. It may be finished with a dull stain and allowed to dry.

Next the power transformer should be mounted in approximately the position shown in Figure 3, with the secondary side turned in the position as shown. Four large round-head iron screws are used in mounting it, with suitable washers placed between the screw heads and the frame.

Then mount the two filter chokes, B and C, and the AmerTran resistor, R, as shown in the same diagram. Notice that there are two sizes of filter chokes and that they must be used in

POPULAR RADIO WORK SHEET

The AmerTran Amplifier and Power-Pack



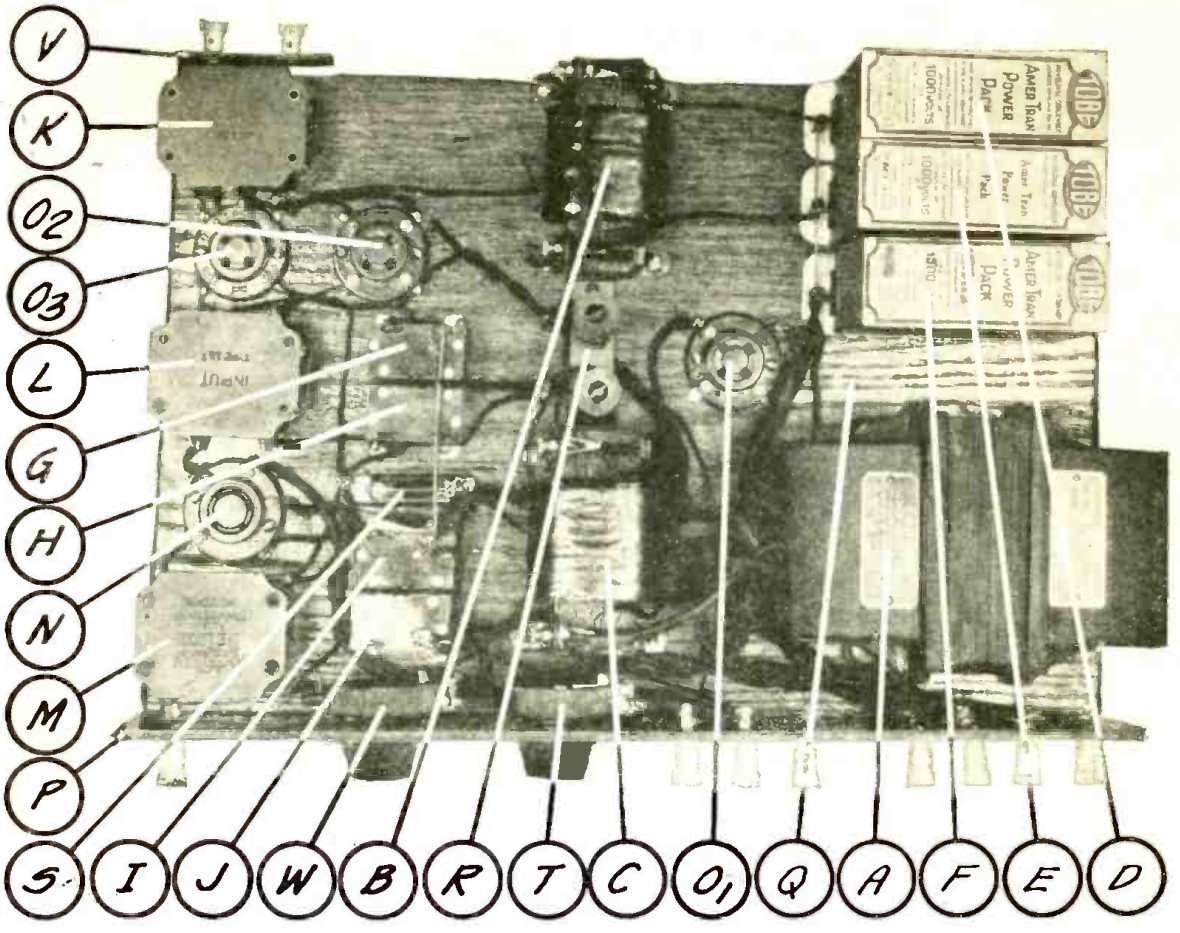
THE WIRING OF THE AMERTRAN UNIT

FIGURE 2: *All the wiring in the AmerTran unit is done above the baseboard, and is indicated in this diagram by solid* RED *lines. The instruments are outlined in* BLACK. *The spacing of the instruments should follow that shown in Figure 3, as the spacing shown above has been changed slightly to make the wiring clearer. The spacing of instruments is important in this unit, since the magnetic fields of the various chokes and transformers might interact and cause an AC hum if the units are not correctly spaced.*

List of Parts for Building This Unit

Cost of Parts—*Not over $125.00*

A—AmerTran power transformer, type PF-281;
B—Amerchoke, No 854;
C—Amerchoke, No. 709;
D and E—Tobe filter condenser for AmerTran power-pack, No. 604, 4 mfd., 1,000 volts DC;
F—Tobe filter condenser for AmerTran power-pack, No. 1102, 2 mfd., 1,500 volts DC;
G, H, I and J—Tobe by-pass condenser, 1 mfd., 300 volts DC;
K—AmerTran output transformer, type 152;
L—AmerTran input transformer, type 151;
M—AmerTran Deluxe transformer for first stage;
N—Na-ald 5-prong vacuum valve socket, No. 427;
O1, O2 and O3—Na-ald 4-prong vacuum valve sockets, No. 426;
P—Formica connection panel, 18 by 4½ by 3/16 inch;
Q—Hardwood baseboard, 18 by 12 by ¾ inch;
R—AmerTran resistor, type R-400 (new style);
S—Aerovox Metalohm, 50,000 ohms, equipped with mounting;
T and W—Centralab fourth terminal potentiometers, 2,000 ohms;
U1 to U10—XL binding posts;
V—Formica binding-post strip, 3 by 2 by 3/16 inch;
Wire, screws, etc.



THE EXACT LAYOUT OF THE AMERTRAN UNIT

FIGURE 3: *For best results, the instruments and parts should be mounted exactly as they are in the view above, to reduce the interaction of the magnetic fields to a minimum.*

the proper places; the large one, No. 709, is lettered C. Next mount the three filter condensers, D, E and F, by means of two screws to each instrument, as shown in Figures 2 and 3. The next job is to mount, on the baseboard, Q, the transformer, M, the input transformer, L, and the output transformer, K. These should first be placed in position and the three sockets, N, O2 and O3, should be spaced with enough room for the connections and then all six instruments should be fastened down. Next mount the remaining socket, O1, with its terminals turned in the position shown, and mount the by-pass condensers, G, H, I and J. These are fastened back to back and screwed to the baseboard with two screws through each instrument. Then fasten down the resistor, S, as indicated. This completes the construction work on the baseboard, Q.

The next job is to cut the Formica binding-post strip, V, to a size of 2 by 3 by 3/16 inch thick, out of ¼-inch stock. The two XL binding posts, U9 and U10, should be attached, as shown, and the binding-post strip may then be fastened into the edge of the baseboard, Q, by means of two screws passing through it and into the edge of the wood.

Now the large connection panel, P, should be cut out of ¼-inch Formica to the size of 4½ by 18 by 3/16 inch. Holes for eight binding posts should be drilled in it, approximately as shown in Figure 3, and two holes should be drilled for the potentiometers, T and W. These two latter holes should be first marked in so that the two potentiometers will not interfere with any of the other instruments mounted on the baseboard. The top view in Figure 3 shows the exact positions that are to be carefully carried out in mounting all of the instruments. The layout shown in this picture must be followed as closely as possible if the unit is to operate successfully without hum. The picture wiring diagram in Figure 2 does not give the correct spacing of parts.

When the panel, P, has been prepared and the eight binding posts, U1, U2, U3, U4, U5, U6, U7 and U8, and the two potentiometers, T and W, have been mounted in the positions shown in Figure 3, the panel itself may be attached to the edge of the baseboard, Q, by means of three strong wood screws, placed through holes in the panel, P, and screwed into the edge of the baseboard, Q.

This completes the construction and assembly of the unit and it is now ready to be wired.

How to Wire the Amplifier

All of the connections for this new unit, except the AC filament leads, are to be made with Corwico Braidite, which is a braided insulation wire heavily waxed. This wire gives ample insulation and at the same time is easy to work with because of the fact that it may be cut into the correct lengths and then the insulation is easily pushed back before soldering it in place. The wire needs no scraping or cleaning.

First of all connect up the filament leads to the binding posts, U5, U6, U7 and U8. These are the AC filament leads and should be made with the lengths of wire with which the transformer is equipped. They should be bent around in a neat position and attached directly to these four binding

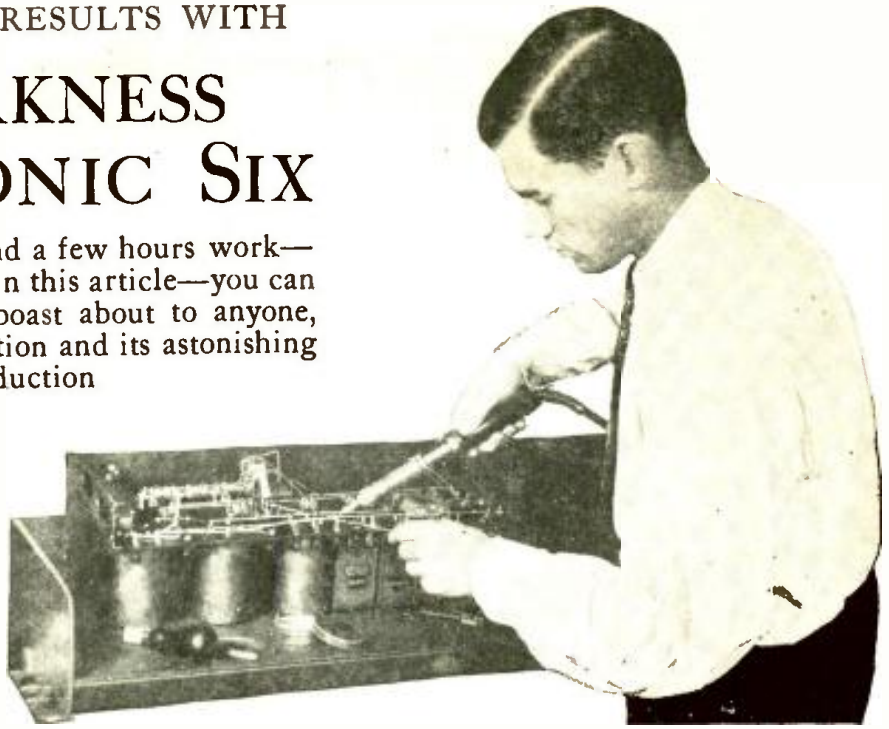
(*Continued on page 77*)

TUNE IN ON BETTER RESULTS WITH

THE HARKNESS COUNTERFONIC SIX

With a small outlay in money and a few hours work—following the instructions given in this article—you can build a receiver that you can boast about to anyone, both for its easy, selective operation and its astonishing quality of reproduction

By KENNETH HARKNESS



A JOB THAT THE BEGINNER CAN COMPLETE

The soldering of the connections on the Counterfonic becomes an astonishingly easy job, by reason of the extreme simplicity of the wiring. Nearly all the wires are run under the sub-panel.

THE theory and design of my latest receiver, the Counterfonic, have been described in an article appearing in the December, 1927, issue of this magazine. In this article Mr. Dorf explained the features that I have strived to bring into actuality—simple construction, easy tuning. high quality of reproduction, and, last but not least, low cost.

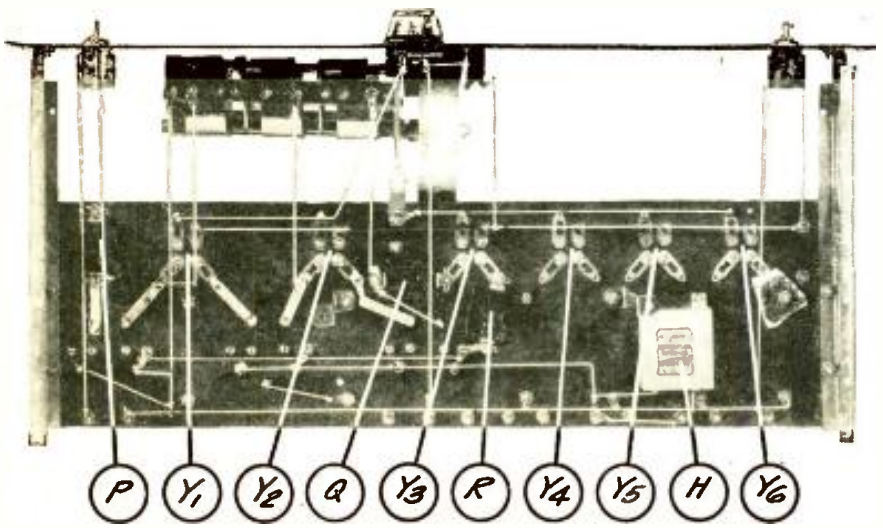
I believe that with the carefully worked out panel arrangement for the assembly of the high-frequency and low-frequency circuits, the construction of this receiver is a relatively simple job.

As for sensitivity, the amplification per stage is closely tied up with the high efficiency of the balanced circuits incorporating the new method of cylindrical coil shielding. As for the quality of reproduction, the new Hiler double-impedance amplifier takes care of this point very completely through its novel method of tuning, as explained in a previous article by Mr. Dorf.

Although the parts used in the new Counterfonic receiver are of excellent quality in both design and manufacture, the completed receiver costs but a fraction of the sum necessary to obtain a manufactured receiver that would give comparable results.

As a résumé of the design, the receiver includes two stages of high-frequency amplification, a vacuum valve detector and three stages of low-frequency amplification equipped with an output filter for handling the large volume and for assuring the excellent tone quality of which the set is capable. The tuning is done completely with the single drum dial that operates the three-gang condenser. The only other controls I have incorporated in the design are a rheostat for the filaments, an "on" and "off" switch and an antenna switch for changing selectivity.

The schematic wiring diagram for the Counterfonic Six is shown in Figure 4.



THE RECEIVER FROM BENEATH

FIGURE 1: *The valve sockets across the center of the sub-panel come ready mounted on the drilled panel; this saves much of the assembly work. The only instruments mounted under the sub-panel are condensers H, P, Q and R.*

How to Assemble the Instruments

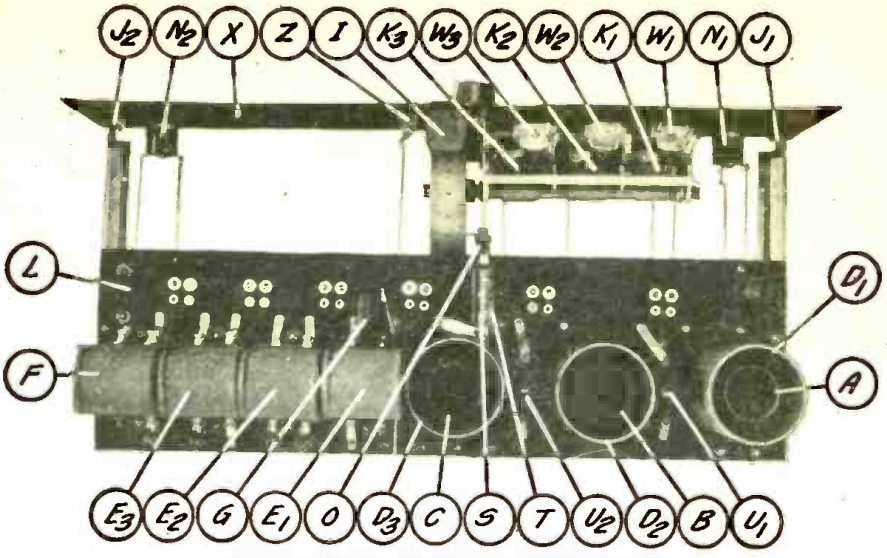
It is best to start mounting the parts that are to be attached to the sub-panel, L. Fasten down the three high-frequency transformers, A, B and C, with two screws to each instrument, and then attach the three cylindrical copper shields, D1, D2 and D3, also by means of two screws apiece.

Then mount the two neutralizing condensers, U1 and U2, with two screws and nuts to each instrument. The three double-impedance couplers, E1, E2 and E3, and the output filter unit, F, should next be attached securely. These are also to be held with two screws and nuts.

Next mount the twelve binding posts, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, V11 and V12, in position, as indicated in Figure 3. The grid-leak mounting, T, may also be fastened on

POPULAR RADIO WORK SHEET

The Counterfonic Six



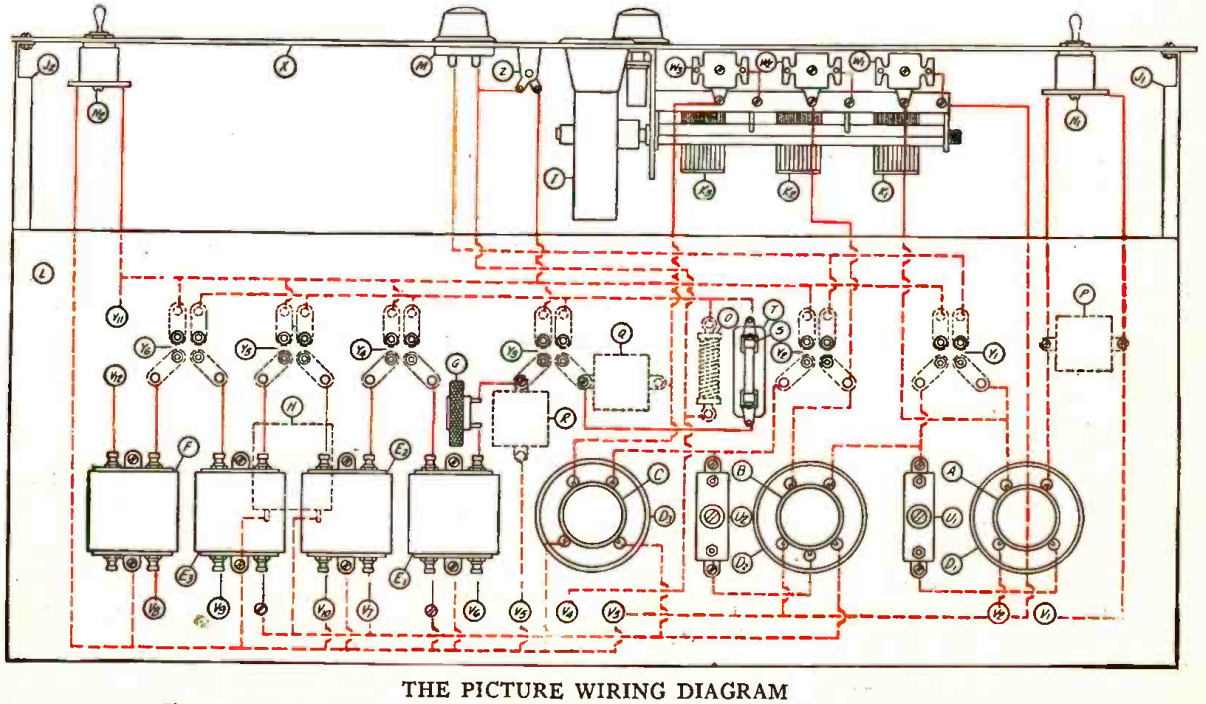
THE LAYOUT OF THE INSTRUMENTS

FIGURE 2: *Note the individual shields of heavy copper tubing around the high-frequency and detector stages at the right.*

List of Parts for Building this Receiver

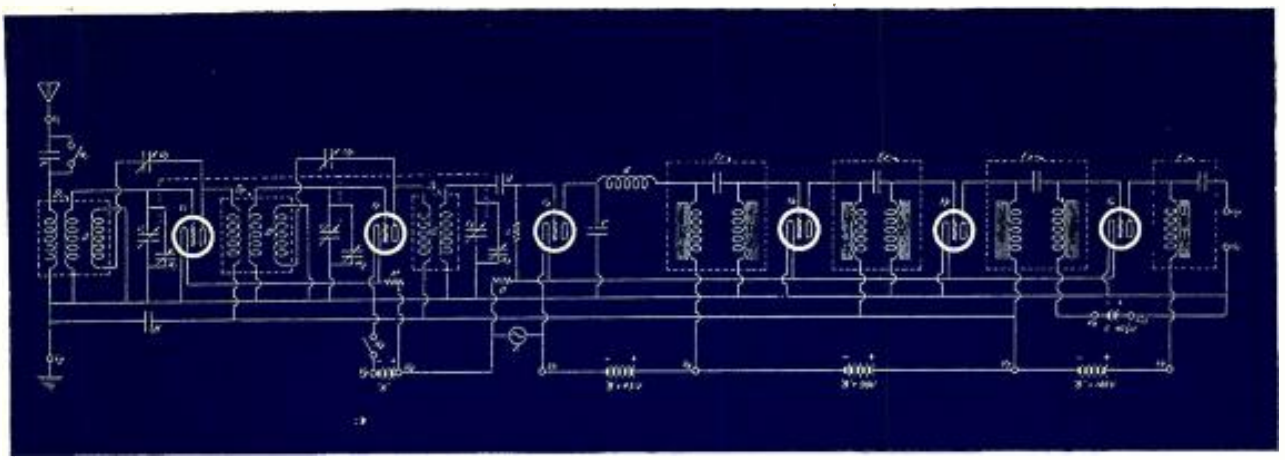
Cost of Parts—*Not over $60.00*

A, B and C—Harkness Counterfonic high-frequency transformers;
D1, D2 and D3—Cylindrical copper shields;
E1, E2 and E3—Harkness tuned double-impedance audio-couplers for the first, second and third stages;
F—Harkness audio-output-filter unit;
G—Harkness high-frequency choke coil;
H—Aerovox by-pass condenser, 1 mfd.;
I—Silver-Marshall drum dial;
J1 and J2—Harkness brackets;
K1, K2 and K3—U. S. L. three-gang variable condenser, .00035 mfd. capacity in each section;
L—Westinghouse Micarta drilled sub-panel, with six sockets attached;
M—Carter midget rheostat, 10 ohms;
N1 and N2—Saturn battery switches;
O—Carter fixed filament resistor, 4/5 ohm;
P—Aerovox fixed condenser, .0001 mfd.;
Q—Aerovox fixed condenser, .00025 mfd.;
R—Aerovox fixed condenser, .001 mfd.;
S—Lynch grid-leak, 2 megohms;
T—Lynch grid-leak mounting;
U1 and U2—L neutralizing condensers, .0001 mfd.;
V1, V2, V3, V4, V5, V6, V7, V8, V9, V10, 11 and 12—Eby binding posts;
W1, W2 and W3—Hammarlund equalizing condensers;
X—Westinghouse Micarta drilled and engraved front panel.
Wire, screws, solder, etc.



THE PICTURE WIRING DIAGRAM

FIGURE 3: *Solid* RED *lines indicate the wiring above the sub-panel, dotted* RED *lines the wiring beneath. The instruments are outlined in* BLACK.



THE SCHEMATIC WIRING DIAGRAM

FIGURE 4: *Note the three windings in the first two high-frequency coils; the third winding in each case is for the purpose of neutralization. The double-impedance, low-frequency amplifier is at the right.*

the sub-panel at this time. These are all of the instruments mounted on the top of the sub-panel, L.

Turn the sub-panel over and mount, with suitable screws and nuts, the three mica fixed condensers, P, Q and R, in their proper positions, as shown in Figures 1 and 3. Then fasten down the by-pass condenser, H, as shown in these same illustrations.

The filament resistor, O, may be fastened at one end by a screw and nut to the sub-panel on the underneath side.

When this is done, fasten the two brackets, J1 and J2 with two screws on each bracket to the sub-panel, L.

To start with the front panel, X, first mount the three Hammarlund equalizing condensers, W1, W2 and W3, on the 3-gang condenser, K1, K2 and K3. It will be noticed that each is fastened to the screw that holds one side of each stator of the triple condenser. The other side of these small condensers should be soldered by means of a lug to the screws that connect to the common frame of the triple condenser. This is shown clearly in Figure 3. Attach the bracket of the drum dial, I, to the condenser, K1, K2 and K3, and then attach the drum itself to the condenser shaft. The complete unit may then be mounted on the front panel, X, with two screws.

Next fasten onto the front panel, with two small screws, the window of the drum dial, I, including the dial light.

Next attach the midget rheostat, M, which is a single-hole mounting instrument. Then mount the two switches, N1 and N2, in the two corners of the front panel.

The sub-panel may then be attached to the front panel by means of four screws inserted through the holes in the front panel and the holes in the ends of the two brackets, J1 and J2. Flat-head machine screws and nuts should be used for this purpose.

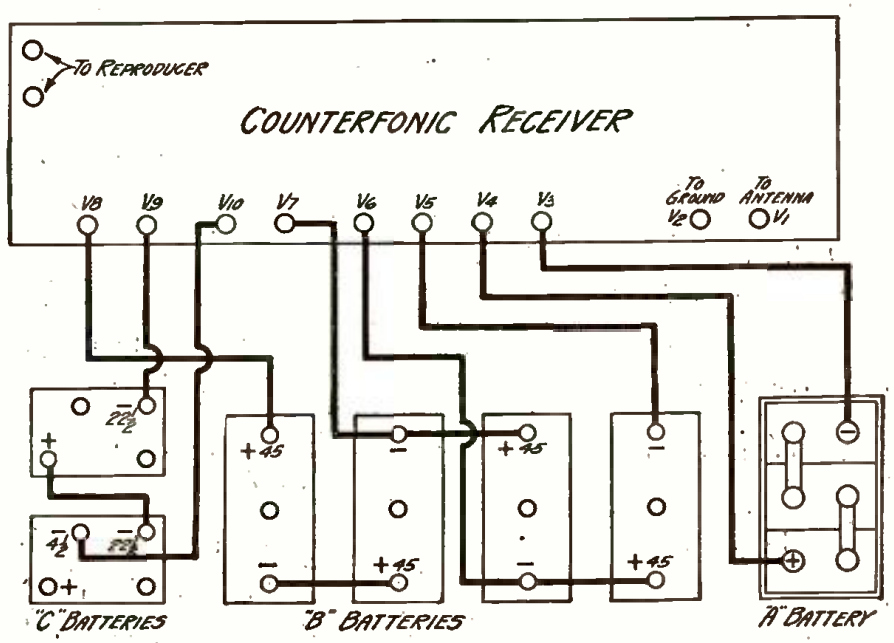
This completes the construction work, except for the mounting of the high-frequency choke coil, G, which is supported by the wiring and may be done at that time.

Wiring the Counterfonic Six

As has been explained in the previous article, I have laid out this receiver so that the wiring may be accomplished in the easiest manner possible. The complete wiring to the low-frequency coupling units may be done by means of small strip connections, which are furnished as part of the complete kit.

I recommend for this particular receiver that all other connections be made with tinned, round busbar. Refer constantly to the picture wiring diagram in Figure 3 for the exact connections that are to be made to all of the instruments, parts and binding posts. This diagram carries out the theoretical circuit shown in Figure 4. In the picture wiring diagram all of the instruments are outlined in black and the instruments outlined in dotted black lines indicate those parts that are mounted underneath the sub-panel. The wiring itself is shown in red and the parts of the wiring to be done underneath the sub-panel are shown in dotted

(*Continued on page 72*)



FOR OPERATING THE RECEIVER

FIGURE 5: *The binding posts on the back of the Counterfonic sub-panel should be connected to the batteries indicated in this diagram. The two terminals marked "To Reproducer" are those lettered V11 and V12 in Figure 3.*

CHECKING THE PILOT FOR HUMS

Among other tests at the POPULAR RADIO *Laboratory, the Pilot power-pack was subjected to the test shown above, in which the unit was run under varying current loads, and the output tested for AC hum under these conditions.*

A UNIT WITHIN THE REACH OF ANY POCKETBOOK—

The Pilot "BC" Power-Pack

If you have been forced to stick to battery operation for your receiver through the lack of sufficient money to buy a power-pack, all your troubles will be solved by the unit whose construction is described here. Although it employs only parts of tested excellence and durability, its cost is almost unbelievably cheap for a "B" power unit. It is especially adapted for use with AC valves.

By M. B. SLEEPER

SUCH strides have been made in the design of "B" power-packs that set builders are now able to make a unit that will supply voltages for operating their receivers at a very low cost, and without fear of breakdown. The unit described here will operate any standard receiver, giving voltages for power-valve operation in the last stage of a set, and intermediate voltages for the high-frequency stages and the detector, as well as a "C" biasing voltage and filament current for the power valve.

The new unit is designed for use with resistance or impedance-coupled amplifiers as well as with transformer types. It is designed to operate without "motor-boating" or other distortion with these standard amplifiers.

One of the special features of the unit is the method of ganging up paper filter condensers for the filter circuit. The condensers are placed side by side and long threaded rods are furnished with cross bars that mount all of the condensers as a single unit.

An idea of the simplicity of this new unit that uses the standard QRS rectifier valve may be gained from a study of Figure 1, which shows the top view of the unit with all of the instruments and parts mounted on a wooden baseboard, and with the binding-post strip running along the left end.

How to Mount the Parts

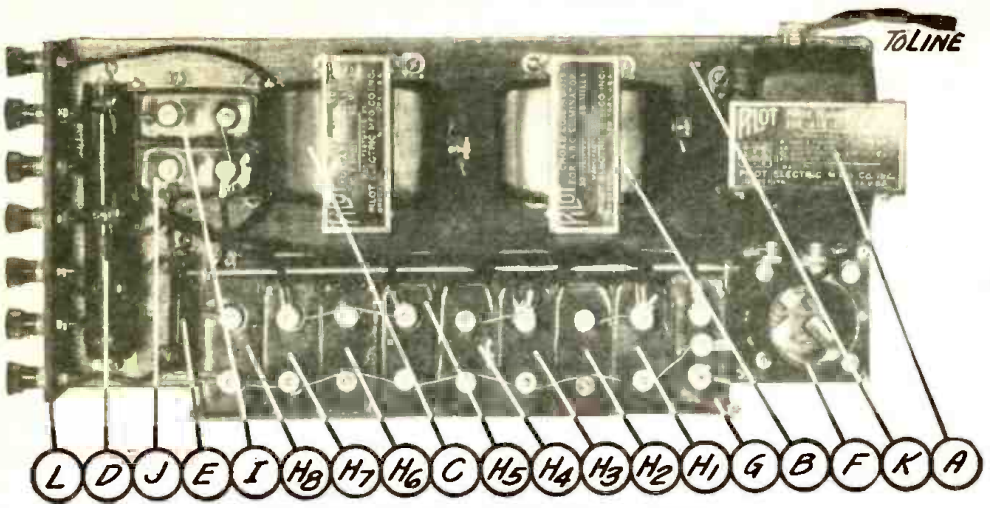
First of all, cut out the wooden baseboard, K, to a size of 6 inches by 14 inches by ¾ inch. Finish it smoothly and give it a coat of shellac or stain. Next prepare the binding-post strip, L, as shown in Figure 3, and fasten on the seven binding posts, M1, M2, M3, M4, M5, M6 and M7. These are fastened by means of a nut tightened on the threaded portion of each binding post after it has been inserted through the connection strip. Mount the connection strip by three screws fastened through the three holes in the strip and into the end of the baseboard, K.

Next mount the two resistors, D and E, with round-head wood screws, driven into the baseboard. Then mount the two condensers, J and I, as shown in Figures 1 and 2. Do like-

(*Continued on page 64*)

POPULAR RADIO WORK SHEET

The Pilot "BC" Power-Pack



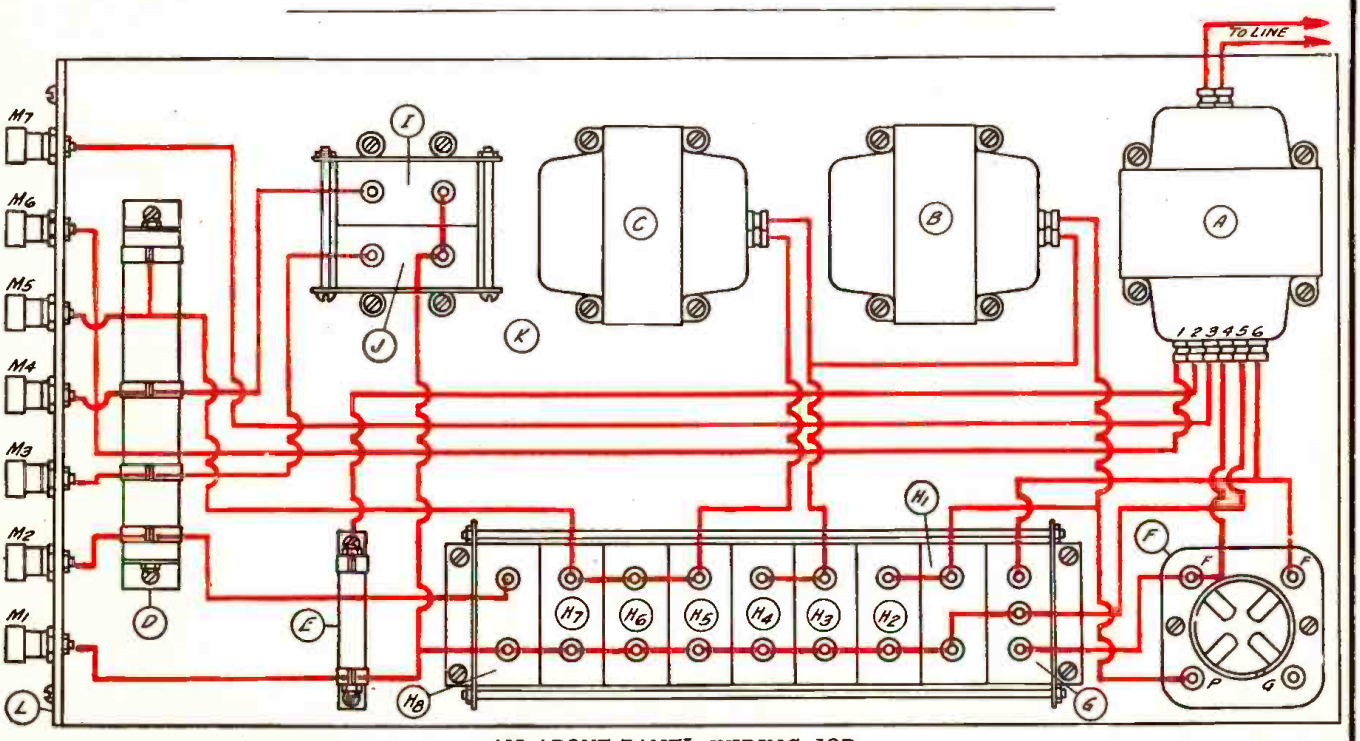
A VIEW OF THE UNIT FROM ABOVE

FIGURE 1: *The condenser bank in the lower center of the illustration is made up of individual units assembled and clamped together with rods. The power transformer and rectifier valve are at the right.*

List of Parts for Building This Unit

Cost of Parts—*Not over $26.00*

A—Pilot power transformer, No. 374;
B and C—Pilot choke coils, No. 375, 30 henrys;
D—Pilot wired resistor, 2,420 ohms, tapped at 1,200, 750 and 470 ohms, No. 952;
E—Pilot wired resistor, 2,250 ohms, No. 951;
F—Pilot socket, No. 201;
G—Pilot buffer condenser, .1 mfd. and .1 mfd., center tapped;
H—Pilot high-voltage condensers, 2 mfd., with mounting rack;
I and J—Pilot by-pass condensers, 1 mfd., with mounting rack;
K—Wooden baseboard, 6 by 14 by ¾ inch;
L—Bakelite connection strip, 2 by 6 by ⅛ inch;
M—Pilot binding posts, 2 plain, 2 "B" positive (+) amp., 1 "B" positive (+) det., 1 "A" positive (+) batt., 1 "A" negative (—) batt.;
Connection wires and lugs, nuts and bolts, screws.



AN ABOVE-PANEL WIRING JOB

FIGURE 2: *The* RED *lines indicate the wiring; the instruments are outlined in* BLACK. *All the instruments are mounted and wired above the baseboard.*

KILLING INTERFERENCE BEFORE IT IS BORN

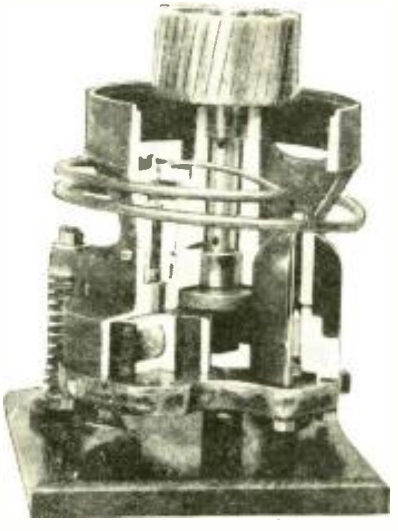
How the big electrical manufacturers are coming to the aid of the broadcast listener by eliminating interference-producing parts from electrical appliances for the home.

By AUBREY DELACY

THERE are hundreds of thousands —yes, millions—of electrical devices operating in the United States today with interference built right into them. They are a chronic and prolific source of electrical disturbance, for they were brought into the world of electrical appliances handicapped with these weaknesses. The day of electric eugenics has at last arrived, however, and in the future the engineering fathers of electrical devices will take care to see to it that no apparatus is reared from the laboratory to the practical stage without first having been correctly conceived.

The large electrical manufacturers of the United States, conscious of their obligation to the six million receiving set owners, have at last engaged in a plan to eliminate interference by so designing electrical apparatus that it will not be able to set up ethereal disturbances. It has been known, for instance, that electric heating pads with thermostatic controls have, in the past, caused a great deal of radio interference. The Westinghouse Company, realizing the devastating influence of such a device, set its engineering department to work on a heating pad with automatic control that could not cause any interference whatever. Its radio teeth were completely extracted, and it will be but a matter of time before other manufacturers of similar appliances will have to do precisely the same thing.

What the Westinghouse Company has done with heating pads the General Electric Company has done with ice box refrigerator units, which, incidentally, are invariably electrically controlled and driven. The illustration shows a refrigerator unit which has had its interference kinks ironed out successfully before it was placed in operation. The motor used is commutatorless, being of the induction split phase type. So carefully has the manufacturer of this equipment considered the possibilities of radio interference, and so successfully has that been eliminated, that a superheterodyne may be operated within a few feet of the contrivance without the slightest indication of hum or disturbance.



A REFRIGERATOR UNIT THAT CANNOT SPUTTER

The unit in the above picture is a cutaway model of the new refrigerator units that the General Electric Co. is employing in their electric refrigerators. By using an induction motor the interference produced by dirty commutators is completely eliminated.

14 Worst Offenders

1. *Sparking Motors.*
2. *Elevator Circuit Breakers.*
3. *Third Rails.*
4. *Arc Lights.*
5. *X-rays.*
6. *Ultra Violet-ray Machines.*
7. *Automatic Telephones.*
8. *Electric Sign Switches.*
9. *Precipitating Apparatus.*
10. *Automatic Heating Pads.*
11. *Toy Trains.*
12. *Electric Railroads.*
13. *Power Leaks.*
14. *Ozonators.*

One of the large electrical manufacturers is submitting all of its power devices to its engineering department as a final check on the design of the apparatus from the standpoint of producing radio interference. It has been found, oftentimes, that the radio engineers when checking over these devices can offer suggestions which will reduce or practically eliminate any interference that might be caused.

The whole electrical industry is responding to the call to eliminate electrical interference, and, within a few years' time, practically all electrical appliances offered for sale will be "radio proof."

The greatest source of interference that must be overcome is that of electric sparks and arcs, and while the problem seems almost insurmountable at the present time, perhaps some genius will discover a way to eliminate this undesirable factor. When he does, he will be hailed as a bringer of peace and security to the world of radio reception, for 70 per cent. of the interference that we now have is caused by sparking devices. If the sparks are small enough they can be absorbed by condensers; but if they are too large to be handled in this way, nothing can be done until some other means of elimination is found.

The action of the big manufacturers in striving to create better conditions for radio reception is a good indication of the marvelous strides that radio has made during the past years. It shows that the world has come to recognize that radio has emerged from its infancy and is taking its place among the important activities of our planet, and is demanding its own "place in the sun." And such progress has been made so far that it is entirely possible that we may live to see an "interferenceless world." The human ingenuity that is able to devise radio will surely not be balked by the problem of eliminating the man-made interference of apparatus devised in pre-radio days.

The virtues of resistance coupling are fully realized when the LC-28 high-frequency pack is connected up with the National unit. The standard Corbett console cabinet of the LC-28 provides ample space for both the National unit and the "A" voltage supply.

A RESISTANCE-COUPLED AMPLIFIER FOR THE LC-28

Owners of LC-28's who put their trust in resistance-coupled low-frequency amplification will find exactly what they want in the new National power-pack amplifier. When used with the LC-28, the National unit supplies all the "B" voltages necessary for the high-frequency pack, and three stages of resistance coupling with a 210 type power valve in the last low-frequency stage.

By LAURENCE M. COCKADAY

RADIO fans who are enthusiasts for resistance-coupled amplification will be interested in this article, which announces a new resistance-coupled power amplifier that may be used with the LC-28 high-frequency packs.

The unit, as shown in the accompanying illustrations, is completely contained in a neat metal cabinet that may be placed in the lower portion of the radio console which houses the LC-28, or in the compartment of the radio table.

It consists of two stages of resistance-coupled amplification, followed by a resistance-coupled power stage utilizing a large power valve of the 210 type. The first stage uses a high-mu valve and the second stage uses a standard type amplifier valve.

This unit will supply the total "B" power necessary for the LC-28 high-frequency pack, as well as for the self-contained amplifier. When this unit is used with the LC-28 high-frequency pack, quite startling reproduction results may be obtained. The maximum volume is greater than necessary, although it may be controlled to a whisper, and the quality is of that high order that may be obtained from a correctly designed and manufactured resistance-coupled amplifier.

There are two variable adjusters on the unit for the intermediate "B" voltages.

In the picture at the beginning of the

article is shown one of the amplifiers being installed in the Corbett console for the LC-28 receiver. Once this has been set up and connected, it needs no further attention.

The Installation of the Amplifier

In using one of these new units in connection with the LC-28, it is recommended that the connection scheme shown in the combination diagram in Figure 1 be followed closely.

First the LC-28 set is placed in either the Corbett cabinet or the console. For simplicity's sake the rear view of the set is shown in Figure 1 installed in the cabinet. At the extreme right is shown the connection for the socket antenna connected to the antenna jack of the set. This combination will work very satisfactorily without an outdoor antenna, although the regular outdoor antenna may be used if desired. The ground wire should be installed and inserted in the ground jack on the set, as shown. Then the power-pack amplifier should be equipped with the necessary vacuum valves. The valves are placed in the sockets by turning the amplifier on its side, and in the first socket (on the left) a 240 type high-mu valve should be used. In the second socket place a type AX Ceco valve, and in the third socket place a type L-10 valve. Put a type R-81 rectifier valve in the last socket. Then turn the amplifier in its normal position and install it in the compartment of the radio table upon which is set the receiver cabinet, or in the bottom part of the console, if one is used. The connections between the colored wires of the Yaxley cable should be made exactly as shown in Figure 1, with the red and black wires also running over to the "A" battery through the knife switch and the Yaxley relay. The cone reproducer, shown in the diagram, should be connected to the two output jacks at the left of the binding-post strip, on the amplifier. It is recommended that a Belden extension cord be used at this place so that the reproducer may be installed on the opposite side of the room from the receiver.

The AC extension cord and plug from the amplifier should be inserted in the socket on the Yaxley switch marked *"B" Eliminator*, and the extension cord and plug of the Yaxley switch should be inserted in a nearby 110-volt, 60-cycle lighting receptacle. The switch on the receptacle may be left turned "on" at all times.

If desired, a trickle charger may be connected in combination with the storage battery, and its extension cord and plug should be inserted in the socket on the Yaxley relay marked *Trickle Charger*.

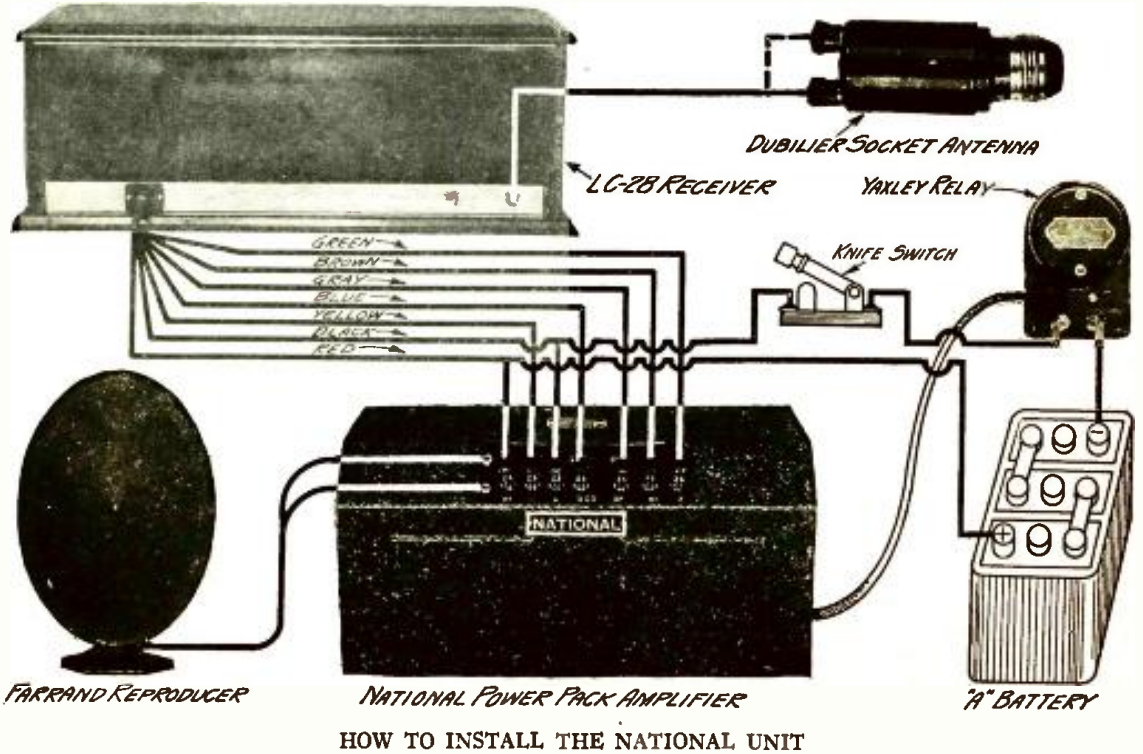
The trickle charger arrangement is not shown in the diagram.

The knife switch that is shown in the diagram is used to turn the set "on" or "off," and the switch rheostat on the LC-28 set itself is left "on" at all times. When the knife switch is closed, current flows through the Yaxley relay, the valves in the set, and two of the valves in the amplifier, thus causing the relay to operate and closing the line of the 110-volt circuit in the amplifier. This causes the rectifier valve and the power valve in the amplifier to light, thus furnishing complete "B" power to the set and to the amplifier itself.

This complete installation may be made in approximately fifteen minutes, and when once installed needs no further adjustment except the two controls for the proper high-frequency and detector plate voltages. These are made on the amplifier with the set in operation and the two adjustments will be found directly above the binding posts marked *DET* and *RF*. If the trickle charger is also installed, the set requires no further care outside of filling the storage battery with distilled water two or three times a year.

As stated before, the system of resistance-coupled amplification has many faithful adherents among the radio fans, and it is believed that this is the first opportunity offered to them to use a complete unit supplying power to the set and incorporating the highest quality resistance-coupled amplifier operated with a 210-type power valve.

(*Continued on page 73*)



HOW TO INSTALL THE NATIONAL UNIT

FIGURE 1: *The hook-up shown above is one that has been tested and approved in the* POPULAR RADIO *Laboratory; if the units are connected as shown here the quality and volume obtainable should equal that of the finest manufactured set obtainable.*

QUALITY RESULTS WITH A CRYSTAL

After the preliminary adjustment of the auxiliary controls, the operation of the New Home receiver is accomplished with the two tuning drums and the volume control knob.

CRYSTAL DETECTION GIVES AMAZING RESULTS IN

The New Home Receiver

Here is a receiver that is designed especially for the fan who is anxious to get the best results with the most economy in operation. Although it uses only four valves, crystal detection and a careful design of the circuit give the New Home receiver a tonal quality and volume equal to that of many six-valve sets—at a much reduced drain on the "A" and "B" batteries, or on the power-pack, if one is used.

By WILL BRADLEY, JR.

IN describing the New Home receiver, it would perhaps be easier to answer, at first, two questions which will be raised in every mind. First, why use a crystal for a detector when vacuum valves are so much more sensitive; and second, how can four valves he used successfully when all of the latest factory-built sets call for at least five valves?

All of the new multi-valve sets depend upon high-frequency amplification before the detector, and in many instances the amplification is so great that the grid of this valve is sometimes biased to prevent overloading and consequent distortion. For this reason alone the use of a crystal is warranted, when it is preceded by sufficient high-frequency amplification. When we further realize that the crystal cannot hiss, cause regeneration, or make any noise of its own accord, then its use hecomes even more desirahle.

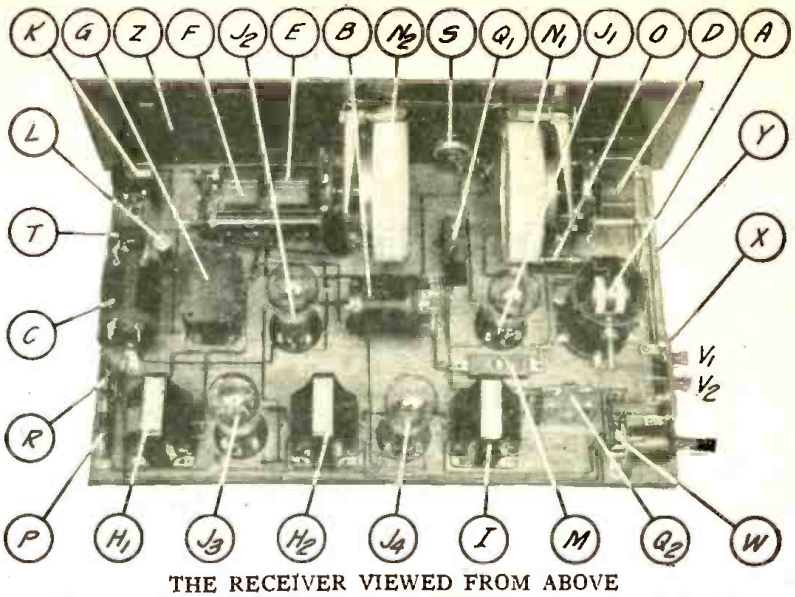
Now, how many valves are necessary? If the set is to be located where a loop must be used, then eight valves seem to he the minimum that will he required, and the most satisfactory circuits will be the superheterodyne and the multi-stage tuned-high-frequency circuits; for on these installations we must also contend with the problem of extreme selectivity and sensitivity. In the suburbs and the country, where it is possible to erect an outdoor antenna, its use will enable us to pick up a vastly stronger signal impulse, and accordingly we can cut down on the high-frequency amplification, or the number of vacuum valves. When we consider that fewer valves will be much cheaper to maintain in service, because their demand upon "B" batteries and the "A" supply will be proportionately less, then the real value of as few valves as possible will he realized.

The New Home receiver has been developed after months of trial and is presented to POPULAR RADIO readers with these essential features:

1. Excellent tone quality;
2. Economy of operation;
3. Selectivity ample to meet the average need;
4. Sensitivity enough for distance reception when atmospheric conditions permit;
5. Easily tuned and logged;

POPULAR RADIO WORK SHEET

The New Home Receiver



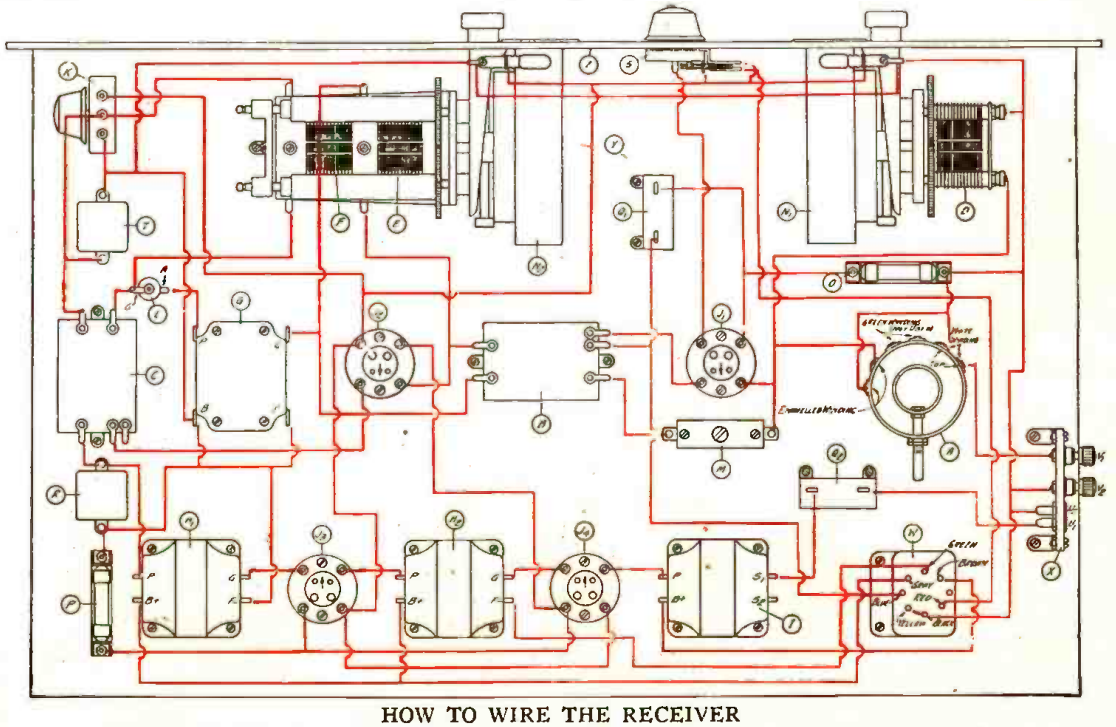
THE RECEIVER VIEWED FROM ABOVE

FIGURE 1: *For the best results the completed baseboard layout should have the neat appearance of that shown above.*

List of Parts For Building This Receiver

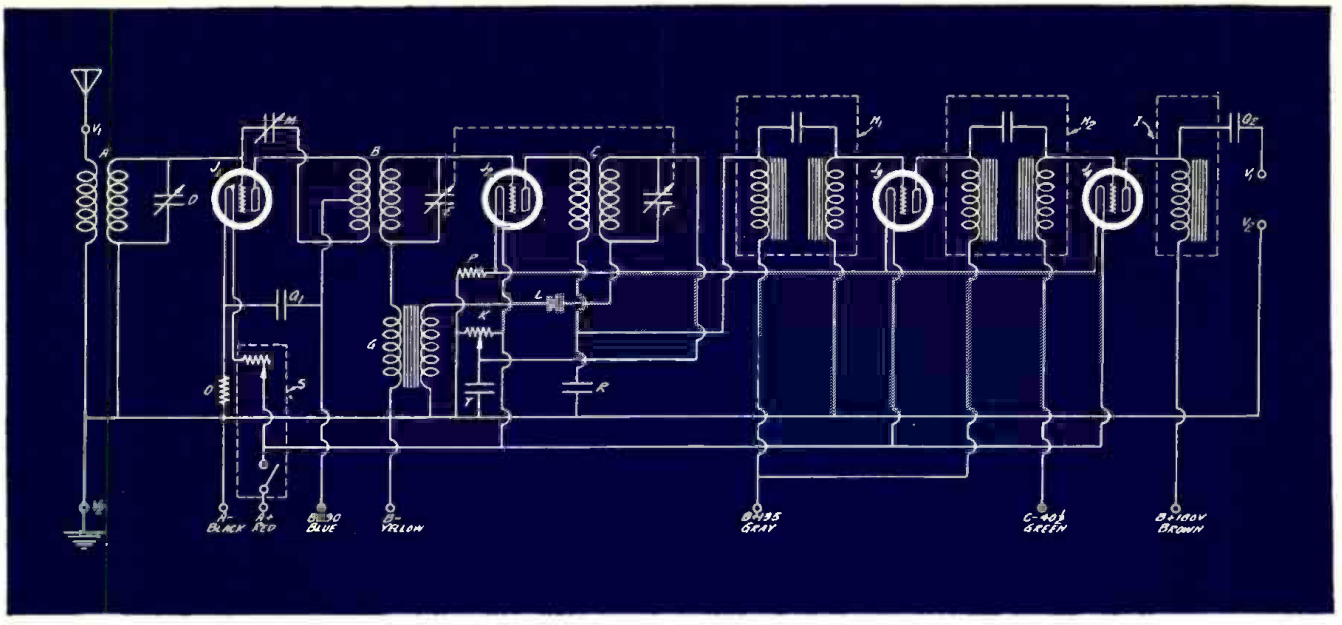
Cost of Parts—*Not over $70.00*

A, B and C—One precision No. 3D 3-circuit tuner for .00035 mfd. condenser and 2 precision No. 4F tapped-primary coils; respectively;
D—Remler .00035 S. L. F. condenser;
E and F—Remler 2-in-line S. L. F. condensers;
G—AmerTran De Luxe transformer;
H1 and H2—Samson dual impedances, type D;
I—Samson output impedance, type O;
J1, J2, J3 and J4—Na-ald sockets;
K—Frost 2,000-ohm potentiometer;
L—Carborundum crystal;
M—X-L model N vario-denser;
N1 and N2—Remler drum dials;
O—Amperite, type 1A;
P—Amperite, type 4A;
Q1 and Q2—Polymet 1 mfd. filter condensers, type A;
R—Polymet moulded condenser, .002;
S—Carter 20-ohm rheostat and switch;
T—Polymet moulded condenser, .006;
U1 and U2—Yaxley pup jacks;
V1 and V2—Eby binding posts;
W—Yaxley No. 600 cable connector plug;
X—Binding-post strip, 1 by 3 inches;
Y—Baseboard, 20 by 12 inches;
Z—Panel, 7 by 21 inches.



HOW TO WIRE THE RECEIVER

FIGURE 2: *The instruments are outlined in* BLACK; *the wiring is all done above the baseboard, and is indicated in* RED.



THE CIRCUITS OF THE NEW HOME RECEIVER

FIGURE 3: *The high-frequency amplifier is at the left in the schematic diagram; the double-impedance-coupled, low-frequency amplifier and output filter at the right. The crystal detector is shown at L, followed by the reflex transformer, G.*

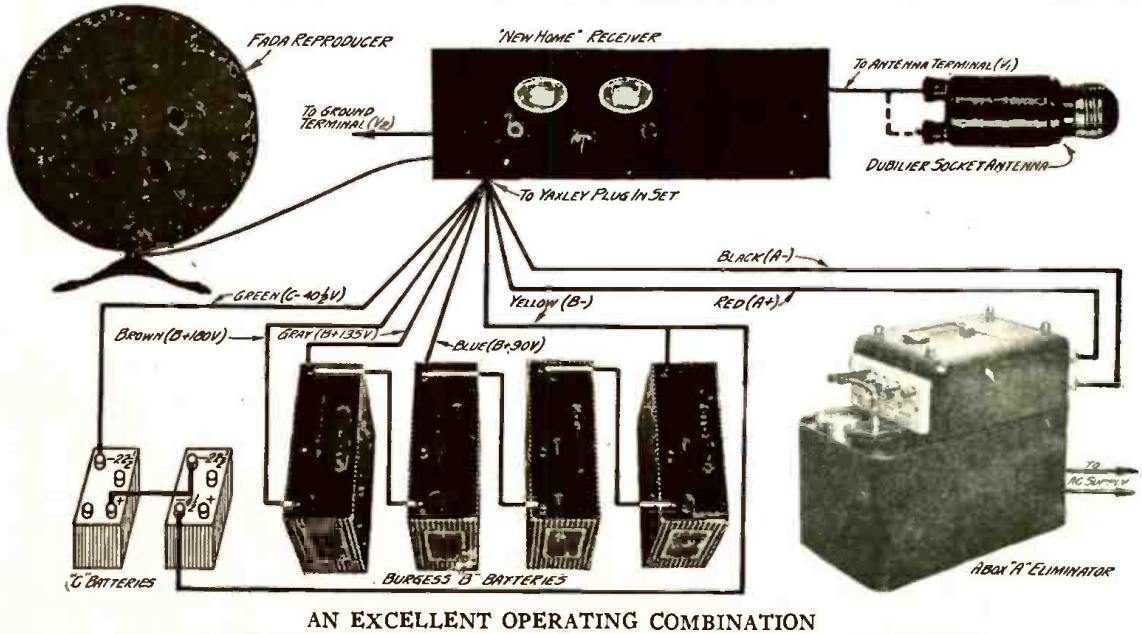
6. Readily converted to entire AC or DC operation;
7. May be used as a low-frequency amplifier for the new electric-cut records;
8. Absolute absence of regenerative howls.

The heart of this circuit is the carborundum crystal detector in combination with the AmerTran De Luxe transformer. Reference to Figure 3 will reveal the total absence of any bridging or by-passing condensers in this part of the circuit, that would otherwise impair the straight-line amplifying qualities of this excellent transformer.

Briefly, the circuit consists of two highly efficient stages of tuned-high-frequency amplification, a crystal detector, followed by a transformer, and two double-impedance stages—in all, the equivalent of six-valve operation. In fact, all of the parts necessary for the construction of a six-valve set are included in this kit, with the exception of two sockets.

Through the careful plotting of the time and phase relations of the currents in the high-frequency end of the circuit, it has been possible to make the second valve perform a double duty, that of amplifying two different frequencies with no impairing effect to either. At all times the valve operates on the correct part of its grid-voltage, plate-current curve. Looking back to the old method of controlling oscillations in reflex circuits by a potentiometer control of grid-bias, so detrimental to high-frequency efficiency, or by variation of the detector filament voltage, which seriously hurt the quality of reproduction, it is but small wonder that the once-popular reflex has lost favor. The New

(*Continued on page 93*)

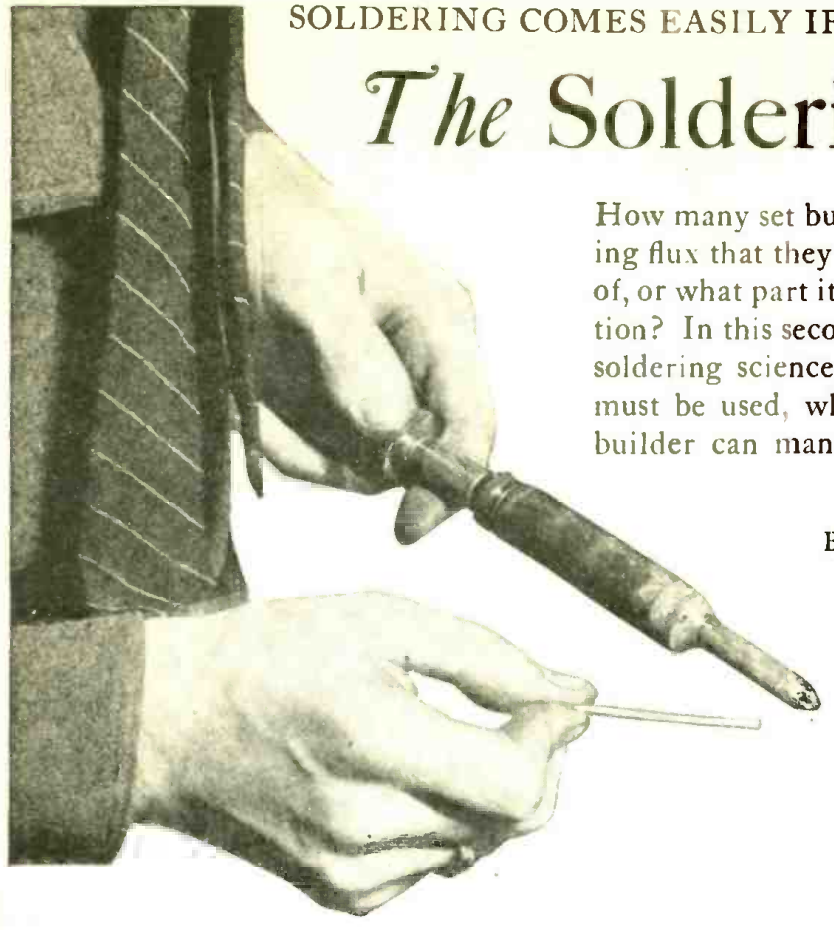


AN EXCELLENT OPERATING COMBINATION

FIGURE 4: *On account of its low current drain, "B" batteries may be employed quite economically with the New Home receiver. The socket antenna and "A" eliminator were also found very successful in this hook-up.*

SOLDERING COMES EASILY IF YOU KNOW THE RULES OF

The Soldering Science



How many set builders know what the soldering flux that they use constantly really consists of, or what part it plays in the soldering operation? In this second article in the series on the soldering science, Mr. Ripley tells why flux must be used, what it does, and how the set builder can manipulate it most successfully.

By P. C. RIPLEY*

ALL unprotected metals in contact with the atmosphere acquire, on their surfaces, a more or less invisible film of oxide. This is the direct result of a chemical action produced by the attraction existing between the metal and oxygen. A common example of this action is the formation of red rust or ferric oxide on iron. Before uniting two dissimilar metals or two pieces of like metal with a bond of solder these oxides must be removed. This is accomplished with a de-oxidizer, more commonly termed a flux.

Suppose we take two metal parts having their surfaces covered with this film of oxide and we wish to solder them. A careful inspection may disclose the fact that matter other than oxides may lie upon the oxide formation, such as sulphates, chlorides, carbon particles (dust), gums (shellac, varnish, enamel, lacquer), or other compounds too numerous to mention. Flux is designed to dissolve metallic oxides and nothing else. The removal of matter other than oxides on radio parts must be accomplished in a mechanical way, for any chemical solvent with sufficient capacity to cope with this varied array of substances would also violently attack the metal itself. The results of such an attack would likely be the formation of new compounds on the work whose removal would be more difficult than the original material encountered.

Too many who attempt to use solder have the delusion that a good flux is a magical substance in whose power it lies to dissolve and remove any and all matter with which it may be placed in contact. Let mechanical cleaning such as sandpapering, filing, or scraping be the means of disposition for such matter, offering the flux the opportunity to accomplish the work for which it is intended—oxide removal.

On certain metals, some fluxes develop their greatest capacity as oxide solvents at higher temperatures, while others must be utilized at lower ones. The safest, surest, and most satisfactory method to be followed when specific knowledge is lacking, is to bring the part to a solder-melting temperature; then apply the solder and flux to the surface where adhesion is desired. The flux attacks the oxides and dissolves them, presenting a clean surface on the metal parts for the reception of the molten solder. The solder in turn acts as a solvent, dissolving a small quantity of the clean surface of the parts; and under the favorable and necessary condition which we have prepared by fluxing and cleaning, it actually alloys with these parts. Following the withdrawal of the soldering heat and the resulting solidification of the solder, we discover that the two metal parts are securely bonded.

Chloride fluxes come under the heading of the stronger fluxing agents and are efficient at oxide solvency. Practically all commercial fluid and paste forms of fluxes depend upon the activity of some chloride salt for their fluxing capacity. Fluxes of the fluid form are generally solutions composed of such solvents as alcohol or water into which have been dissolved varying amounts of zinc and ammonium chlorides. Pastes are emulsions formed from organic greases or waxes and chloride salt solutions. In both cases, the chlorides are the active constituent of the flux.

Residuals of the chloride fluxes are always more or less conductive, due to the activity of the zinc chloride at moisture collection; furthermore, it does not lose this quality from exposure to the temperature of soldering heats. A dilute solution of hydrochloric acid is an efficient conductor of electrical energy and such solutions are formed from the residual of chloride fluxes. Leakage is likely to result through this conducting medium. Such leakage will rob a receiving set of measurable signal strength, with the corresponding loss in volume and receptive range.

Let us visualize what takes place when chlorides are employed as a fluxing medium, either in a paste or fluid form. We will take for an example the soldering of a stranded conductor

(*Continued on page 65*)

*The author of this series of articles on the science of soldering, Mr. P. C. Ripley, is Chief Engineer of the Chicago Solder Co.

A New Discovery in Loudspeakers

The familiar cone and horn types of loudspeakers have, at last, a serious rival in this new type of reproducer that operates on the principle of "balanced tension" between two tightly stretched skins. So extraordinary have been the results with the Air-Chrome loudspeaker, which incorporates this principle, that great popularity is predicted for it by radio experts who have heard it

By CARL DORF

THERE are two general types of reproducers that have found wide popularity for radio broadcast reception —the cone type and the horn type. These are so generally known and understood that it is not necessary to go into explanatory details in the variations of these two types.

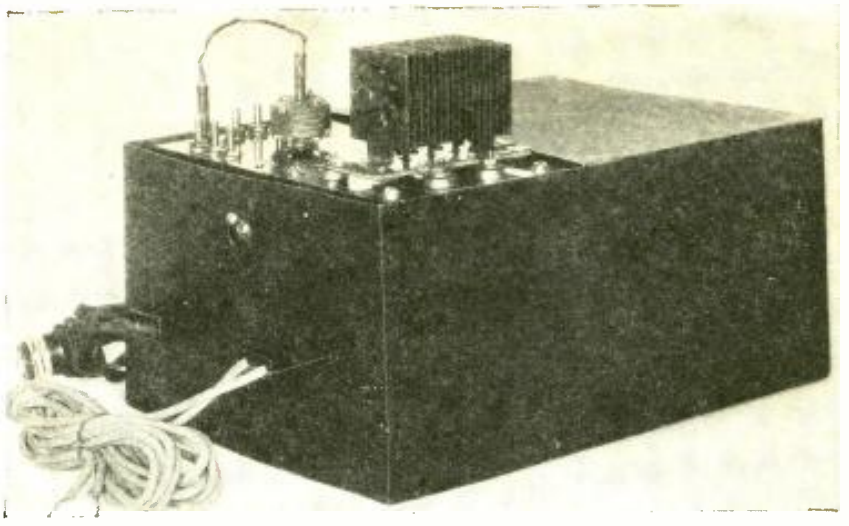
A third general type has recently been developed by W. B. Whitmore that bids fair to excel both these types, on account of its possibilities and inherent qualities. This has been called the balanced-tension type of reproducer. It consists of two tightly stretched, but thoroughly flexible, skins of treated linen or other material, the center points of which are fastened together concentrically so that each one forms, in cross section, a hypercycloid, with the apexes of the two pointing towards each other. The two stretched skins, as shown in the cross section drawing in Figure 1, are mounted on two frames, and the apex point of each is brought to a balanced position due to the tensions acting on the center point of each skin. To this center point is attached the pin of the reproducer unit.

The large stretched skin is of the correct dimensions and stretched to the

(*Continued on page 76*)

THE WORKING PARTS OF THE NEW UNIT

FIGURE 1: *At the left is a cross section of the unit, showing the two skins stretched on separate frames, with their center points drawn together and attached to the driving pin. In the center is a view of the large skin on its frame, and at the right is a view of the unit from the rear, showing the driving unit mounted on the small frame.*



READY FOR INSTALLATION

FIGURE 1: *The Knapp "A" unit is shown here with the shield in position over the working parts. The only exposed parts are the rectifier unit and the bakelite plug panel for varying the amount of current to suit the filament needs of the receiver.*

WHAT RADIO FANS HAVE BEEN WAITING FOR—

"A" Power—Dry and Silent

One of the radio fan's most crying wants—an "A" power-pack that is efficient and silent in operation, that requires no attention and that can be assembled by a novice—is described here. It employs a new type of rectifier that requires no upkeep. The output current may be varied to suit the needs of from one to eight valves.

By CLIFFORD H. HAMILL

AN "A" power-pack for delivering enough current at the proper voltage to supply anything from a one to an eight-valve receiver and employing no vacuum valve rectifier is indeed an innovation in equipment of this type. Such is the Knapp "A" power unit, which has a low power input of 50 watts when operating an average eight-valve receiver. The rectifier unit is perfectly dry and has an exceptionally long life, while the operation of the complete unit is cool and efficient, due to liberally designed transformers and chokes. Special condensers involving a new principle and measuring only 6¾ by 2 by 2 inches supply the amazing capacity of 2,500 mfds., which gives perfect capacitative suppression of ripples without the least trace of a hum.

How to Assemble the Unit

For the convenience of the builder, the small parts of this kit set, including all the necessary hardware, bolts, screws, brackets, wire, etc., are placed in envelopes which are supplied with the kit and which are numbered from one to sixteen. In the list of parts on the page opposite, the number of the envelope in which it is to be found is given after each item. That the ensuing description may not become unnecessarily involved, no further reference will be made to the hardware, it being assumed that the builder will locate this material from the markings on the envelopes.

A special base-plate made of coppered steel is supplied with the kit and on this there is mounted, by means of brass spacers or feet, the transformer, A. It will be noted from Figure 3 that the transformer is mounted so that its core is horizontal, while the choke coil mounted beside it is arranged so that its core is vertical. It will not be necessary to drill the holes for the machine screws, since the special base-plate is supplied with these holes already drilled. Both the transformer and the choke coil are supplied with brass spacers, which are used to support the bakelite connection panel or plate carrying the rectifier unit and the secondary connection taps. All of the dotted lines in Figure 4 represent connections made underneath the panel and these connections should be made with the wire provided *before* the panel is put in place on the top of the unit. The terminals, 10, 11, 12, 13 and 14, in Figure 4 represent the special clamping screws of the binding posts which hold into place the rectifier unit, R, the latter being supplied with lugs to engage with the screws mentioned. The wiring to the rectifier should be done with No. 16 tinned copper wire which is covered with saturated sleeving.

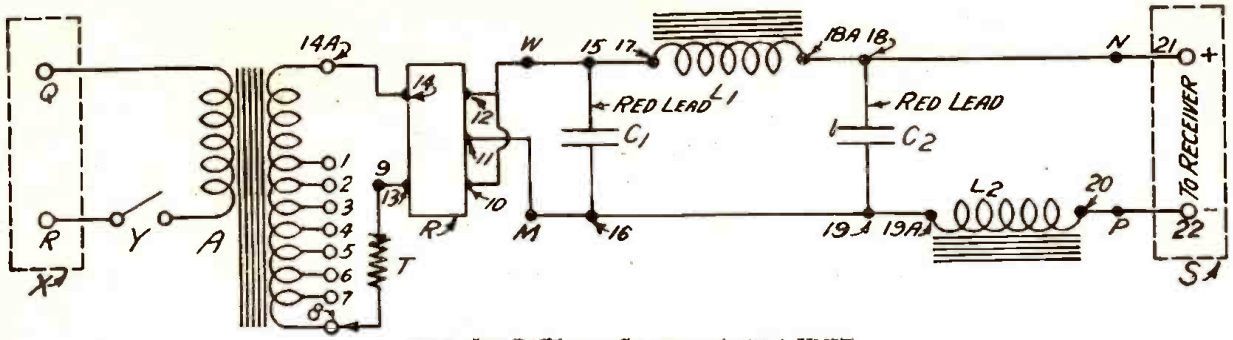
The secondary tap leads are now soldered to the secondary taps of the transformer and, in turn, connected with the corresponding binding posts, 1, 2, 3, 4, 5, 6, 7 and 8, in Figures 3 and 4. The transformer taps are designated with numbered paper tabs, so that there can be no mistake in connecting the right transformer tap to the corresponding connector on the panel.

The top plate should now be screwed into place, using the machine screws and washers supplied for this purpose.

(*Continued on page 86*)

POPULAR RADIO WORK SHEET

The Knapp "A" Power Pack

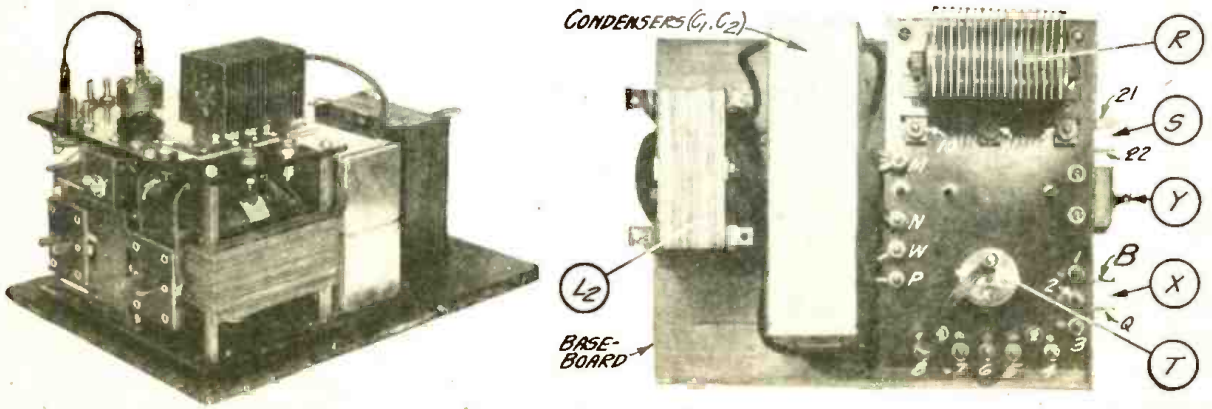


THE CIRCUIT DIAGRAM OF THE UNIT

FIGURE 2: *The step-down transformer is shown at A, and the rectifier unit at R. To the right is the filter circuit that changes the pulsating output of the rectifier to pure DC. The numbers on the diagram are referred to in the text, and indicate exactly where each wire in the circuit should be connected.*

List of Parts for This Unit

1—Transformer with tapped secondary, A;
2—Rectifier unit, R;
3—Special high-capacity "A" power condenser, C1;
4—Choke coil with brass spacers, L1;
5—Special high-capacity "A" power condenser, C2;
6—Choke coil, L2;
7—Top contact and switch plate (brown bakelite), with rubber-covered lead;
8—Base-plate (copper-plated steel);
9—Input-output receptacles with mounting brackets, X and S;
10—H. & H. toggle switch, Y, envelope No. 8;
11—Resistance unit, T, envelope No. 10;
12—Switch post connector of braided copper, with receptacles, envelope No. 9;
13—Transformer mounting screws and nuts, envelope No. 1;
14—Choke coil (L1) mounting screws, envelope No. 2;
15—Input-output receptacle bracket screws, nuts and washers, envelope No. 3;
16—Switch post nuts, envelope No. 4;
17—Transformer to top plate hexagonal spacers with screws, envelope No. 5;
18—Top plate mounting screws and washers, envelope No. 6;
19—Transformer secondary tap leads, envelope No. 7;
20—Mounting board;
21—Shield;
22—Mounting brackets for condensers;
23—Condenser bracket to mounting board wood screws, envelope No. 12;
24—Mounting board to base-plate machine screws, envelope No. 11;
25—Choke coil (L2) to mounting board wood screws, envelope No. 13;
26—Attachment cord with plugs;
27—Six-volt output leads with polarized plug;
28—Shield to mounting board wood screws, envelope No. 14;
29—Four feet of No. 16 tinned copper wire, envelope No. 15;
30—Three feet of No. 10 saturated sleeving for wire, envelope No. 16.



TWO VIEWS OF THE NEW UNIT

FIGURE 3: *At the left the Knapp "A" unit is shown with the shield removed to expose the component parts. Note the compact way in which the unit is assembled. At the right is a view of the unit from above, showing one of the chokes (L2), the top filter condenser, and the bakelite panel on which is mounted the rectifier, R, and the taps for varying the amount of filament current.*

International Newsreel

EVERY TOWN NEEDS A SERVICE MAN

A reputation as a reliable service man may be gained by any industrious and conscientious radio fan among the set owners of his immediate neighborhood. Upon this may be built, as the author of this article built, a lucrative business in servicing, repairing and building radio sets in the community.

HOW I PUT SPARE HOURS TO WORK AND SUCCEEDED IN

MAKING RADIO PAY

By JAMES A. ROBINSON

SIX months ago I was a bookworm using up all of my spare time without any thought of capitalizing on what I knew or what I could learn. Today, besides my regular means of employment, I have a bank account of substantial proportions; I have a car; I have approximately $400 worth of radio merchandise in stock; I have a credit with the local dealer to the extent of $1,000; I have radio tools and testing apparatus valued at $150; and I have established good will and prestige in the community in which I live. This, I believe, is a rather enviable record for a man who had never before been in business for himself, and who was equipped with only the rudiments of business knowledge.

The whole thing came about through my studying and completing a course in radio construction offered by a radio correspondence school. Although the town I live in—Methuen, Mass.—has a population of but 12,000, I came to realize that even in such a small place there was great opportunity for a man who knew something about radio, and who could intelligently and efficiently service, build, and repair radio receivers.

It is estimated that no less than 30,000 alert young men are making anywhere from twenty to one hundred and fifty dollars a week constructing radio receivers for local use. Statistics seem to show that approximately ten million dollars a year is being expended for custom-built sets.

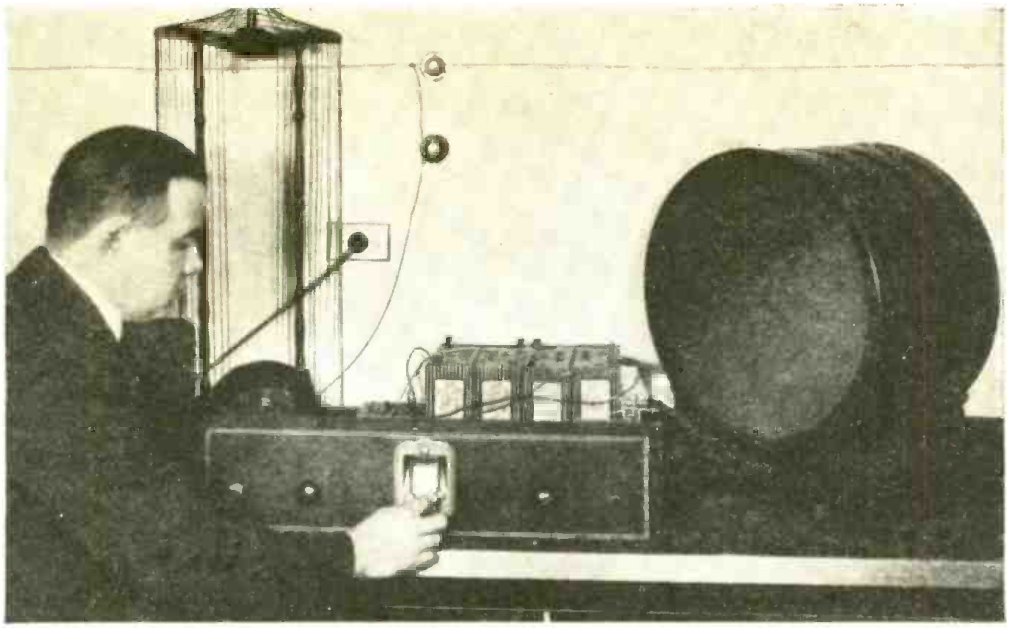
Mr. James A. Robinson, who knew little about radio prior to taking a correspondence course at the National Radio School, here tells how he built up a good business on small capital and large faith.

The one obstacle to my whole plan of action, however, was the modest capital of $75, which was all that I could afford to invest in the new venture at the time, since I was handicapped with a chronic illness in the family.

While I knew that there was radio business to be had, how was I to get it? I couldn't advertise, nor could I afford to spend a great deal of time in soliciting business. After giving the matter a great deal of thought, I finally concluded that perhaps the best way to do would be to work entirely on the basis of recommendation.

At the start, much of my work was done gratis. Being equipped with a

(*Continued on page 69*)



THE VICTOREEN IN OPERATION

The Victoreen is shown here operating with a loop antenna; however, one of the features of the new receiver is its adaptability to operation with other kinds of antennas, such as the light socket and outdoor types.

THOUSANDS OF FANS ARE BUILDING

THE VICTOREEN "SUPER"

Here is an eight-valve superheterodyne that incorporates all the latest ideas in radio construction and design, yet is as easy to assemble, wire and operate, as many an old five-valve set. But its tonal qualities rank it with the best that 1928 engineering will be able to produce.

By LESLIE BILES

PARADOXICAL as it may seem, the superheterodyne is probably the most praised and the most condemned circuit known to-day, and has probably caused more grief and a greater waste of money than any other circuit or combination of circuits. Yet, basically, the superheterodyne is one of the supreme circuits for radio reception.

It is not the hook-up alone that makes a good superheterodyne, for with the exception of the wiring of the oscillator there are few differences in the hook-ups of the various types of superheterodynes in use to-day. The basic circuit may be improved, or the parts may be arranged, with various numbers of intermediate-frequency stages of amplification, but the theory and scheme of all types are fundamentally the same.

Judging by past experience, however, it is safe to say that many superheterodynes that are built by radio fans are inferior to a good tuned-high-frequency or combination tuned-high-frequency and original type of receiver. On the other hand, in a carefully designed superheterodyne there are certain outstanding features that make it superior, if the apparatus used has been properly designed, manufactured and tested, and if the mechanical arrangement has been laid out with a clear understanding of just what will happen in the circuits.

One of the outstanding features of the superheterodyne is its ability to get distance reception satisfactorily; in this respect it is superior to most of its rival circuits. And in spite of the tendency among fans in recent years to forget about distance reception in their interest in low-frequency apparatus and quality reproduction, it is the author's opinion that almost every fan at some time or other experiences a strong desire to own a receiver capable of bringing in programs on the loudspeaker from stations far away.

The set described in this article is not only designed to give high quality of reproduction, but to have the necessary sensitivity and selectivity to enable it to tune through the locals and pick up stations at great distance.

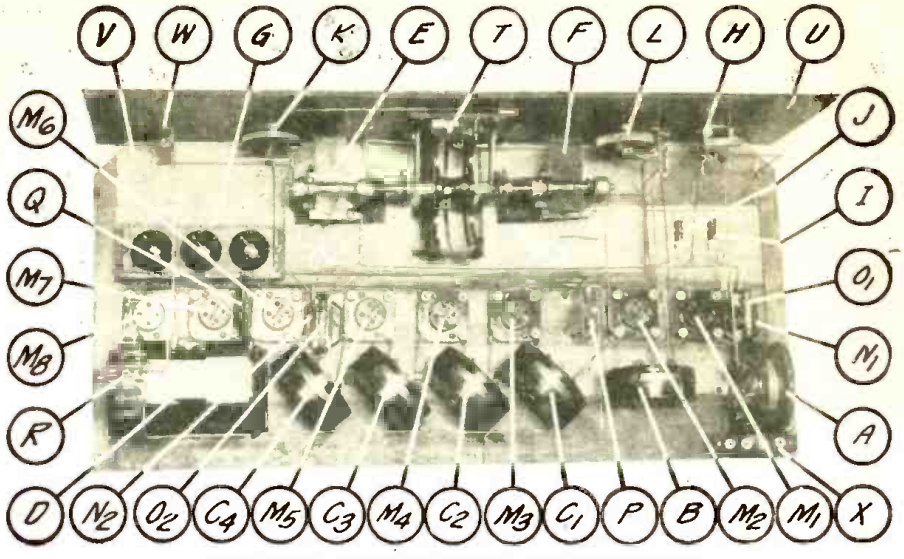
The circuit arrangement is such that it may be used with either a loop antenna or with an outdoor antenna by simply throwing the switch. The circuit contains an oscillator and first detector coupled together so that the frequency of the incoming signals may be lowered to the frequency of the three-stage intermediate frequency amplifier. This is followed by a vacuum valve detector for rectification and two stages of high-quality, transformer-coupled amplification. Two transformers are incorporated in a single unit known as an audio coupler. The schematic circuit diagram for the receiver is shown in Figure 3.

How the Set Is Constructed

In building the set described in this article a rectangular section is cut

POPULAR RADIO WORK SHEET

The Victoreen Superheterodyne



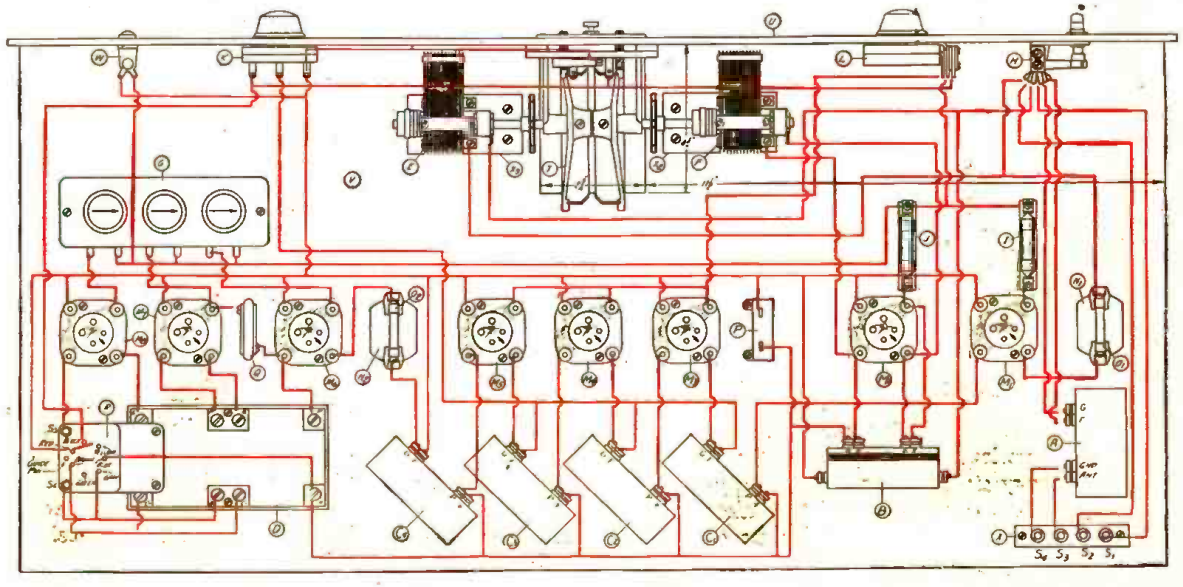
HOW THE INSTRUMENTS ARE MOUNTED

FIGURE 1: *The simplicity of the arrangement of the parts makes this superheterodyne an easy one for the novice to attempt.*

List of Parts for Building This Receiver

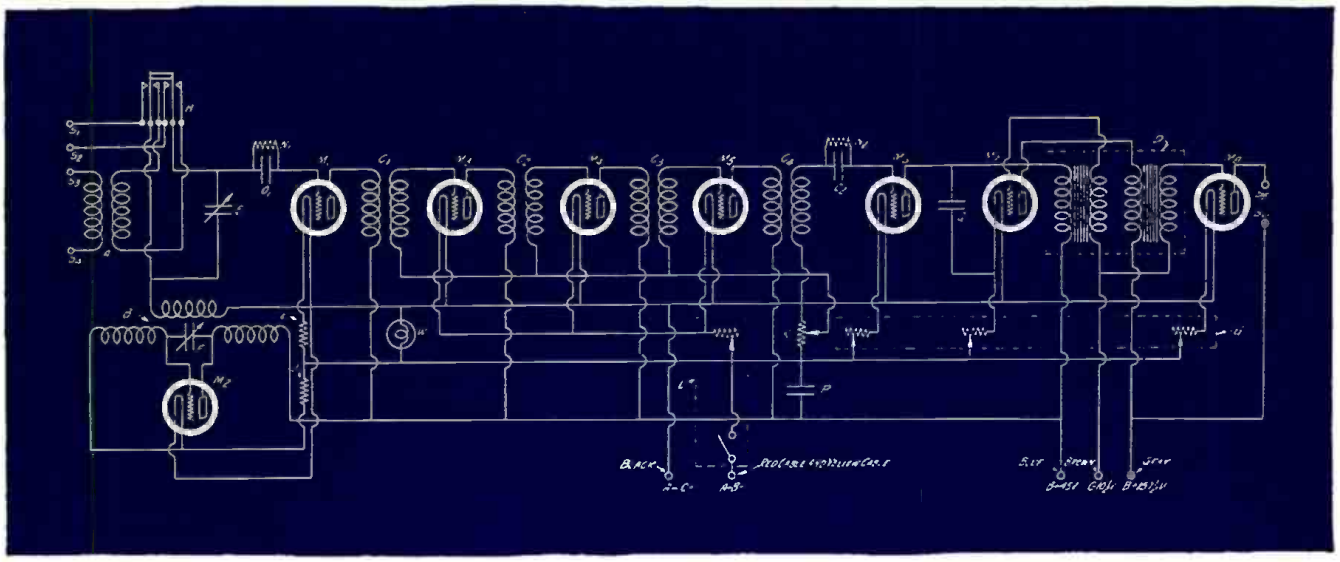
Cost of Parts—*Not over $110.00*

A—Victoreen antenna coupler;
B—Victoreen coupling unit;
C1, C2, C3 and C4—Victoreen high-frequency transformers;
D—Victoreen audio coupler, type No. 112;
E and F—Hammarlund midline variable condensers, .0005 mfd.;
G—Victoreen audio control unit;
H—Yaxley double-pole, double-throw panel switch;
I and J—Amperites No. 1-a;
K—Yaxley potentiometer, 400 ohms;
L—Yaxley rheostat switch, 6 ohms;
M1, M2, M3, M4, M5, M6, M7 and M8—Benjamin Cle-ra-tone vacuum valve sockets;
N1 and N2—Sangamo fixed condensers, .00025 mfd., equipped with grid-leak mounting;
O1 and O2—Durham metallized resistors, 2 megohms;
P—Tobe by-pass condenser, 1 mfd.;
Q—Sangamo mica fixed condenser, .0035 mfd.;
R—Yaxley cable plug;
S1, S2, S3 and S4—Yaxley pup jacks;
T—Hammarlund illuminated double-drum dial;
U—Lignole drilled and decorated wood panel, 7 by 26 inches;
V—Corbett baseboard (this is part of the equipment of the Corbett model C cabinet chest);
W—Yaxley pilot light, No. 310;
X1—Micarta antenna connection strip, 3 by ⅝ by ⅛ inch;
X2 and X3—Micarta condenser mounting strips, 3½ by 1¾ by ⅛ inch.



A "SUPER" CIRCUIT WITH FEW WIRES

FIGURE 2: *The instruments are outlined in* BLACK *and the wires are indicated in* RED. *The wiring is quite simple for this type of circuit.*



THE VICTOREEN CIRCUIT

FIGURE 3: *One novel feature of the circuit is the change-over arrangement, shown in the upper left-hand corner, which permits the use of any type of antenna that the owner desires. A turn of the switch H, makes the change.*

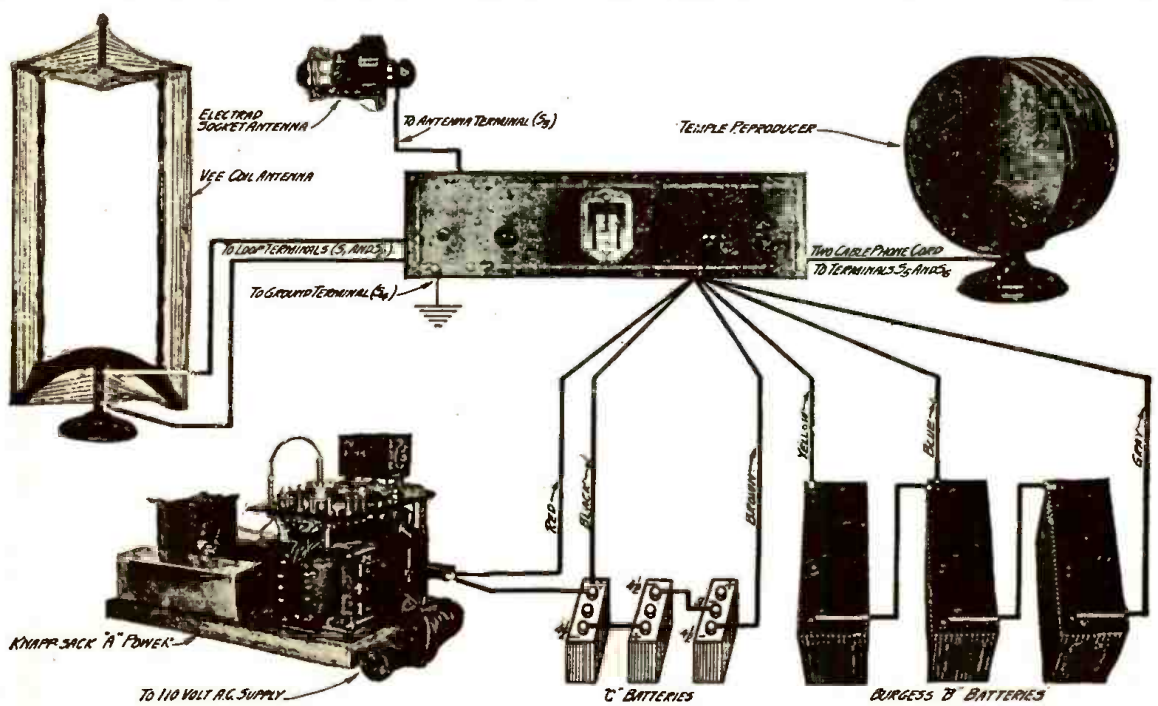
out of the baseboard, V, that is furnished with the Corbett cabinet, to allow for the drum dial. The dimensions of this cut-out are shown in Figure 2. The eight sockets, M1, M2, M3, M4, M5, M6, M7 and M8, are mounted in a straight line in the positions shown in Figures 1 and 2. These sockets are turned with the arrows pointing as shown in Figure 2.

The antenna coupler, A, is mounted by means of a single screw fastened through the bracket into the baseboard, V, in the position shown in Figure 1. The coupling unit, B, is mounted similarly in the position shown in Figure 1. The four high-frequency units, C1, C2, C3 and C4, are mounted slanting, in the positions shown in the same diagram. The audio unit, D, is drilled and tapped, as shown in Figure 2, for two screws to support the Yaxley cable plug, R. These two holes are drilled in the casing as close to the edge as possible, so that the windings are not damaged. The drill, in doing this work, must not be allowed to go further than just through the metal casing. The unit, D, is mounted on the baseboard, V, in the position shown in Figures 1 and 2, by means of two round-head screws of suitable size for fastening down this heavy instrument.

The two amperites, J and I, are fastened to the baseboard, V, with a single screw to each instrument, in the positions shown in Figures 1 and 2.

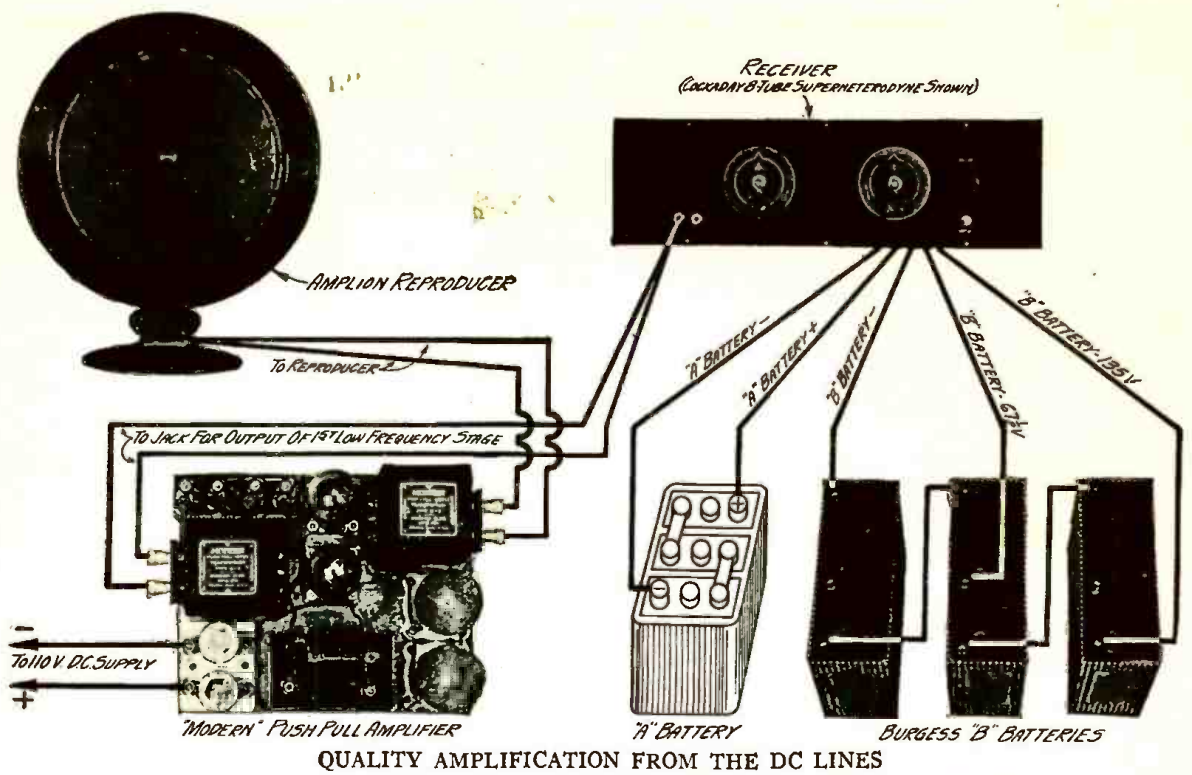
The by-pass condenser, P, is screwed

(*Continued on page 78*)



AN EFFICIENT OPERATING HOOK-UP

FIGURE 4: *The units illustrated here have been found by tests to give very good results when hooked up with the Victoreen as indicated by the heavy* BLACK *lines. Note that either a loop or socket antenna may be employed.*



QUALITY AMPLIFICATION FROM THE DC LINES

FIGURE 1: *The hook-up shown above should bring cheer to those who live in neighborhoods where direct current is employed. The Modern push-pull amplifier, at the lower left, is shown supplying a 371 valve push-pull stage of low-frequency amplification for the Cockaday 8-valve superheterodyne.*

THE MODERN PUSH-PULL AMPLIFIER GIVES YOU

Power and Quality from DC Lines

DC house wiring may be utilized with profit by means of this powerful push-pull amplifier that employs 371-a power valves. The construction of the unit, as outlined in this article, is simple enough to complete in a very short time, and the finished amplifier should put astonishing punch into any new or old receiver.

By ALBERT G. CRAIG

THE recent development, by a number of reliable manufacturers, of input and output transformers which are suitable for push-pull amplifiers has made available a DC light socket operated amplifier capable of reproducing music with greatly improved quality.

Previously the 120 line voltage so limited the output of a power valve that ordinary room volume could not be obtained without serious distortion. However, the use of two valves in a push-pull arrangement more than doubles the undistorted output which can be obtained from a single valve using the same "B" voltage.

The present unit consists of a single stage of push-pull amplification which can be plugged in after the first low-frequency stage of any set. The unit has been simplified as much as possible and no effort has been made to obtain "A" or "B" current supply for the remainder of the radio set. Under these conditions it was found that a filter could be dispensed with.

In contrast to many former DC light socket operated amplifiers, this unit is economical to use. It employs two CX-371-a type valves which are operated in series, and thus take only one-quarter ampere from the line. This is approximately the same as the ordinary 25-watt electric light bulb.

For the home constructor it was found desirable to use a "C" battery for a grid bias rather than to take the drop across a resistance, as the latter method would have cut down the "B" voltage available. An extra "C" battery of 4½ volts is connected between the input transformer and the grid of the valve, having less bias because of the series filament arrangement. These "C" batteries have to be replaced approximately once a year.

A double fuse block is used between the light socket and the amplifier to take care of any accidental short-circuits in the amplifier.

The schematic diagram in Figure 5 shows the amplifier circuit at a glance.

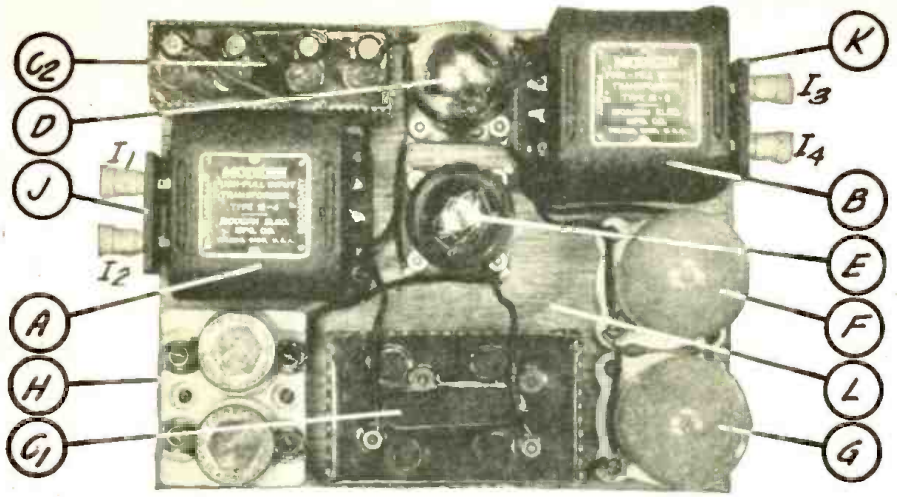
How to Construct the Amplifier

Cut the wooden baseboard to a size 10 inches by 8 inches by ½ inch. Next

(*Continued on page 74*)

POPULAR RADIO WORK SHEET

The Modern Push-Pull Amplifier



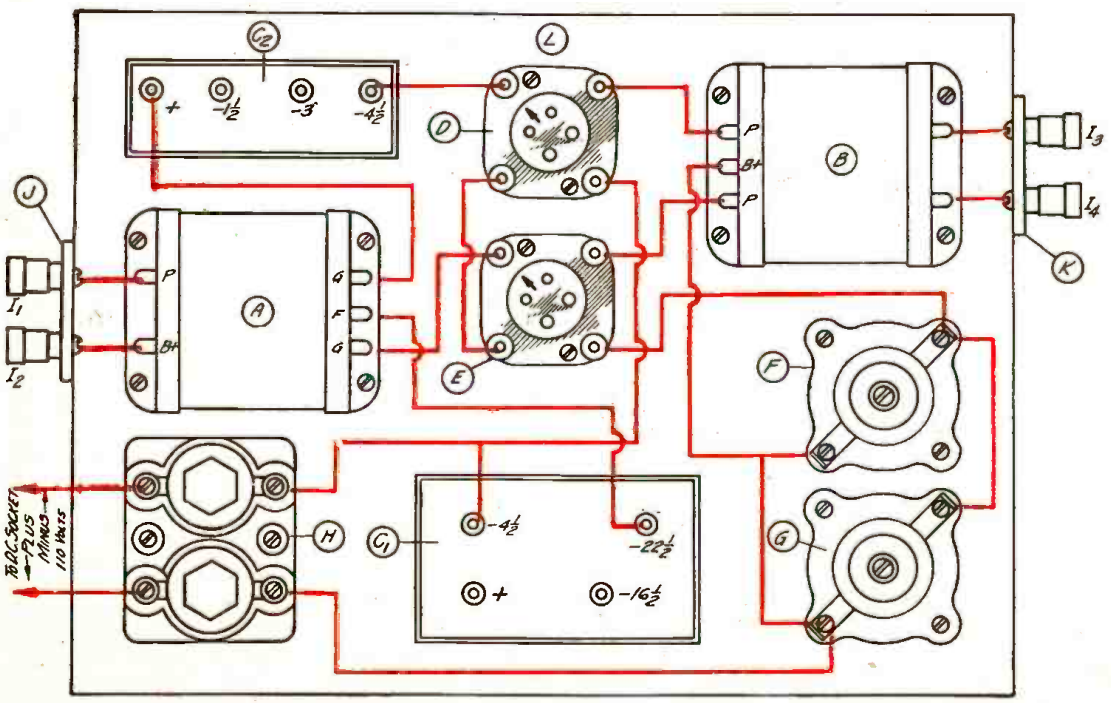
THE PANEL LAYOUT OF THE UNIT

FIGURE 2: *Note the two "C" batteries that are incorporated in the panel layout of the amplifier. Ward Leonard resistances of the proper values may be used instead of the two Mazda lights in this picture.*

List of Parts for Building This Unit

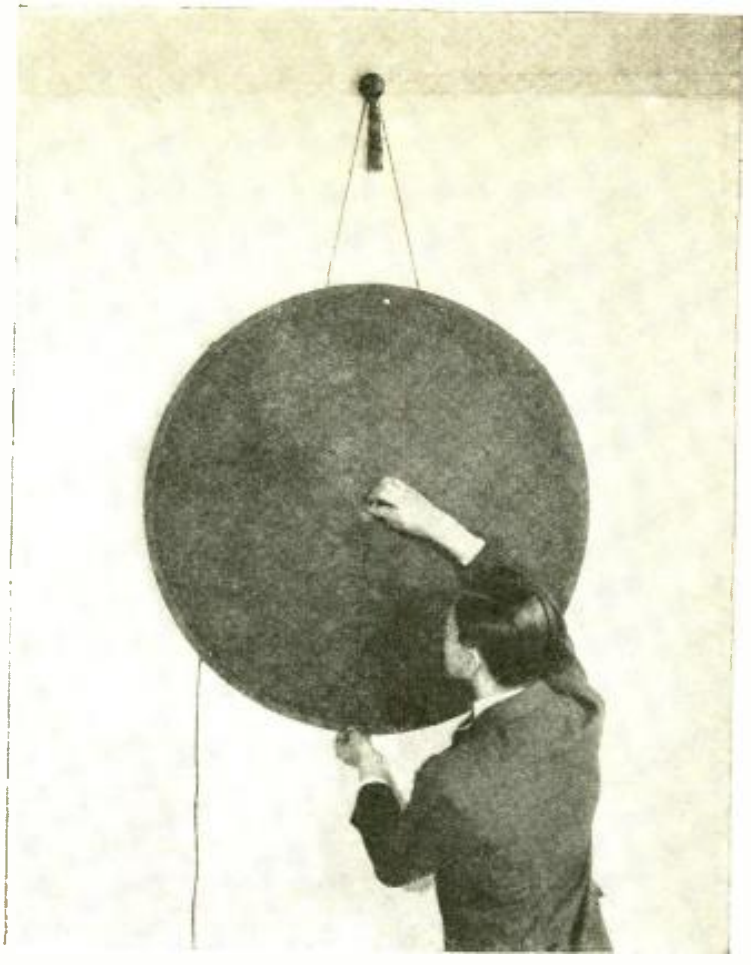
Cost of Parts—*Not over $27.00*

A—Modern Push-Pull input transformer, type M-4;
B—Modern Push-Pull output transformer, type M-5;
C1—Burgess "C" battery, No. 5156;
C2—Burgess "C" battery, No. 2370;
D and E—Benjamin Cle-ra-tone sockets;
F and G—Benjamin receptacles, No. 9401;
H—Fuse block;
I1, I2, I3 and I4—X-L binding posts;
J and K—Binding-post strips, 2 by 1½ by 3/16 inch;
L—Hardwood baseboard, 10 by 8 by ½ inch.



HOW THE UNIT IS WIRED

FIGURE 3: *All the wiring is done above the baseboard, and is indicated here in* RED *lines. The instruments are outlined in* BLACK. *The wiring job may be completed in a very short time.*



AFTER AN HOUR'S WORK

The completed cone is quite distinctive in appearance when hung on the wall by means of the cord. And its tone quality, if the cone is assembled with reasonable care, should be equal to that of the best manufactured reproducers of this type.

AN HOUR'S WORK WILL BUILD THIS

3-Foot Double Cone Speaker

Here is a chance for those who admire the excellent tone and pleasing appearance of the 3-foot double cone speaker to build one for themselves —with but a small outlay in time and a still smaller outlay in money.

By THE TECHNICAL STAFF

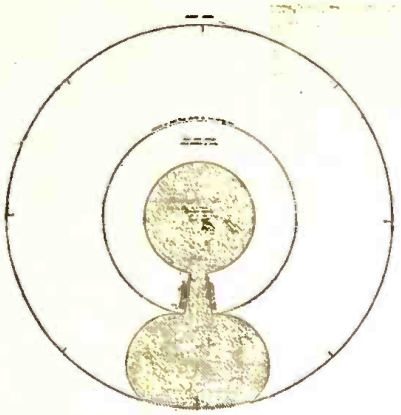
A THREE-FOOT cone speaker with exceptional fidelity of tone may now be assembled by any novice in less than an hour's time and at a saving in cost which is very substantial and which will appeal very strongly to those with three-foot cone tastes and one-foot cone pocketbooks.

The materials for this cone are available in kit form and they may be purchased in retail stores or by direct mail.

Recognizing the deserved popularity of this particular cone, and believing that many of POPULAR RADIO'S readers would be interested in learning the details of its assembly, the Laboratory Staff has assembled one, and, as a result of this work, prepared the following outline of the steps necessary in its construction.

Since the special paper (in this case called FONOTEX) is rolled in the kit to save space and the possibility of damage, it is necessary for the prospective user to flatten the two large sheets out before any attempt is made to use them. This may be done by re-rolling the sheets in the reverse direction to that in which they were originally rolled. Care must be taken to see that no cracks or dents are permitted to develop during this re-rolling.

This is a double cone with a back and front piece. First, take the sheet marked "back cone" and with a sharp pair of scissors cut it along the solid



THE CUT-OUT OF THE BACK CONE

FIGURE 1: *The shaded portion is the part cut out. The back ring is cemented to the back cone inside the inner circular dotted line shown above.*

printed lines. The sheet when finished will have the appearance of Figure 1.

The sheet of paper containing the printed outline of the front cone is now laid flat with the decorated side down. Using a sharp knife or scissors, the segment or wedge-like piece is cut out, as illustrated in Figure 2. Operations on the front cone should be suspended for the moment.

For the best results it is now suggested that the constructor place a newspaper or sheet of smooth wrapping paper under the wedge-like opening or segment, and between the two cones—that is, between the front and back cone.

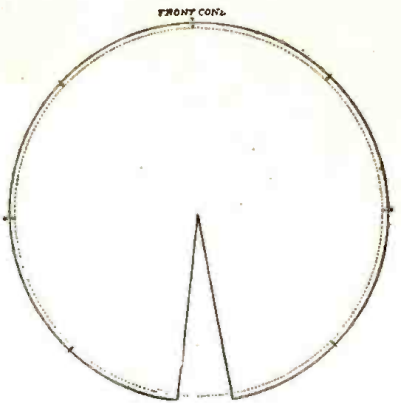
Place the cut-out back cone on the front cone, with the smooth side of the back cone against the smooth side of the front cone and along the circular dotted line of the latter.

At this point the worker should look for three arrowheads printed on each of the cones. These are plainly marked X, Y and Z. The arrowheads on the back cone should exactly meet those on the front cone, and the back cone should fit exactly into the circle made by the dotted line.

This done, the back cone should be held firmly in position by placing weights on it, which may be heavy books or flat boards loaded with flat-irons or other heavy objects.

It is now time to apply the Ambroid cement which is used as a binder. This should be started by cementing the back cone to the front cone at one tip end of the back cone. With the forefinger of the left hand hold the back cone tightly against the front cone, to prevent the cement from seeping in between the two. The worker should smoothly place a thin stream of cement directly around the circumference of the back cone. Accuracy should not be sacrificed for speed and impatience. This is a critical part of the operation and is easy enough if it is done slowly. The cement should be given a chance to set before the fingers are removed.

When the worker has gone completely around the back cone, a second trip is made. This time the spout of the cement can is placed about ⅛ inch in from the edge of the back cone. Care should be taken to see that the cement flows over the edge of the back cone to the front cone, so as to join the two solidly in a general line. Here again the worker must not be impatient, but should give the cement plenty of time to dry.



THE CUT-OUT OF THE FRONT CONE

FIGURE 2: *The wedge-shaped segment at the bottom of the diagram is cut out before the cementing process. The rest of the cutting is done after the cementing.*

When the cement is thoroughly dried, the remainder of the front cone may be carefully cut away along the solid printed line. In one corner of the sheet the builder will find a diagram marked "Reinforcing Cone." This is a small cone of paper which is used to rein-

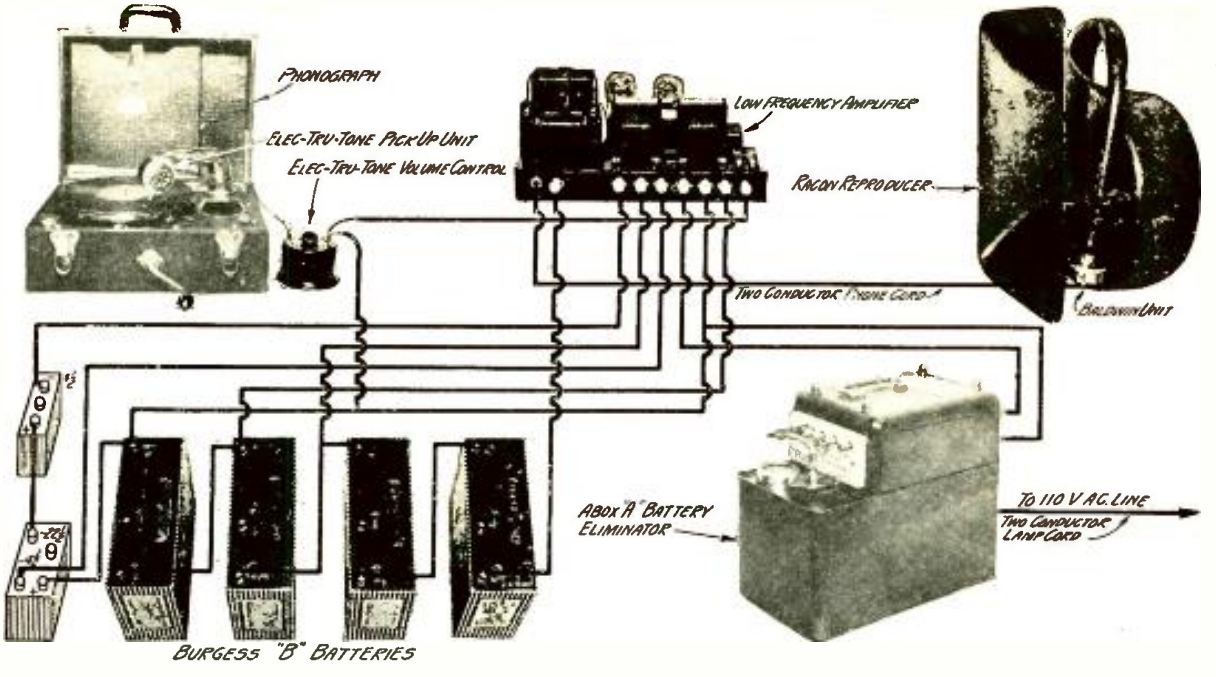
(*Continued on page 90*)

Penn Sales Corporation

Penn Sales Corporation

HOW THE CONE IS BROUGHT INTO SHAPE

FIGURE 3: *At the left the cone is being brought into its final shape by fastening the back ring latch. At the right the butt joint made by the two edges of the front cone, when the cone is brought into shape, is being taped together inside the cone by means of narrow strips of adhesive fabric. The long strip is then taped over the inside joint.*



A COMPLETE PHONOGRAPH COMBINATION

FIGURE 1: *In this diagram the Rauland low-frequency amplifier, whose construction is described in the article below, is shown hooked up with a number of units into a combination that gives excellent results in reproduction from phonograph records.*

TWO EASY NEW WAYS TO

"Radioize" Your Phonograph

Two more hook-ups are here described in POPULAR RADIO'S series on the use of electrical pick-up units for revivifying phonograph reproduction. They offer the builder the choice of battery or power operation, and very fine results in tone and volume may be obtained with either of these hook-ups.

By MORRIS M. SILVER

IN the last six months POPULAR RADIO has originated and explained a number of methods for bringing the old-fashioned phonograph up to date from a reproduction standpoint. These articles have described specific combinations of the new and increasingly popular electrical pick-up unit with various types of amplifiers and radio loudspeakers. This information has been complete and in such simple language that anyone can make the change and get reproduction that is natural and for that reason very enjoyable.

Regardless of how old a phonograph is or how bad it sounds at present, one of the new units added to it will so transform its reproduction that it will be immediately placed upon the same plane as the most expensive radio receiver now obtainable.

In this article two improved combinations of this sort will be described. The first one consists of a two-stage, transformer-coupled amplifier in combination with an exponential horn-type reproducer. With these units hooked up, as shown in Figure 1, any phonograph can be rejuvenated.

How the Low-Frequency Amplifier Is Constructed

In the amplification unit, which was designed and built in the POPULAR RADIO Laboratory, the instruments are mounted upon a ½-inch thick wooden baseboard cut to the size of 12 inches by 6 inches. A binding-post strip is cut from ¼-inch formica to the size of 12 inches by 1½ inches. This is drilled for mounting the eight binding posts, L1, L2, L3, L4, L5, L6, L7 and L8, and the jack, G. When these parts are screwed down, as shown in Figure 2, the binding-post strip, J, is screwed into one of the long sides of the baseboard, K, as shown in Figure 2. Then the other pieces of apparatus, including the filament controls, H and I, the two transformers, A and B, the choke coil, E, and the filter choke, C, the two sockets, D1 and D2, and the paper condenser, F, are also fastened to the baseboard.

The instruments, when mounted, are wired up according to the picture wiring diagram shown in Figure 3.

In this diagram the parts and instruments are outlined in black lines and the wiring is shown in blue. If the wiring is followed exactly, the results outlined in this article will be obtained.

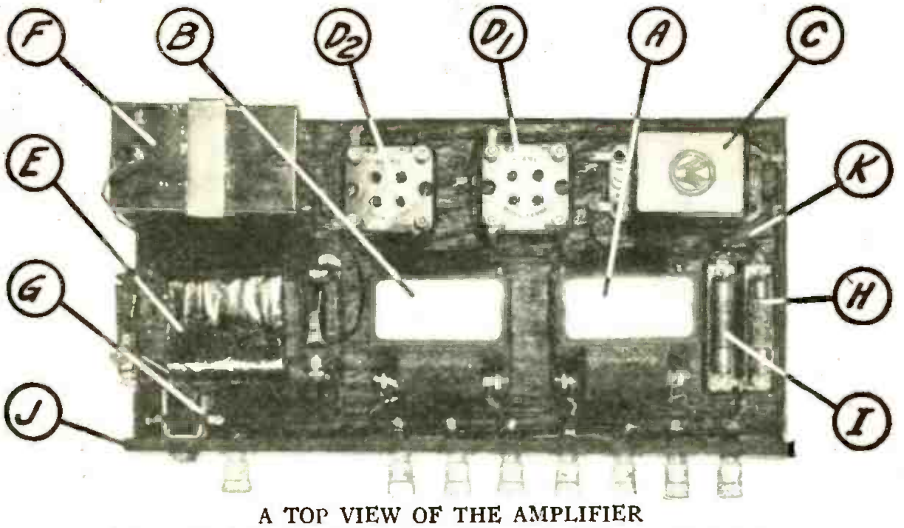
How the Combination Is Used

In Figure 1 is shown a pictorial hook-up for a phonograph with a new electrical pick-up attached to it, as well as a special volume control. The low-

(*Continued on page 92*)

POPULAR RADIO WORK SHEET

THE RAULAND PHONOGRAPH AMPLIFIER



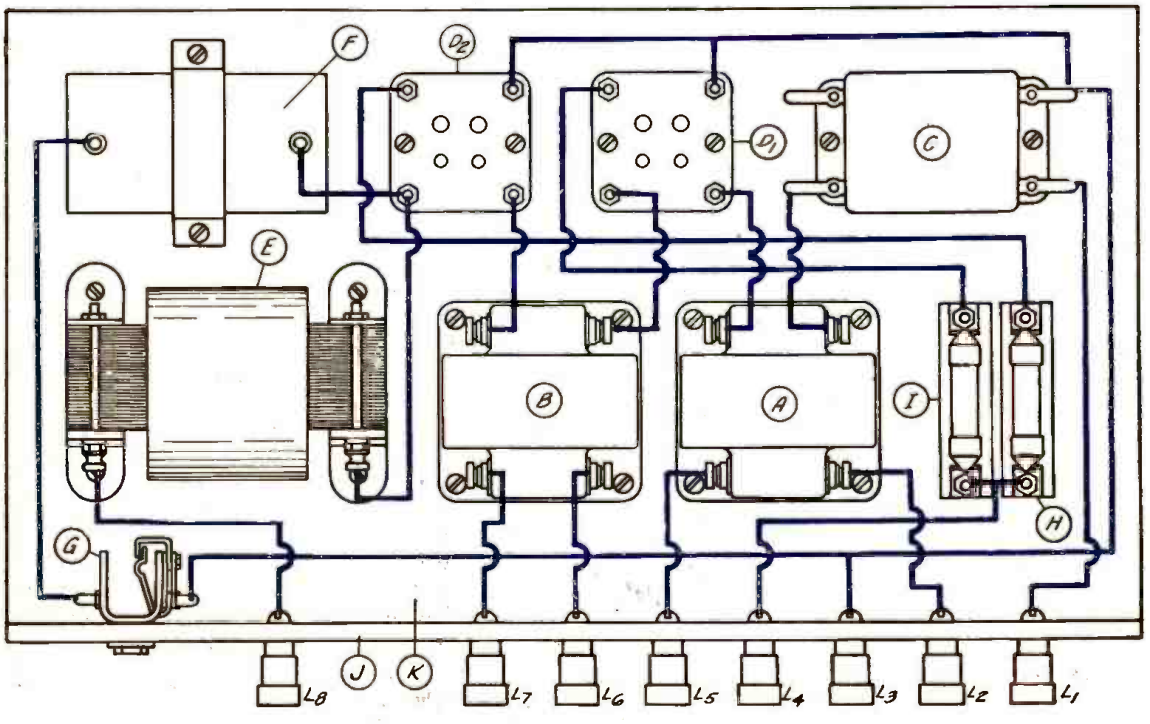
A TOP VIEW OF THE AMPLIFIER

FIGURE 2: *Here is shown the layout of the parts mounted on the wooden baseboard and the arrangement of the binding-post strip, J, and the jack, G.*

LIST OF PARTS FOR BUILDING THIS UNIT

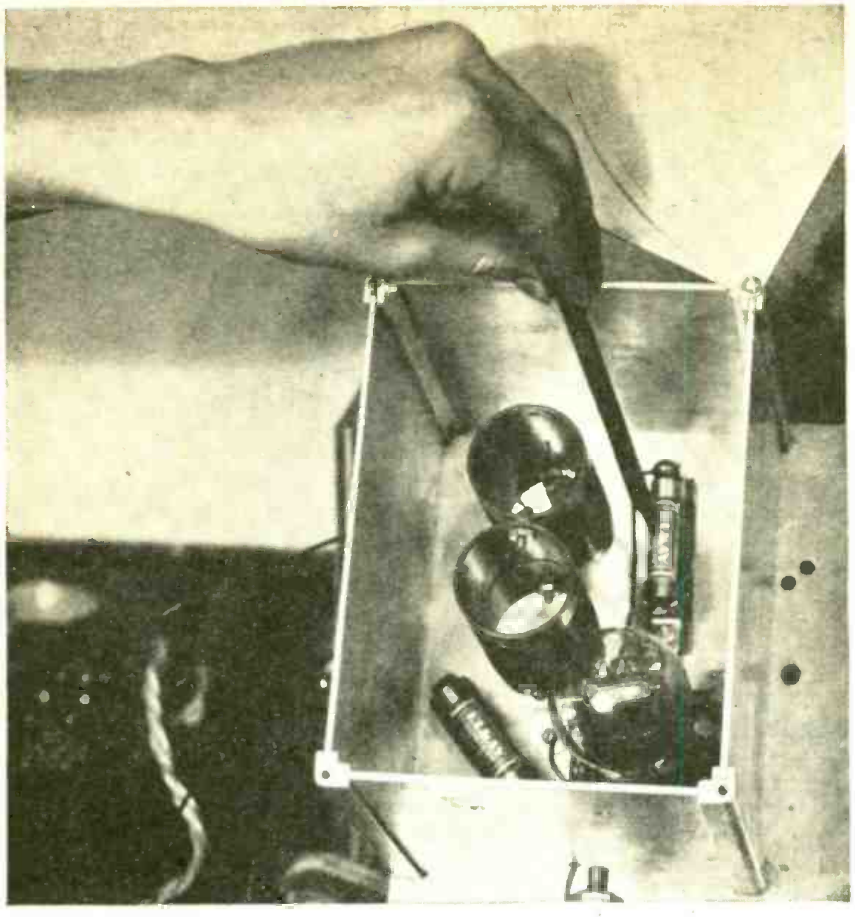
COST OF PARTS—*Not over $39.00*

A and B—Rauland Lyric All American low-frequency transformers, type R-500;
C—High-frequency Laboratories R. F. choke, L-425;
D1 and D2—Frost bakelite sockets, No. 530;
E—AmerTran choke, No. 854;
F—Polymet filter condenser, 4 mfd., 600 volts DC;
G—Frost Gem Jac, open-circuit, No. 953;
H—Polymet Polytrol No. 1, with mounting;
I—Polymet Polytrol No. 5, with mounting;
J—Binding-post strip, 12 inches by 1½ inch by 3/16 inch;
K—Hardwood baseboard, 12 inches by 6 inches by ½ inch;
L1, L2, L3, L4, L5, L6, L7 and L8—X-L binding posts.



THE PICTURE WIRING DIAGRAM

FIGURE 3: *This diagram outlines all of the instruments and parts in* BLACK; *the wiring is shown in heavy* BLUE *lines that indicate exactly where the wires are to be run and connected.*



HOW GRID SUPPRESSORS ARE USED

This picture shows one of the shielded stages of the LC-28 high-frequency amplifier, with the grid suppressor connected in the circuit between the tuning circuit and the grid of the valve.

MAKING BALKY SETS BEHAVE WITH

SUPPRESSORS

By ERNEST ROULTON

THERE were many thousands of sets built during the early days of radio in which high-frequency amplifiers were cascaded together in one, two, or three stages, that were not inherently stabilized.

An unstable condition in such an amplifier is bound to produce squeals and howls that interfere not only with the operator's reception, but with reception in nearby receivers that are tuned to the same wavelength.

One old method for controlling oscillation was by means of a rheostat in the filament circuit. This was used as a combination volume control and oscillation control. Another method was to use a potentiometer for varying the grid bias. Still other methods used absorption circuits for preventing oscillation.

All of these, however, controlled regeneration by some form of loss, so that the total amplification was reduced and the circuit's criticalness was affected. This, of course, reduced the over-all amplification and likewise necessitated an adjustment for various wavelengths.

Another method that has been described somewhat at length in the September, 1927, issue of POPULAR RADIO, in the article on the design of the LC-28 receiver, makes use of grid resistances, commonly known as suppressors. This use of a grid suppressor in high-frequency circuits presupposes a grid resistance unit in which the distributed capacity across the resistance winding is exceptionally low and also a resistance unit that is practically non-inductive. Resistances such as the Elkay suppressor or the Lynch suppressor are made with a double winding, wound so that one-half of the natural inductance counteracts the other half of the natural inductance of the unit.

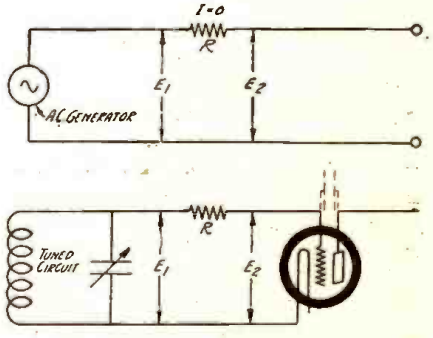
In Figure 1 are shown two diagrams. In the top diagram is an alternating current generator with a resistance connected in the upper leg of the circuit.

If the circuit is left open, the current flowing through the resistance, R, will be zero, and in this case the voltage drop across the resistance, R, will be zero, when no load is applied across the output.

In the bottom diagram is shown the same principle applied to a vacuum valve, high-frequency amplifier circuit. If the resistance, R, is of the proper size, feedback due to current flowing through the imaginary condenser, shown in dotted lines, would be eliminated without in any way affecting the voltage of the signal impressed on the grid from the tuned circuit. In other words, the voltage E2 will equal the voltage E1. The "C" battery applied to the stage should be correct for the plate voltage applied to the plate circuit of the vacuum valve to produce the best results.

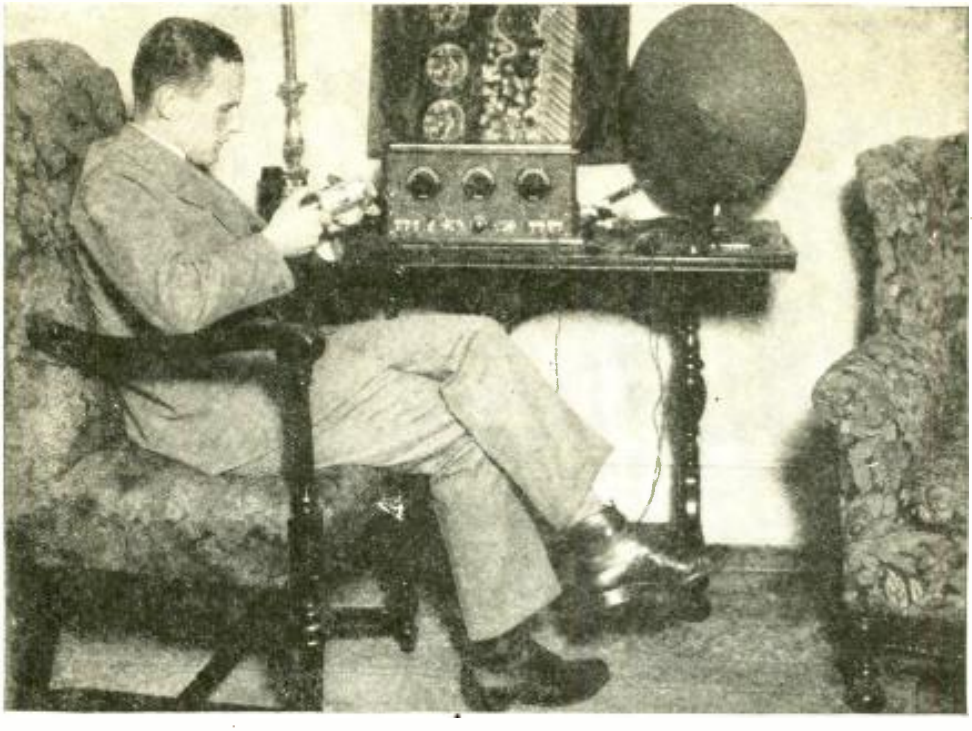
These types of suppressors are available in sizes ranging from 100 to 2,000 ohms in steps of 100 ohms. For installing suppressors in ordinary one-, two- or three-stage high-frequency receivers, the wire running from one side of the tuning condenser to the grid of the vacuum valve should be cut, and a grid suppressor and mounting should be placed in position and wired into the circuit. For standard types of receivers a value somewhere between 500 and 700 ohms should be approximately correct. Higher values of grid suppressors will tend to further suppress squealing and lower values will increase regeneration.

The proper use of suppressors in the grid circuits will improve any receiver and will eliminate howls. Suppressors are not used in detector circuits—only in the high-frequency stages.



HOW THE SUPPRESSOR PREVENTS CURRENT FLOW

FIGURE 1: *This diagram shows the analogy between an AC generator circuit, with the resistance, R (top diagram), and the grid circuit of a high-frequency stage of amplification (bottom diagram).*



AN AUTHORITY ON RADIO AT THE AGE OF TWENTY

Baron Manfred von Ardenne, author of this article, is here shown holding one of the "multiplex" valves of his own design. (See his article in POPULAR RADIO *for September, 1927.) He is known on both sides of the Atlantic as an authority on the subject of low-frequency amplification.*

A SIMPLE NEW METHOD FOR

Measuring Grid Current

This article, which should interest every experimenter who is anxious to get the utmost efficiency out of radio apparatus, tells how delicate grid measurements on vacuum valves may be made with instruments many times less sensitive than those usually employed.

By MANFRED von ARDENNE

TO get good reproduction in a low-frequency amplifier, it is of great importance that the grid current flowing be accurately determined.

If a considerable amount of grid current flows in the circuit, then distortion is induced, and this, in the case of low-frequency amplifiers, makes satisfactory reproduction impossible.

The instruments that are necessary for directly measuring grid currents have to be sensitive—down to about a hundredth of a microampere. In special cases it is even desirable to measure grid currents of the order of ten-thousandths of a microampere.

This new method of measuring grid currents, devised by the writer, enables these currents to be measured indirectly by means of an instrument that is included in the plate circuit of the vacuum valve; the necessary sensitivity of this instrument may be ten thousand times less than that otherwise necessary in direct grid-current measurements.

Thus a simple milliammeter in the plate circuit is made to measure grid currents of the order of tenths of a microampere.

This method has been evolved from a consideration of the fact that if grid current is flowing, then a potential drop will be induced across a resistance included in the grid circuit. This potential drop changes the effective grid potential and, in turn, the value of plate current.

If the degree in which the plate current changes with the grid potential is known (and that is always the case if the characteristic of the valve in question is given), then it is possible to calculate the change of grid potential from the measured variation of plate current.

The change of grid potential in volts is equal to Ig x Rg, where Ig is the grid current in amperes and Rg is the grid resistance included in the circuit, in ohms.

Thus it is only necessary to divide the calculated change of grid potential by the grid resistance in order to know

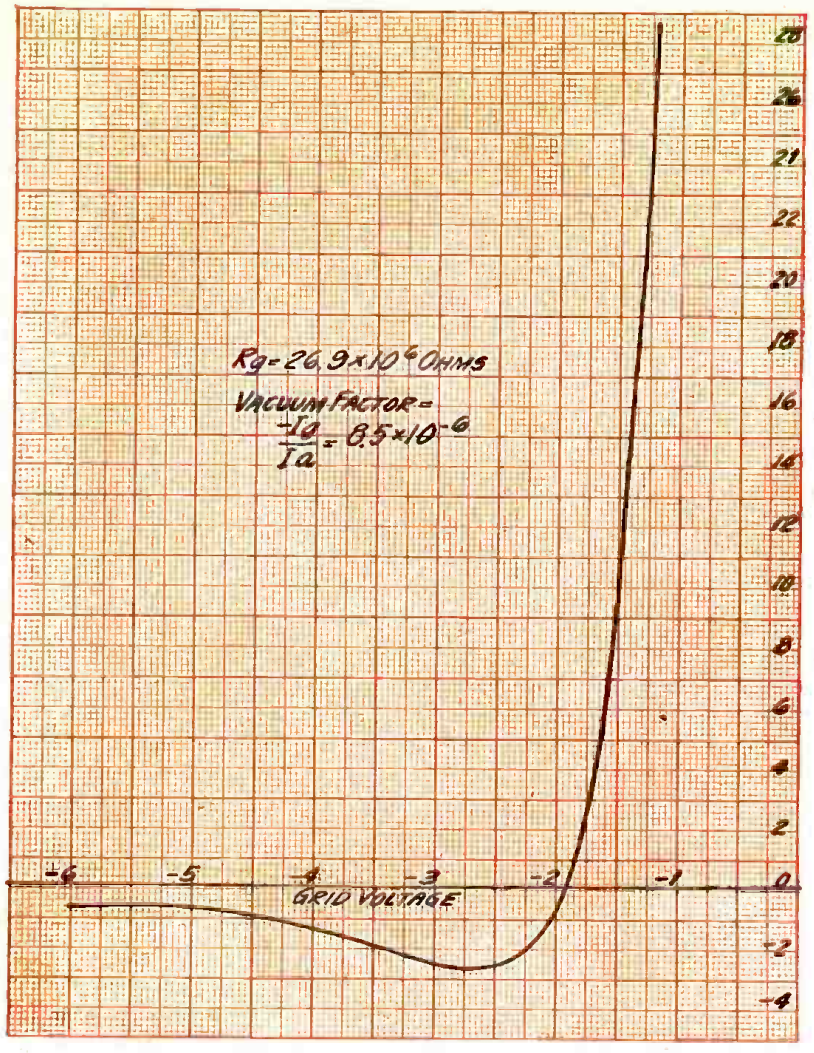


FIGURE 1: *A grid-voltage, grid-current curve that shows the variation of these two factors in a vacuum valve.*

the amount of grid current flowing in the circuit.

The formula for the grid current in this measuring arrangement is

$$Ig = \frac{\triangle Eg}{Rg}$$

where Ig is the grid current and Rg is the grid resistance and △ Eg is the change of effective grid potential calculated from the variation of plate current measured.

The sensitivity of this method is proportional both to the steepness of the valve characteristic and the amount of resistance included in the grid current. For the usual characteristic steepness of about

$$5.0 \times 10^{-4} \frac{\text{ampere}}{\text{volts}}$$

and a grid resistance of about 20 megohms, the sensitivity is equal to $S \times Rg = 10000$. This sensitivity enables grid currents of 1/10000 of a microampere to be measured by means of a simple milliameter in the plate circuit.

In Figure 4, the measuring layout is given.

Rg is the grid resistance
S is the short-circuiting plug
P is the grid-bias potentiometer
"C" is the grid bias battery
Rh is the filament resistance
"A" is the filament battery
V1 is the valve filament voltmeter
V2 is the grid potential voltmeter
V3 is the plate potential voltmeter
"B" is the plate potential battery
MA is the milliammeter in the plate circuit.

The valve characteristics are taken by means of changing the grid potential

(*Continued on page 70*)

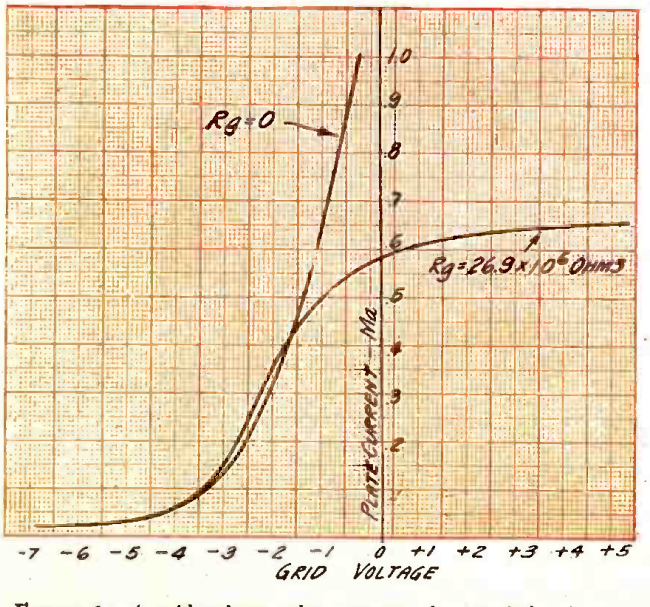


FIGURE 2: *A grid-voltage, plate-current characteristic of a vacuum valve, showing how this factor varies with different conditions of grid resistance.*

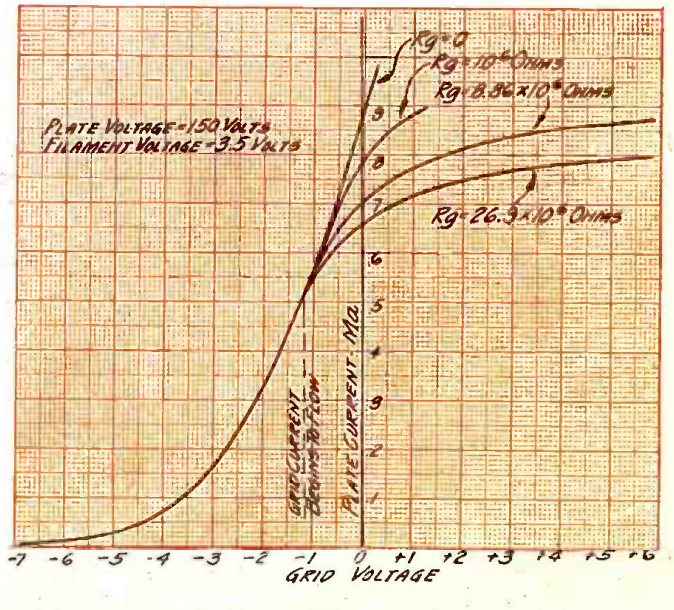
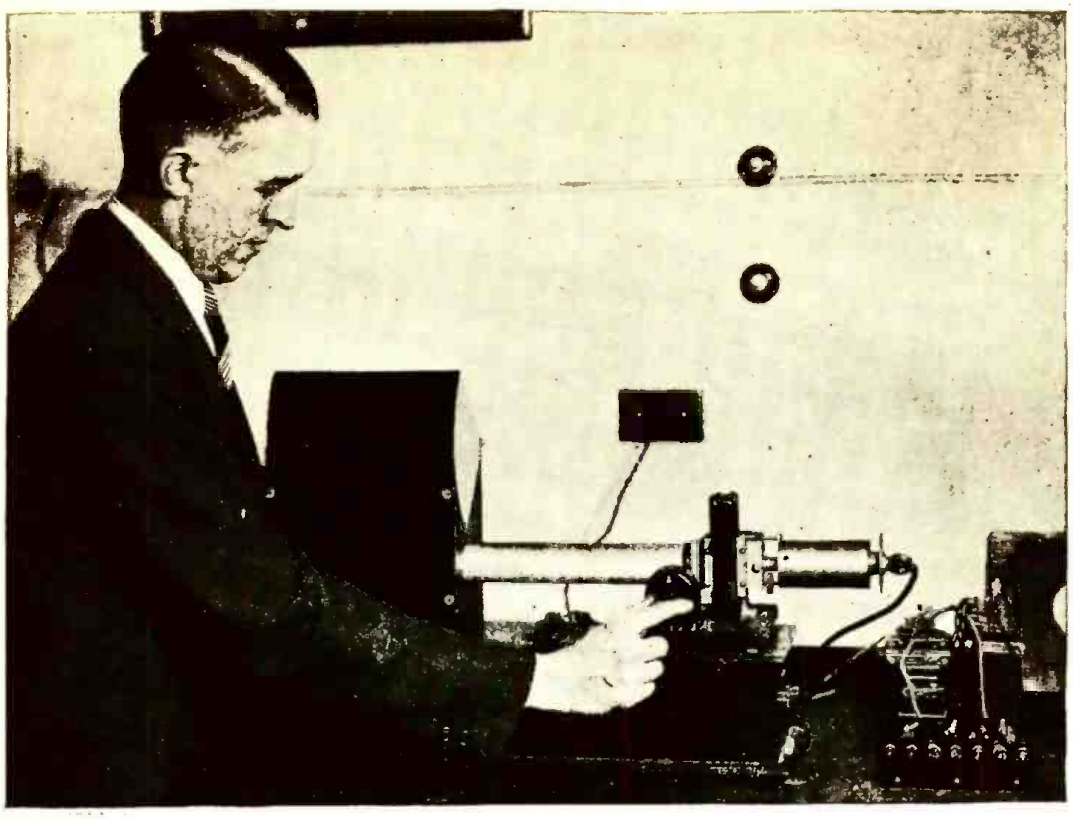


FIGURE 3: *A family of grid-voltage, plate-current curves, taken with varying conditions of grid resistance values, indicating the point where grid-current begins to flow.*



MAKING A HUM SHOW ITS PATH

By means of the oscillograph, shown in the picture above, oscillating currents are made to trace, on a screen, luminous paths showing their wave form. The engineer is shown testing the output of a power-pack with this delicate instrument in the POPULAR RADIO *Laboratory.*

Trailing the Elusive Hum

Have you had trouble with annoying hums in your power-operated set? Do your "A" power apparatus, your "B" power packs or your AC valves refuse to give silent, satisfying operation? It is probable that you have neglected some of the precautions that must be observed when using the AC lighting lines as a power source. This article gives valuable information on tracing down these annoying hums that sometimes occur when power operation is used incorrectly.

By CHARLES L. DAVIS

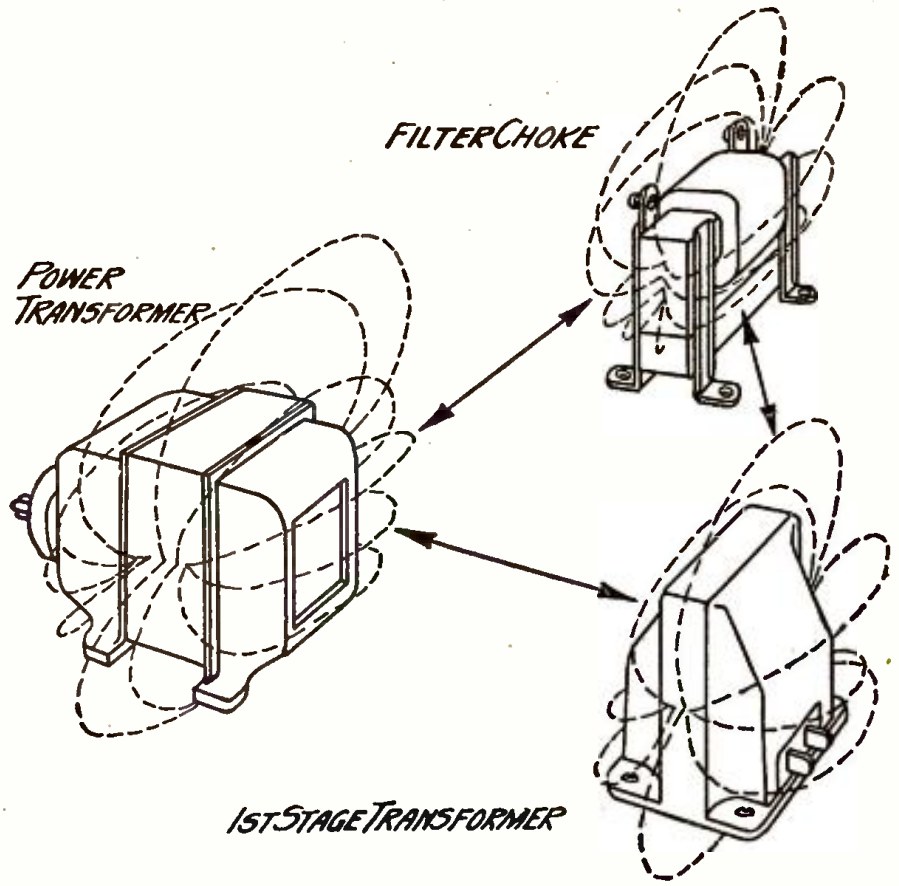
A SUCCESSFUL power-pack, and in fact any current-operated receiver, should work without annoying extraneous noises of any kind being generated within them. This, of course, is an ideal condition much sought after by the broadcast listener.

Absolutely silent operation, however, is seldom obtained, although in cases of well-designed power units or receivers the hum is usually reduced to a value where it causes no great disturbance and soon becomes practically unnoticeable to the regular listener.

However, many experimenters have built power-packs or have used various types of AC valves without being able to find out the cause of this form of trouble.

This is particularly true now, since the low-frequency amplifying apparatus used in modern receiver designs has been brought up to its present high standards. The better amplifying apparatus to-day amplifies and reproduces the low notes of the musical scale to a higher degree than ever before, and if there is any trace of hum generated in the power apparatus it may immediately become evident as a very bothersome noise, because its fundamental frequency is at the low range of the musical scale. The frequency of the hum that may cause trouble is of the same frequency as the alternating current in the lighting circuits—60 cycles. Other frequencies that may be generated as harmonics—120 cycles, 240 cycles, etc. —may cause minor trouble, although usually not so annoying.

A brief consideration of the causes of hum in power apparatus, therefore,



ISOLATING THE FIELDS OF TRANSFORMERS AND CHOKES

FIGURE 1: *Interaction between the magnetic fields of transformers and choke coils is one of the most common sources of hums. In their efforts to get a simple and compact layout, many set builders crowd their instruments, with disastrous results. The spacing shown in this diagram is an example of good spacing of instruments. Notice that the fields, shown in dotted lines, do not interlink, but are separated by distances indicated by the arrows.*

should be of great interest to set builders.

Of course, the idea back of noiseless operation from an alternating current source of power presupposes a method of rectification or changing of the alternating current into a unidirectional current of certain prescribed voltages. This is accomplished by a step-up transformer and rectifier valve. Direct current in this form, however, is not suitable for reception purposes because it will be pulsating in nature, whereas it should be a *pure* direct current without variations in strength or amplitude.

The type of unit required to eliminate these harmful pulsations that are left after rectification is known as a filter circuit, of which a standard one is shown at A in Figure 3. This standard filter consists of two choke coils in series, that have a smoothing effect upon current ripples, and three condensers, that have a storage effect on the direct-current impulses supplied to them. Theoretically, such a circuit should take out all pulsations and give silent operation.

However, when a heavy load is taken from such a circuit the inductance of the choke coils may decrease rapidly and thus serve to let quite a percentage of "ripple" through to the amplifying apparatus. This is true where large power valves are used in the last stage of amplification.

Strangely enough, considerable AC ripple can be applied to the last power valve in a set without causing a noticeable hum, although, if this same ripple should be applied to previous amplifier stages the ripple itself would be amplified along with the signal and would produce a terrific hum that would undoubtedly spoil reception.

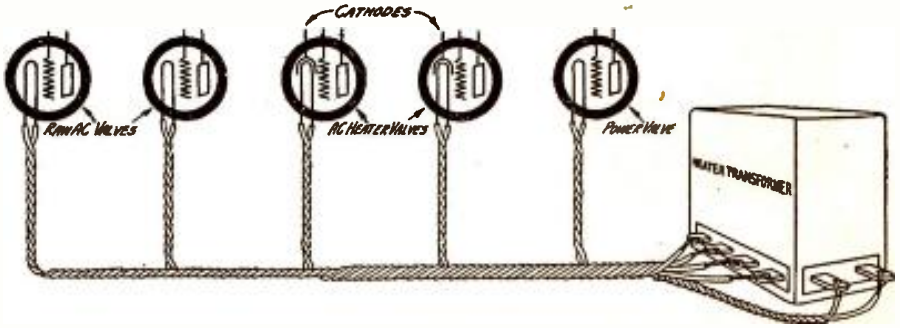
One method of eliminating this trouble is to connect the high voltage lead for feeding current to the power valve in the last stage, so that its load will come through *only one* of the choke coils. This leaves only a small load on the second choke coil and its inductance value will be maintained at a high enough value to filter out the ripple in the DC lead that feeds the other amplifier valves and the detector valve. Such a scheme is shown at B in Figure 3, and in many cases corrects a power-pack where the filter itself is at fault due to overloading.

Of course, it is presupposed that the choke coils are properly made and have an inductance large enough at the loads at which they are to be used, and also that the three filter condensers are of large enough capacity to offer little resistance to the AC ripple currents, at the same time storing up a suitable supply of direct current for the receiver's needs.

However, no change that could possibly be made in the filter can eliminate a hum that may be generated directly by induction.

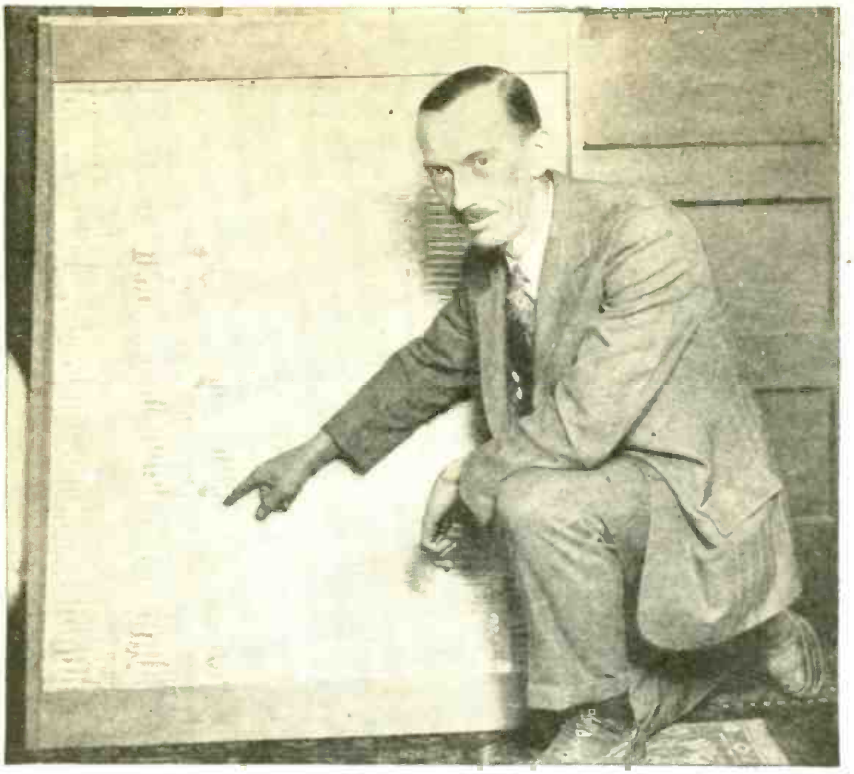
As seen in Figure 1, the power transformer used in the power-pack, as well as the filter chokes and the first-stage transformer in the low-frequency amplifier, have electromagnetic fields that spread to a considerable distance in their immediate vicinity. If these instruments are placed so close to each other that the fields interact, an alternating-current voltage will be set up in the chokes and in the low-frequency transformer that will be amplified along with the signals, producing a bad hum in the loudspeaker.

(*Continued on page 68*)



THE FILAMENT WIRING FOR AC VALVES

FIGURE 2: *By twisting the wires of the AC leads to the filaments of AC valves, the fields of the individual leads are made to neutralize one another, so that the field is confined to the cable itself, and cannot affect other nearby circuits. This precaution should always be observed with AC valves.*



A NEW IDEA IN LOUDSPEAKER CONSTRUCTION

Instead of the familiar magnetic coil construction of the ordinary loudspeaker, this unique reproducer unit, the patented invention of Collin Kyle, of San José, Cal., employs electrostatic attraction and repulsion as its operating principle. The complete absence of mechanical parts prevents it from getting out of adjustment, and the large vibrating surface makes for distortionless reproduction.

What's New *in* Radio

Conducted by

THE TECHNICAL STAFF

The material listed in these columns has been carefully tested in the POPULAR RADIO Laboratory, which is acknowledged to be one of the most completely equipped institutions of its kind. Mention in the following pages signifies that the apparatus illustrated has met the approval of the POPULAR RADIO Engineering Staff.

An Output Unit for Power Valve Receivers

Name of instrument: F M C speaker filter.

Description: This is a neat unit, intended primarily for use outside of the receiver cabinet, although it may be mounted within the cabinet if space is available. It measures 3½ inches by 3½ inches by 3 inches in height over all and is inclosed in a neat metal case which is finished in crystalline black. An extension cord with phone tips projects through an insulating bushing in one side of the case. This cord is for connection to the output terminals of the receiver. On the other side of the case is a small insulating panel which carries two tip jacks to accommodate the loudspeaker terminals. The extension cord that comes with the unit permits placing the loudspeaker at some distance from the receiver.

Outstanding features: Compact in size. Neat in appearance. Provides protection for reproducer windings against the high direct current present in the output of receivers that employ power valves.

Maker: Ford Radio & Mica Corp.

An Absolutely Dry Rectifier for Trickle Chargers

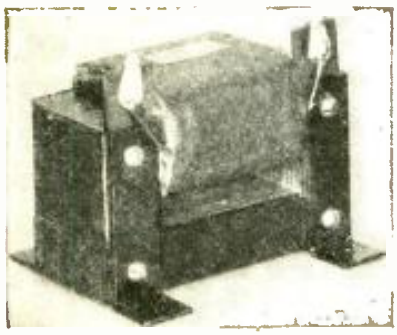
Name of instrument: Kuprox trickle charger unit.

Description: In this rectifier unit the rectifier elements are of metal. It is

therefore indestructible and requires absolutely no attention. Its life is said to be indefinite, inasmuch as the elements do not deteriorate with use. A number of these rectifier elements are clamped together and are inclosed in a perforated metal case which is open at the ends to permit free dissipation of heat. The unit illustrated may be used with a suitable transformer to make a trickle charger, or may be substituted for broken-down rectifier jars in electrolytic rectifiers. Four binding posts are provided on the unit, two for connection to the transformer output and two for connection to the battery.

Outstanding features: Absolutely dry. Requires no attention. Sturdy and indestructible.

Maker: Kodel Radio Corp.



A Most Useful and Handy Choke Unit

Name of instrument: F M C 30-henry choke.

Description: The heavy iron core used in this choke is solidly clamped and the construction throughout is rugged. Terminals are provided in the form of soldering lugs which are mounted on insulating strips at the top of the unit. An impregnated winding is used and is covered with an insulating cloth. The unit is much smaller in size than most chokes of the same electrical characteristics and is an excellent unit for use in the filters of small power-packs. It is rated at 90 milliamperes current carrying capacity and has an inductance of 30 henries.

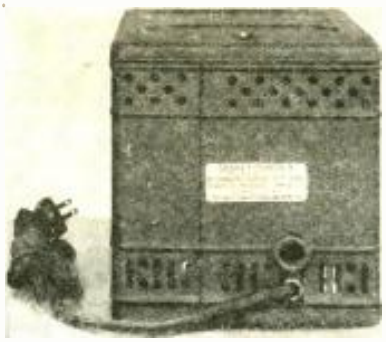
Outstanding features: Reasonable price. Small size. High current carrying capacity and inductance.

Maker: Ford Radio & Mica Corp.

A "B" Power-Pack Without Rectifier Valves

Name of instrument: Philco socket power B, types 86 and 82.

Description: The rectifier used in this Philco unit is unusual, in that it is of the electrolytic type. There are eight electrolytic rectifier cells in the unit. These do not require the addition of water, as do ordinary rectifier cells, but instead are replaced with new ones when worn out. In other respects this "B" supply unit is standard, but with a number of refinements. For instance, there is an adjustment inside to adapt it to receivers of different size. Also, it is fool-proof, in that the power is automatically turned "off" if the cover of the metal case is raised. There are



terminals to provide three "B" voltages, as required by most receivers, and the intermediate voltage is adjustable. The device will provide up to 196 volts at a current drain of 50 milliamperes.

Outstanding features: High voltage. Unusually fine rectification. Type 86 for use where supply is 50-60 cycle. Type 82 for use with 25-60 cycle supply. Fool-proof. Well ventilated.

Maker: Philadelphia Storage Battery Co.

A Capable Low-Frequency Transformer

Name of instrument: Type H low-frequency transformer.

Description: This is a new addition to the well-known line of Dongan transformers. It is a carefully designed and constructed job with an unusually husky iron core, which in part accounts for the even amplification obtained throughout the band of useful tone frequencies. The windings are completely inclosed within a metal case, except for small panels of composition material on either side, which serve as mountings for the four terminals. Flanges are turned out at the bottom for mounting the transformer. The cost is unusually low for a transformer of such ability.

Outstanding features: Good amplification characteristic curve. Well constructed and neat in appearance.

Maker: Dongan Electric Mfg. Co.

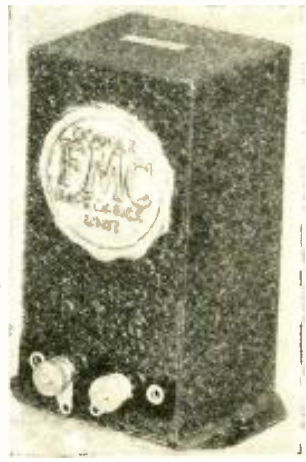
A Handy Socket Adapter

Name of instrument: UX valve adapter.

Description: The purpose of this adapter is to permit the use of UX-199 type valves in receivers that are equipped with old-style standard sockets—something which could not be done heretofore because of the small base on the 199 valve and also because the old-style UV-type socket required the use of a bayonet pin. The new adapter consists of a threaded composition collar and a base. The collar is small enough to fit down inside of the base and screws into a thread on the inside of the base. The base is perforated at the bottom to permit the prongs of the 199 valve to project through. To assemble this adapter on a 199 valve, the collar is slipped over the upper part of the valve, then the base is slipped up over the base of the valve. When the collar and base are screwed together, the valve is held firmly between them.

Outstanding features: Makes it possible to use UX-199 valves in any receiver which is equipped with old-style UV standard sockets.

Maker: DeJur Products Co.



This Coupling Device Increases Amplification Without "Blocking"

Name of instrument: F M C double impedance unit.

Description: Two separate impedance coils and a coupling condenser are included in a metal can which is finished in a crystalline black. Thus this single unit includes all equipment for a single stage of double impedance-coupled low-frequency amplification, excepting the valve. It is equipped with four binding-post terminals, clearly marked P, B, G and F to avoid any possibility of error in connecting the units into the circuit. The advantage of this type of coupling is that the use of an impedance coil in the grid circuit, as well as the plate circuit, tends to permit greater amplification without overloading or blocking.

Outstanding features: Can be readily substituted in any low-frequency amplifier for either transformers or resistance coupling by simply removing the old units and replacing with these new ones. Occupies comparatively small base room in receiver. Different types made for different low-frequency stages.

Maker: Ford Radio & Mica Corp.

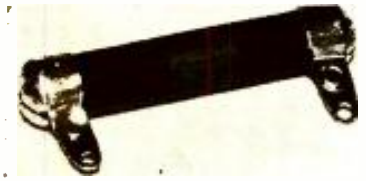
A "B" Power-Pack Without a Rectifier Valve

Name of instrument: Balkite model B-135 "B" power-pack.

Description: Where ordinary receivers, including those which employ a 112 type of valve in the last low-frequency stage, are used, this "B" power-pack provides an excellent source of high-voltage "B" power. It includes the necessary filter, transformer and electrolytic rectifier, all inclosed within a neat metal container. It operates from the 110-115-volt, alternating-current, house-lighting lines. There are two types available, one for a 60-cycle supply system, which is the most common, and the other for use in communities where the supply source is 25-40 cycle. It will supply a pure DC voltage of 135 or slightly higher. It is equipped with an extension cord and plug for connection to the light socket and has binding posts for the various voltages for the receiver supply.

Outstanding features: No larger than a single 45-volt "B" battery. All current-carrying parts entirely inclosed. Smooth in operation and economical to operate.

Maker: Fansteel Products Co., Inc.



An Accurate, Heavy-Duty Resistor

Name of instrument: "Hy-Watt" fixed resistor.

Description: This new resistor consists of an isolantite tube on which is baked a coating of special resistance compound. This compound is homogeneous in nature and provides a continuous and constant resistance path. The completely coated tube presents comparatively low resistance to current flow. To obtain the required resistances, a spiral groove is cut in the resistance. This groove cuts completely through the resistance coating and leaves the resistance coating in the form of a spiral ribbon on the tube. The length of this ribbon, and therefore the resistance of the unit, depends on the length of the spiral cut.

While the resistance unit is in the machine that cuts the spiral it is also in an electrical circuit with a resistance meter. As the spiral cut is started the meter shows the increasing resistance and the cut, which is made at a predetermined pitch, can be stopped when the resistance reaches exactly the desired value. This permits a high degree of accuracy to be obtained.

To insure good contact between the metal end caps and the resistance material, the ends of the resistance coated tube are electroplated. The end caps are then clamped in position on the plated ends and the whole resistance unit is given a coating of insulating compound for protection. The metal caps are equipped with soldering lugs to permit the resistance to be connected directly in the circuit without the necessity for using any kind of mounting.

Usage: In the circuits of radio receivers, transmitters or power-packs, where the resistances are not called upon to dissipate more than 6 watts.

Outstanding features: Accurate. Heavy-duty rating of 6 watts. No mounting required. Low in price.

Maker: Electro-motive Engineering Corp.

A Filament Control That Simplifies the Panel

Name of instrument: Victoreen filament control unit.

Description: This unit contains three rheostats mounted on a composition frame to form a single unit. Screw holes are provided in the frame to permit it to be mounted on the baseboard of a receiver. The rheostats are of 30 ohms resistance each, but may be substituted with rheostats of different resistances if desired. The unit is especially useful in superheterodyne receivers where some of the valves are more or less critical as regards the filament voltage adjustment.

Usage: To provide manual control of filament voltages in superheterodyne receivers, and particularly in the Victoreen superheterodyne.

Outstanding features: Provides exact adjustment of filament voltages. Will regulate the voltage of three or more valves. Designed for mounting on the baseboard, thus permitting the minimum number of panel controls.

Maker: George W. Walker Co.

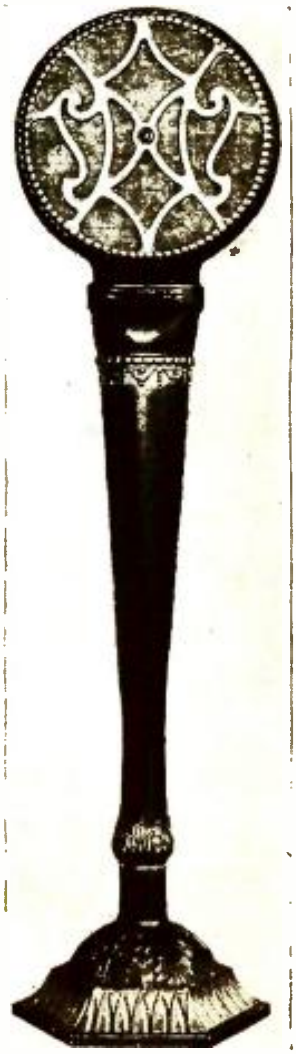
A Horn-Type Reproducer of Unusual Appearance

Name of instrument: "True-Tone" speaker.

Description: This reproducer is of the horn type and is of heavy metal construction, but so designed that there is no metallic or harsh tone evident in the reproduction. The reproducer unit is inclosed in the base of the device and the long, tapering pedestal, as well as the belled top, serve as the horn. The whole unit stands about 40 inches high. The heavy metal construction prevents the reproducer from being tipped over easily. The finish is a warm antique bronze and the distinctive appearance of the unit makes it a pleasing addition to the furniture of the home.

Outstanding features: Accoustically well designed. Neat appearance. Sufficiently heavy to stand on the floor without danger of tipping over easily.

Maker: Yabr-Lange, Inc.



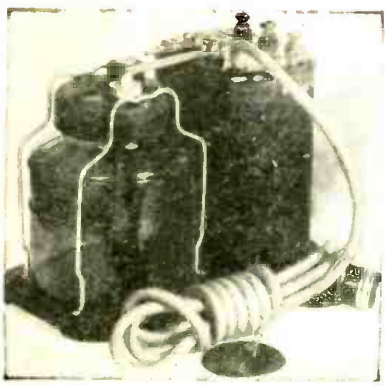
A "B" Power-Pack for Power Valve Sets

Name of instrument: Burns high-voltage "B" eliminator.

Description: This power-pack is designed for use particularly with receivers which employ a 171-type valve in the last low-frequency stage. In the case of the average large receiver, the current drain for the plate supply does not exceed 35 milliamperes; this power-pack will supply this amount of current at 180 volts. It employs a Raytheon BH type rectifier valve. All parts are completely inclosed within the metal case, including the output binding posts. Three output voltages are available, the detector and amplifier voltages being variable and the power voltage being fixed. Two variations of power voltage are obtainable, however. The unit is equipped with an extension cord and plug and with a pendant switch in the cord for turning the power "off" and "on."

Outstanding features: Provides a constant DC supply at voltages up to 180, even for receivers of unusually heavy current drain. Fool-proof and safe. Variable detector and intermediate voltages.

Maker: American Electric Co., Inc.



A Trickle Charger for Continuous Service

Name of instrument: Balkite model N trickle charger.

Description: An electrolytic rectifier is used in this trickle charger. The rectifier jar and transformer are two separate units, but are mounted on a single base. The transformer is inclosed within a crystalline-finished metal case with a composition top, upon which the necessary connection terminals are mounted. The rectifier is inclosed within a glass jar so that the water level may be seen at all times. Two charging rates are provided. The lower one is .5 ampere per hour and is for use with receivers which consume an average of up to 7 ampere hours per day. Where the current drain on the battery is greater than this, the higher rate of .75 ampere per hour may be used. The unit is equipped with an extension cord and plug for connection to the 110-volt AC electric light socket.

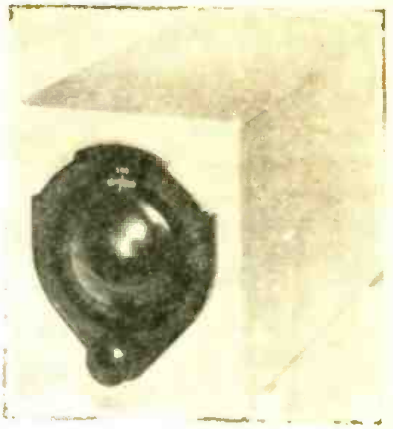
Outstanding features: Compact in size. Keeps battery constantly charged at a low cost. Water level in rectifier jar is always visible. May be obtained with a special transformer where the alternating-current supply is 25-40 cycle instead of the usual 60 cycle.

Maker: Fansteel Products Co., Inc.

A Novel and Thorough Wave Trap

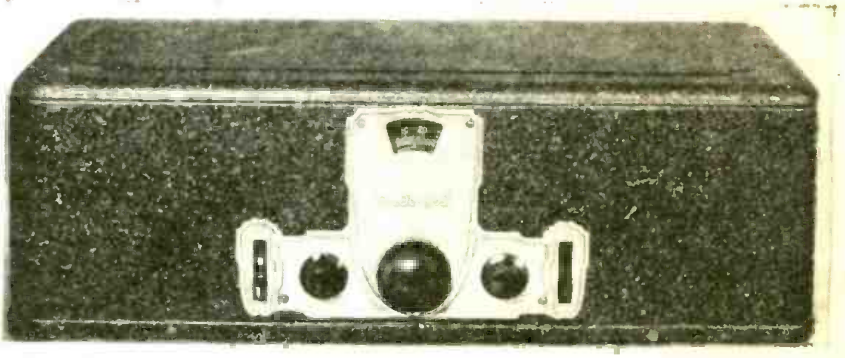
Name of instrument: Wave trap.

Description: This unit consists of a combination of several coils and a variable condenser, all inclosed in an aluminum box shield with a dial on the front end for operating the variable condenser. Eight binding posts are mounted on the reverse end of the shield for making connections to the receiver and the antenna-ground. By making the proper connections, as explained in the instruction leaflet which comes with the instrument, this device will meet any trapping requirements, regardless of the number of sources of interference.



Outstanding features: This trap can be made to function as any one of the three different types of wave traps by making suitable connections to two or more of the eight binding-post terminals. Will function as a trap with either an antenna or a loop, or can be used as an antenna coupler when it is desired to use an antenna with a receiver that is designed exclusively for loop operation.

Maker: Madison-Moore Radio Corp.



An Exceptionally Fine Receiver for the Size and Price

Name of instrument: Crosley "Bandbox" receiver.

Description: It seems almost unbelievable that a receiver which measures only 17 inches in length by 7 inches in depth and 6 inches in height can employ six valves and be capable of exceptional sensitivity, selectivity and tone quality. Yet that is exactly what the Bandbox receiver is. Subjected to rigid tests of these and other qualifications, this receiver came through with unusually high honors in all of the features that go to make up the requirements for a highly desirable receiver for home use.

The Bandbox employs three stages of high-frequency amplification, a detector and two stages of transformer-coupled, low-frequency amplification. One of the high-frequency stages is untuned, which limits the number of tuned circuits to three; these are ganged together for control by a single knob. Not only are the individual stages shielded, but the principal components of each stage are individually shielded. This shielding, together with the neutralizing methods employed, absolutely eliminates the possibility of the receiver spilling over into oscillation. As proof of this, the volume control may be turned up full and the tuning knob turned throughout the entire scale without encountering a single "birdie" whistle of oscillation.

The low-frequency amplifier employs two transformers of high quality. These too are individually inclosed within "cans" to carry out the complete shielding scheme. Suitable grid biasing is provided for in order to eliminate the possibility of overloading—an important consideration in a receiver which provides such great volume of reproduction as this one.

Valves of the 201-a type are employed throughout, except in the last low-frequency stage; here the 171 type valve is recommended, although either a 112 or even a 201-a type valve may be employed with good results, particularly where "B" bat-

(*Continued on page 66*)

A Handy Charger-Relay Unit

Name of instrument: "Tritox" combination trickle charger and relay switch.

Description: The charger used in this unit employs the Westinghouse Rectox rectifier, which is a small rectifier that contains no liquid, requires no valves or bulbs, and operates indefinitely without attention of any kind. In addition to the rectifier, there is the usual step-down transformer and also an automatic relay switch which turns the charger and "B" power-pack (if one is used) "on" and "off" automatically with the operation of the battery switch on the receiver panel. Binding posts are mounted on the front of this unit for connections to the receiver and the "A" battery, and there is an extension cord and plug for connection to the electric light socket. A receptacle is also provided into which the plug of any "B" power-pack may be inserted, to be operated by this relay switch.

Outstanding features: Dry rectifier that requires no attention. Tapering trickle charge with decreasing charging rate as battery approaches the fully charged condition. Compact.

Maker: Sarvas Electric Co., Inc.

Filament Supply from the Lighting Lines for 199 Valves

Name of instrument: Type 94 "A" power supply unit.

Description: This is an "A" power-pack which supplies filament current for valves of the 199 type from the alternating current house lighting lines. It consists of a metal case which incloses the necessary transformer, a 1-ampere Tungar bulb, and two small 4-volt storage batteries and also an automatic relay switch which turns this unit and also a "B" power-pack (if one is used) "on" and "off" with the operation of the battery switch on the receiver panel. This is not a trickle charger-battery combination. The small storage cells are "floated" on the rectifier output and function as filter condensers of extremely high capacity. Current is drawn from the light line only while the receiver is in operation.

Outstanding features: Permits the filament current for receivers employing 199 type valves to be drawn from the AC light lines and thus eliminates batteries. The battery-filter is not subject to charge and discharge, and there is consequently little evaporation of the electrolyte and the unit therefore requires practically no attention. Automatic relay is built in to control both this and "B" power-pack. For the latter purpose a receptacle for the "B" power-pack plug is incorporated in the front of the "A" unit.

Maker: Sterling Mfg. Co.

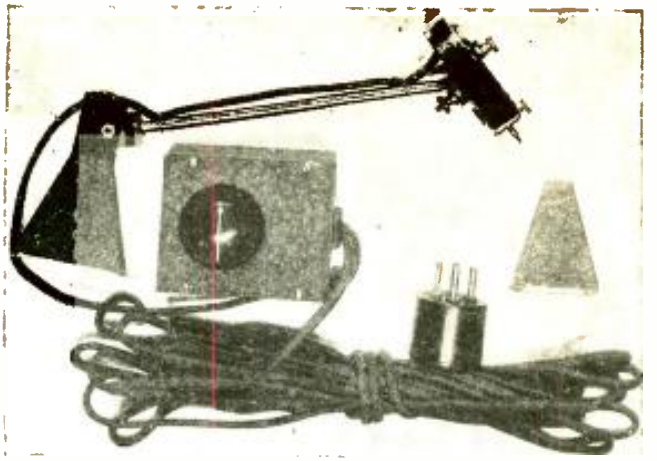
A Meter for AC Filament Operation

Name of instrument: Alternating current voltmeter.

Description: This is a panel mounting voltmeter which measures voltages in alternating current circuits, up to a maximum of 15 volts. It is intended primarily for use in receivers or power-packs where filament current is supplied from the AC mains through step-down transformers. It is a meter of the standard Weston type, with a two-inch dial.

Outstanding features: Small size. Easily mounted on a panel. Accurate.

Maker: Weston Electrical Instrument Co.



Electrical Reproduction of Phonograph Music

Name of instrument: Electrical phonograph pick-up unit.

Description: This pick-up unit is for use in reproducing the music of a phonograph record through the use of the amplifier and reproducer of a radio receiver. The tone arm of the pick-up unit is placed with its base on the phonograph next to the record, and the head of the arm, with its needle, is rested on the record in place of the regular arm. The plug at the other end of the cable is inserted in the detector socket of the radio receiver. With the receiver turned "on" and the phonograph started, the output of the phonograph is passed on to the receiver electrically and is reproduced with the same quality as the broadcast programs picked out of the ether. The small rectangular box with the knob is the volume control.

Outstanding features: Permits even the oldest and cheapest phonographs to be used with the radio receiver to reproduce recorded music with quality equal to that obtained in broadcast reception.

Maker: Canadian Marconi Co.

Improved Appearance for Antenna Masts

Name of instrument: W-E-B-B "Ball and Socket" aerial mast fitting.

Description: This set of mast fittings consists of a decorative tip which is provided with eyes for the halyard and guy wires, a split socket base and a ball butt for the mast. The base is attached to the roof or other mounting place by means of screws or bolts. The tip and butt are then placed on the mast pipe and the whole is mounted on the base by resting the ball butt in the base socket.

Outstanding features: This arrangement provides a firm support for the mast, but the ball and socket joint permits enough freedom of movement so that the mast may bend and give under strain without loosening the base, as would be the case if the mast were rigidly fastened to the roof. Heavy cast iron.

Maker: Timing Gears Corp.

IN THE PROFESSIONAL SET BUILDER'S SHOP

Practical pointers and kinks to increase the efficiency and earning power of those who construct, repair or service receivers for profit. If there is a better and easier way to do it, this department of POPULAR RADIO, *aided by a well-equipped Laboratory, will find it and present the details to our readers in a practical and concise manner.*

Resistance-Coupled Amplification at Its Best

HERE are some practical data on an amplifier that the writer has found to give excellent results in practice:

It will be noted from the accompanying diagram (Figure 1) that the conventional hook-up of the resistance-coupled amplifier has been followed, with just a few, but highly important, deviations. The resistors are of the usual .1 megohm value. It is strongly advised that the resistors be of the metallized type and of good make, to insure noiseless and lasting operation. The coupling condensers are of 0.1 mfd. capacity. The condensers should be mica insulated, to insure against leakage and breakdown. A 300-turn honeycomb coil has been found ideal as a high-frequency choke, to prevent high-frequency currents from getting into the low-frequency circuits. A standard high-frequency choke coil may be substituted if desired. Two small by-pass condensers of .0001 mfd. capacity complete the high-frequency filter.

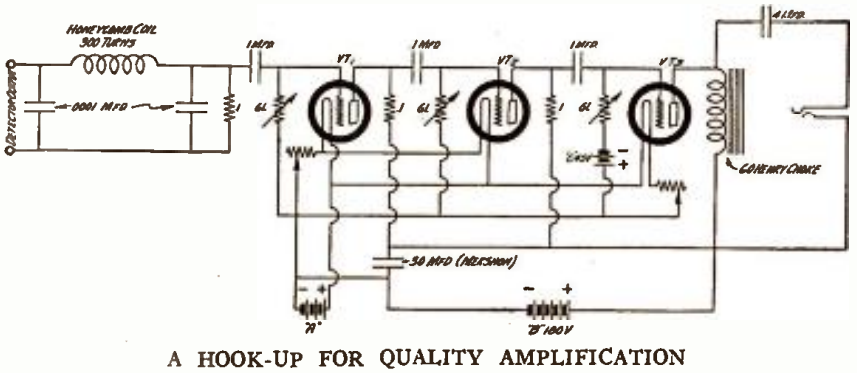
The first and second amplifier valves are of the MU-20 or UX-240 or Donle high-mu type of vacuum valves. The last valve should be of the UX-171 type preferably, if sufficient "B" voltage (135 to 180 volts) is available, with the correct "C" battery. The UX-112 type may be substituted if only lower voltages are obtainable. It will be noted that an output filter, in the form of choke coil and a 4 mfd. by-pass condenser, is employed. The choke coil may be the secondary of a discarded transformer, if necessary, but its inductance should approximate 60 henries. This filter is essential for satisfactory results with the UX-171 type valve.

The other variations from standard practice are to be found in the variable grid-leaks, which have proved indispensable for the best results. A variable grid-leak is virtually essential for the power valve, while the first and second valves may also be provided with grid-leaks. After experimenting with various resistance, a unit with a range of from practically zero to 5 megohms (such as the Clarostat universal resistor) was found satisfactory.

Still another and highly important variation is the Mershon condenser of 30 mfd. capacity, connected across the full plate voltage ("B" — and "B" +) of the amplifier. The purpose of this condenser is to provide the necessary reserve of energy to reproduce bass notes. It is little appreciated that the bass notes—those wonderful double bass and 'cello strains of the orchestra, and the big pipes of the organ, for example—require many times as much power as the notes of the middle register. Often, when operating resistance-coupled amplifiers on a "B" power-pack, the low notes will "crack" or fail. The cause is to be found in insufficient "B" energy. The usual condensers across the output of the "B" power-pack, serving as electrical flywheels, so to speak, are drained of their accumulated power and have not time to fill up again; hence the low bass notes are sometimes not reproduced. The Mershon condenser is an electrolytic affair, now available for various purposes. If preferred, paper condensers may be employed, having a capacity of at least 12 mfds.

With a reliable variable grid-leak such as a Clarostat, the grids of the amplifying valves may be adjusted to the precise point of top efficiency, in accordance with the other factors in the

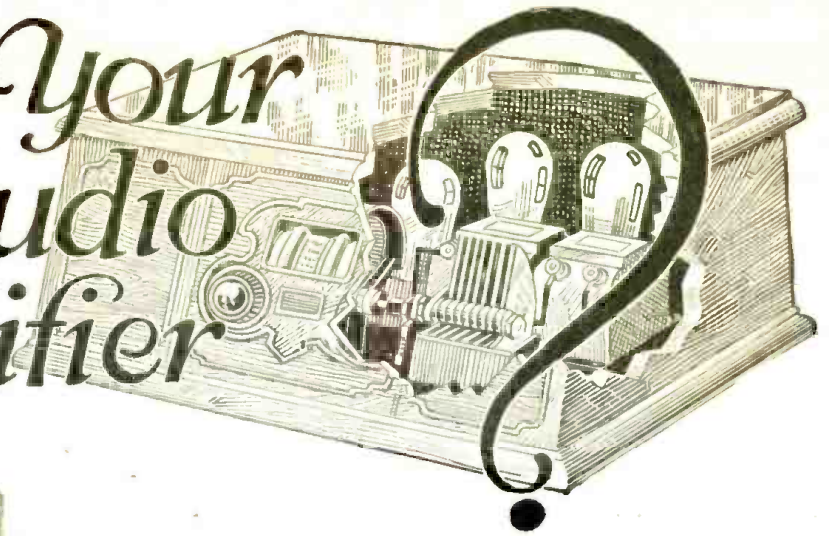
(*Continued on page 62*)

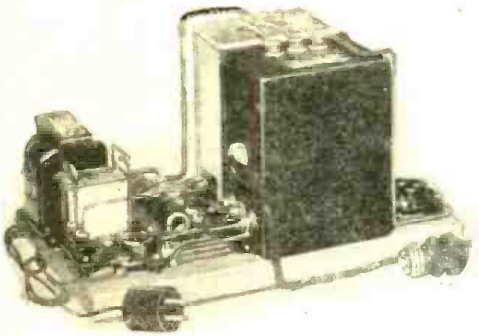


A HOOK-UP FOR QUALITY AMPLIFICATION

FIGURE 1: *In this schematic wiring diagram of the resistance-coupled amplifier, the high-frequency filter can be seen at the left. At the right is the output filter to keep the direct current from the windings of the reproducer. Note also the three variable grid-leaks.*

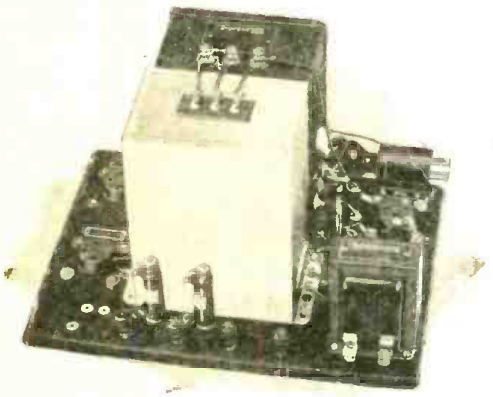
How's Your Old Audio Amplifier





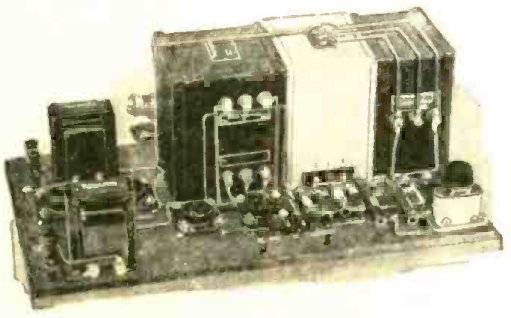
THORDARSON 171 TYPE
POWER AMPLIFIER

Built around the Thordarson Power Compact R-171, this power amplifier supplies "A," "B," and "C" current for one UX-171 power tube and B-voltage for the receiver. Employs Raytheon B. H. rectifier.



THORDARSON 210 TYPE
POWER AMPLIFIER

This amplifier, mounted on a special metal chassis, uses the Thordarson Power Compact R-210. Provides "A," "B," and "C" current for one UX-210 power tube and "B" voltage for the receiver. Employs one 216-B or 281 rectifier.



THORDARSON 210 PUSH-PULL
POWER AMPLIFIER

This heavy duty power amplifier operates two 210 power tubes in push-pull and has an ample reserve of power for "B" supply for the heaviest drain receivers. Built with Thordarson Power Transformer T-2098, and Double Choke Unit T-2099.

A Home Assembled Thordarson Power Amplifier Will Make Your Receiver

A Real Musical Instrument

IMPROVEMENTS in the newer model receiving sets are all centered around the audio amplifier. There is no reason, however, why you cannot bring your present receiver up to 1928 standards of tone quality by building your own Thordarson Power Amplifier.

With a screw driver, a pair of pliers and a soldering iron you can build any Thordarson Power Amplifier in an evening's time in your own home. Complete, simple pictorial diagrams are furnished with every power transformer.

The fact that Thordarson power transformers are used by such leading manufacturers as Victor, Brunswick, Federal, Philco and Willard insures you of unquestionable quality and performance.

Give your radio set a chance to reproduce real music. Build a Thordarson Power Amplifier.

Write today for complete constructional booklets sent free on request.

THORDARSON

3572

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists Since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Huron and Kingsbury Streets — Chicago, Ill. U.S.A.

Hi-Q SIX

The Best in Radio Must be CUSTOM-BUILT

Electrify *The* Hi-Q Receiver— *with the* Hi-Q POWER PACK

Especially designed for the Hi-Q Six Circuit — Officially Endorsed by the Hi-Q Board of Engineers

THE Hi-Q Power Pack described in the following pages, is the result of the same conscientious effort to produce finest results that has been so universally recognized in the Hi-Q SIX Receiver itself. Both theory and form of construction have been developed at the expense of months of patient experiment in the most modern experimental radio laboratories in the country. Parts used are the products of manufacturers who lead the industry in their particular fields. The ensemble is a perfect complement to the Hi-Q SIX Receiver and is endorsed by the Hammarlund-Roberts Board of Engineers. The Hi-Q Receiver electrified with the Hi-Q POWER PACK assures the highest type of instrument known to modern radio science—*regardless of price!*

Hammarlund
ROBERTS
Hi-Q SIX

HAMMARLUND-ROBERTS, Inc.
1182 Broadway, New York

The "Hi-Q" Power Supply

(*Continued from page 14*)

tween the black and brown terminals of the Yaxley plug, Q. The amperite, P3, should be removed and a twisted pair of filament leads should be attached to socket N6.

When this has been done, the unit is ready to be installed in the console that houses the Hi-Q "Six" receiver.

Operating the Unit with the Hi-Q "Six"

First the receiver should be set in the compartment of the Superior console, as shown in the illustration at the beginning of this article, and then the Hi-Q power-pack should be set in the upper compartment with the Balkite "A" current unit alongside of it.

Then the instruments should be connected up with the Yaxley cable, as shown in Figure 1.

Five SX-401-a valves should be inserted in the first five sockets of the receiver, and an SX-471 should be placed in the last socket.

A 4½-volt "C" battery should be installed between the ground lead and the green wire of the Yaxley cable.

The light-socket antenna should be connected to the regular antenna terminal on the set, or a regular outdoor antenna may be used if desired. The AC input wires to the Hi-Q power-pack should be connected in parallel with the two AC input wires to the Balkite "A" current unit, and the common ends of these should be connected to a lighting plug, to screw into a light socket.

An output unit is recommended for use with the reproducer, and a decorative chest containing such a unit is shown in the diagram in Figure 1 with the proper connections to the cone reproducer. This unit protects the reproducer from high voltage currents and helps to improve the quality of reproduction. The Farrand oval cone is shown and is officially recommended with the Hi-Q "Six."

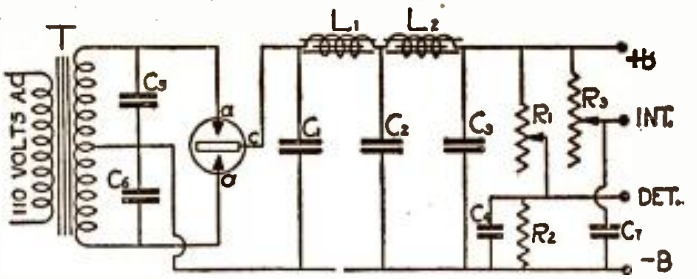
The set will tune exactly as before, as explained in the article in the December, 1927, issue of this magazine, and the proper "C" bias for the last valve in the set may be adjusted by rotating the left-hand knob on the Hi-Q power supply. The right-hand knob controls the detector and high-frequency amplifier "B" voltage and should be adjusted for the loudest signal strength obtainable with stable operation.

This combination of apparatus will give the best results obtainable with standard vacuum valves, and the complete unit will furnish excellent reproduction from both local and distant stations. The only unit that will need replacing is the small "C" battery, which should last for about a year.

The Balkite unit will need replenishing with distilled water only two or three times a season. Its operation is automatic and requires no adjustments.

In the Professional Set Builder's Shop

(*Continued from page 58*)



THE STANDARD RAYTHEON CIRCUIT

FIGURE 2: *In trouble shooting a Raytheon power-pack, the important danger points are the resistor bank at the right of the diagram, the filter condensers in the center, and the power transformer at the left.*

circuit. Greater volume, without distortion, may thus be obtained.

This amplifier should be employed in conjunction with a reproducer capable of operating over the total range of musical frequencies.

—CHARLES GOLENPAUL

Trouble-Shooting Raytheon Type Power-Packs

THERE are few elements to cause trouble in standard "B" power-packs using the B or BH type Raytheon rectifying valves. However, when trouble does develop, it may be readily located and remedied, and the following suggestions are offered as an aid to radio enthusiasts in facilitating such work. Figure 2 shows the power-pack circuit.

No Voltage at Given Tap: The logical place to begin the hunt for trouble in a "B" power-pack is at the resistor bank, and then work backwards through the filter, the rectifier valve, and finally the power transformer. It is assumed, of course, that the 110-volt alternating current is known to be flowing through the transformer primary when the power-pack is turned "on," and that the rectifier valve is not visibly damaged in any way. Of course the current should be turned "off" before any part of the power-pack or associated wiring is handled, to avoid dangerous shocks.

An open-circuited or burnt-out resistor will result in no voltage from the tap it controls. If the 10,000-ohm fixed resistor, R2, becomes open-circuited, in the case of the "B" power-pack, the detector voltage will immediately increase so that in the tuned-high-frequency type of receiver the signal strength will be greatly diminished, while in the regenerative receiver there will be constant oscillation.

The simplest method to locate a defective resistor is by means of a high-resistance voltmeter, connected to each tap in turn. In fact, this device is essential in adjusting "B" power voltages on any receiver, in preference to the cut-and-try method. In the absence of this device, a 15-watt, 220-volt incandescent lamp may be employed. It should glow a dull red on the full output and on the intermediate tap of the "B" power-pack. If it lights equally bright on the detector tap, it is an indication of an open or defective 10,000-ohm fixed resistor.

If the tap voltages are found satisfactory, and the receiver still does not operate well, the trouble may be due to an open-circuited or an omitted by-pass condenser, C4 or C7. A short-circuited by-pass condenser will act the same as short-circuited resistor.

No Voltage at All Terminals: This condition can be caused by an open circuit in the wiring, transformer, choke coils, or a broken-down filter condenser.

With power disconnected from the "B" power-pack and the Raytheon valve removed, a click should be heard in the testing headphones when connected in series with a battery between the plate terminal of the rectifier socket and the "B" positive terminal of the power-pack. A click should also be heard between the filament terminal of the rectifier socket and the "B" negative terminal of the "B" power-pack. These clicks should be of equal strength. If one filament terminal gives a much louder click than the other, it generally indicates a defective buffer condenser. If no click is heard on either filament terminal, then the transformer secondary is open-circuited, or the center tap of the transformer does not connect to the "B" negative side, as it should.

The circuit continuity of the transformer itself may be tested by the click between the two filament terminals of the rectifier socket, with the valve removed. If the transformer secondary tests O. K. on the foregoing procedure, there must of necessity be an open circuit in the "B" negative lead.

A short-circuit in the secondary of the transformer can be most easily checked by connecting a 25-watt, 110-volt lamp in series with the primary. The current may be turned "on" in the usual way, but with the Raytheon valve removed from the socket. The incandescent lamp should glow dully, if at all. If it glows brightly, either the

transformer secondary or one of the 0.1 mfd. buffer condensers, C5 or C6, is broken down. With the lamp still in the primary, the rectifier valve is inserted in the socket. If the secondary connections are O. K., and the Raytheon valve is operative, the lamp will increase in brilliancy. The buffer condensers, if suspected, may be disconnected from transformer secondary and rectifier socket, so as to be tested separately for short-circuits.

Testing the Raytheon Valve: A Raytheon valve can be depended upon to provide satisfactory service for about a year of normal use—at least a thousand hours of radio entertainment. After serving nearly its full life, the voltage output of the valve, previously maintained at a uniform high level, begins to drop off. When such a condition obtains, the voltage controls can often be adjusted to bring the voltage up again to the desired value, and many weeks more of good reception enjoyed before the valve is finally discarded.

If the Raytheon gets warm when the "B" power-pack is in operation, it is sufficient indication that the rectifier valve is operating.

Excessive Hum: This condition may be caused by an incorrect connection in the filter circuit, such as a condenser by-passing a choke coil. The hum should increase when either choke coil is short-circuited in turn. If the hum does not increase, the circuit connections to that choke coil should be checked, and if found correct then the choke coil should be replaced by another of similar characteristics. Make sure that one side of the "A" battery is grounded.

Importance of High-Resistance Voltmeter: Those desirous of operating a "B" power-pack or a Raytheon "ABC" power-pack, as the case may be, should have a voltmeter whose resistance is at least 100,000 ohms, with a full scale deflection of 200 or 250 volts. Such a meter will permit of adjusting the resistances for the proper output voltages when connected with a given radio receiver. Not only is this of great benefit when the initial installation is made, but it will later be of use in making adjustments to take care of line voltage fluctuations, changes of receiving valves, etc. Correct readings are impossible with the inexpensive, low-resistance type of voltmeter.

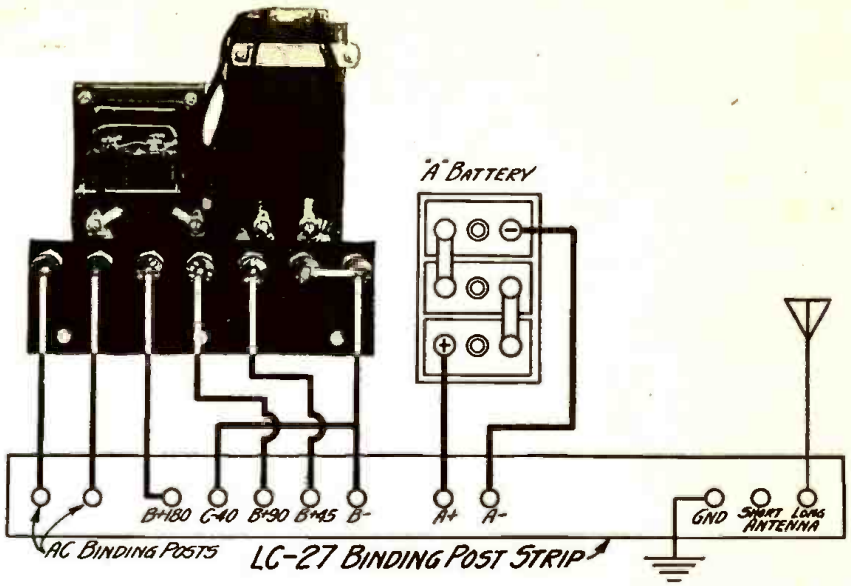
Motor-Boating, or troublesome low-frequency oscillations which cause fluttering in the reproducer, are generally due to conditions in the amplifier, and may be corrected by satisfactory adjustment of the amplifier.

Replacement Valves: It is of utmost importance that the existing rectifier valve in the power-pack be replaced by the same type of valve.

—LAURENCE MARSHALL

The Pilot "BC" Power-Pack

(Continued from page 26)



"B" POWER FOR THE LC-27

FIGURE 3: *The Pilot power-pack is here shown hooked up to the LC-27 receiver. The connections to any other standard receiver would be about the same.*

wise with the filter condensers, H1, H2, H3, H4, H5, H6, H7 and H8, including the buffer condenser, G. These are to be strapped together with the threaded rods and fastened securely in place with four wood screws.

Now fasten down the two chokes, B and C, and the transformer, A, in the positions indicated in Figures 1 and 2. The last job will be to mount the socket, F, as shown in the same figures.

How to Wire the Set

This unit may be wired completely with the connection wire furnished by the manufacturer, without soldering. These connection wires are furnished in varying lengths equipped with lugs, and the resistors and condensers, the transformers and chokes, as well as the binding posts and the socket, are furnished with screw terminals, under which these lugs may be fastened tightly.

If these connection wires are used, and the circuit is wired exactly as is indicated in the picture wiring diagram in Figure 2, there will be no possibility of making a mistake.

The complete wiring job may be done in less than half an hour and the unit should then be ready for operation.

How to Use the "BC" Power-pack

The unit may be used with any five- or six-valve receiver, and a power valve of the 171 type may be inserted in the last stage of low-frequency amplification.

For illustrative purposes the diagram in Figure 3 shows the unit connected to the LC-27 receiver. The "A" supply may be furnished by a storage battery. In this diagram the unit is shown with the wires running between it and the connection strip on the back of the receiver. The diagram also shows the connection for the storage battery and for the antenna and ground binding posts. A standard QRS rectifier valve is first inserted in the new "B" power-pack, and then the set is ready for operation exactly as before, except that the plug from the "BC" power-pack must be inserted in a 110-volt, 60-cycle AC lighting socket and the current switched "on." A Baldwin "99" loudspeaker is recommended with this combination.

In using the new power-pack with an ordinary set, the filament circuit of the power valve, which is the last valve, is cut off from the battery and a twisted pair of separate wires are run over to the two left-hand binding posts on the power-pack, as shown in Figure 3. This operates the last valve in the set on pure alternating current.

The only other change is that the "C" negative (—) terminal for the last valve in the set must be connected over to the "C" positive (+) binding post on the set, or to the "B" negative (—) binding post on the power-pack.

That's all there is to the job of installation. If a 4½-volt "C" bias is needed in the set, it will continue to be fed from a small Eveready 4½-volt battery, as the "BC" power-pack furnishes only the "C" battery voltage for the last valve.

This is probably the first description of a "BC" power-pack that will give really reliable results at such an extremely low cost. The unit may be relied upon to operate a standard receiver for years without trouble or without fussing with numerous complicated and bothersome adjustments.

The Soldering Science

(Continued from page 34)

to a lug. The paste or fluid flux is usually applied to the parts; then the solder is applied from the point of a heated iron. If the flux be in paste form, the organic grease melts, allowing a certain portion of the suspended chloride solution to be deposited upon the work's surface, where it serves as the de-oxidizing agent. The remainder of the suspended chloride solution still held by the grease more remote from the point of heat application will be driven down or up our stranded conductor by the acceleration of the grease through heating. These chlorides find a resting place on the conductor strands under the protecting insulating material, where their removal is impossible. There the chlorides are able to start their destructive work unobserved and undisturbed. The action of fluid forms of flux will be found to be substantially the same. The boiling and spattering, caused from soldering heat, drive the chlorides under the protecting insulation with the same resulting conditions that follow the use of the paste.

Rosin for a fluxing medium possesses the distinct advantages of not being corrosive or conductive, as are the chloride fluxes. These two qualities are paramount in value for radio use. The striking lack of any tendency to promote corrosive action makes it a safe medium for use on the most delicate wire or part, and the lack of conductivity works in perfect harmony with insulation materials. It is not hygroscopic, and the residual matter presents a dense, hard and glass-like surface that does not favorably lend itself to the collection of moisture or foreign matter, as do the residuals of the chloride fluxes.

However, any attempt to use rosin or rosin-core solder on nickel-plated parts or connections will result in solder failure, for abietic acid, the oxide solvent in rosin, has a negligible capacity for nickel oxide. Should it be necessary to make use of nickel-plated soldering contacts, file away the plating, and the base metal, usually brass, will respond to the fluxing power of rosin.

Rosin will display its greatest activity as a flux on metals plated with tin, cadmium, silver and gold or on unplated but reasonably clean copper, brass, or zinc. Electro tin-plated metals frequently show such a poor deposit of tin and the resultant heavy accumulation of sulphates and oxides that this treatment, unless properly executed, is of questionable relief. Hot tin dipped contacts will usually be found superior.

In the next article the practical uses of soldering will be described, with complete information as to the best procedure in making soldered joints in radio construction work.

What's New in Radio

(Continued from page 56)

tery economy is an important consideration. However, the 171 type valve provides the best quality of reproduction.

Any of the usual antenna and ground installations is suitable for use with the Bandbox. It will also function admirably with a light-socket antenna, such as the Dubulier Ducon. In localities close to several broadcasting stations, where there is severe interference, an antenna of from 50 to 75 feet in length is best. For more isolated localities the antenna length may be up to 150 feet.

Tuning is accomplished with a single knob, as explained. There are, however, two auxiliary controls in the form of toggle levers on the front of the receiver. Once these auxiliary controls have been adjusted they require no further attention on local or medium distant station reception. In receiving signals from extreme distances they are useful, but even then they are not at all critical in adjustment, and therefore do nothing to complicate the tuning. The only other control is a small knob which regulates volume and provides a smooth control from maximum to inaudibility. There is also a switch knob for turning the receiver "on" and "off."

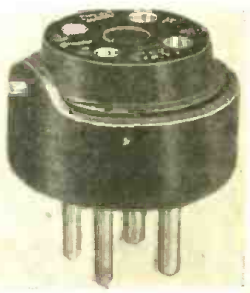
The decorative case which incloses the receiver is all metal and is finished in frosted, crystalline brown. It is attractive in form and finish and is the type of object that lends itself well to any kind of surroundings. The controls on the front of the receiver are all mounted on a burnished bronze escutcheon plate, which has a small opening near the top through which the illuminated tuning drum scale is visible.

For those who prefer console cabinets there are a variety available, including low-boy and high-boy, There is also a cone-type reproducer that is a product of this same manufacturer and is admirably suited for use with this receiver.

Outstanding features: Excellent circuit design and construction. Complete shielding. Small size. Fine appearance. Meets all the requirements of a fine receiver at a low cost.

Maker: Crosley Radio Corp.

TYPE 927UY



TYPE 921S

A New Line of Sockets with Excellent Features

Name of instruments: Na-Ald vacuum valve sockets and adapters.

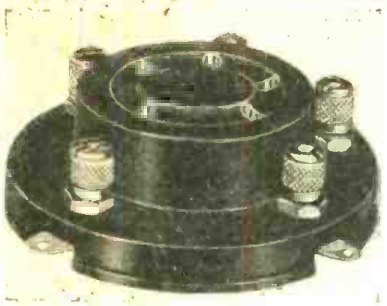
Description: The units comprising this new line of sockets and socket adapters are all of bakelite and will be described individually.

TYPE 927UY: This is an adapter for use in any receiver which is equipped with standard UX-type sockets and in which it is desired to use the new UY-227 five-prong AC valves. The adapter consists of a moulded bakelite block with four standard valve prongs on the bottom and with five holes in the top to take the new five-prong UY-227 valve. It also has two small extension arms and terminals for the AC heater current leads. To use it, the adapter is inserted in the standard valve socket in the receiver and the UY-227 valve is inserted in the adapter. The AC filament supply current leads are then connected to the extension terminals on the side of the adapter. By this simple means a standard receiver is readily converted to AC operation without changing the wiring of the set.

TYPE 921S: A cushion adapter for use with any standard UV- or UX-type valve socket, to prevent microphonic howls. This adapter consists of an outer shell with four standard valve prongs and a bayonet pin. Inside of this, on a cushioned support, is a standard UX-type socket top. The adapter is inserted in any standard UX- or UV-type socket in a receiver and the valve is inserted in the top of the adapter. In addition to making any standard socket one of the vibrationless type, this adapter permits the use of the UX-199 or UX-120 valves in old-type sockets intended for 5-volt valves of the UV type. This adapter will stop howling in the detector of any set.

TYPE 427: This is a standard UY-type socket for mounting on top of a baseboard or sub-panel. It is small in size and sturdy in construction. Terminals take the form of both binding posts and soldering lugs. A decidedly advantageous feature of this socket lies in the grooved top which facilitates insertion of the valve, inasmuch as it is only necessary to allow the valve prongs to rest in the groove and then turn the valve until its prongs drop into their respective holes. This eliminates the annoyance usually attendant in inserting a valve in its socket, especially in the darkened interior of a cabinet receiver.

TYPE 425: This socket is similar to the type 427, except that it is for mounting on a sub-panel where the wiring is to be underneath the sub-panel. It is especially suitable for manufacturers of complete receivers. It requires that a hole slightly larger than the diameter of the body of the socket be drilled in the sub-panel. The socket rests down in this hole, with its terminals projecting through the under side of the panel. The mounting wings rest on the top of the sub-panel and provide the holes for

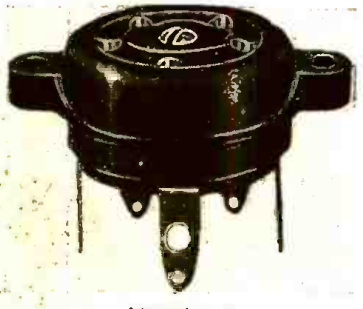


TYPE 427

the mounting screws. This socket also has the grooved top mentioned above.

Outstanding features: Excellent design and construction throughout. Unusual conveniences for the radio fan, whether he be one of the experimentally inclined type or a user of a standard commercial receiver. Especially interesting to the professional radio service man. All of these new sockets and adapters, except 921S, have a new feature, consisting of a guide ring that greatly facilitates easy insertion of the valves into the sockets.

Maker: Alden Mfg. Co.



TYPE 425

Moisture and Heatproof Fixed Condensers

Name of instrument: Molded mica fixed condenser.

Description: These fixed condensers are made up of mica and foil, and are molded into bakelite blocks under heavy pressure. This bakelite covering insures permanent capacity values and affords excellent protection against moisture and against the effects of heat when connections are being soldered to the terminal lugs. Capacities are guaranteed to be permanent and within 10 per cent of the rated values. Terminals are in the form of soldering lugs of convenient size and shape. The capacity value is clearly stamped in the bakelite covering of each condenser. Made in capacities from .00005 mfd. to .02 mfd. They are also made with grid-leak clips in two values, .00015 and .00025 mfd.

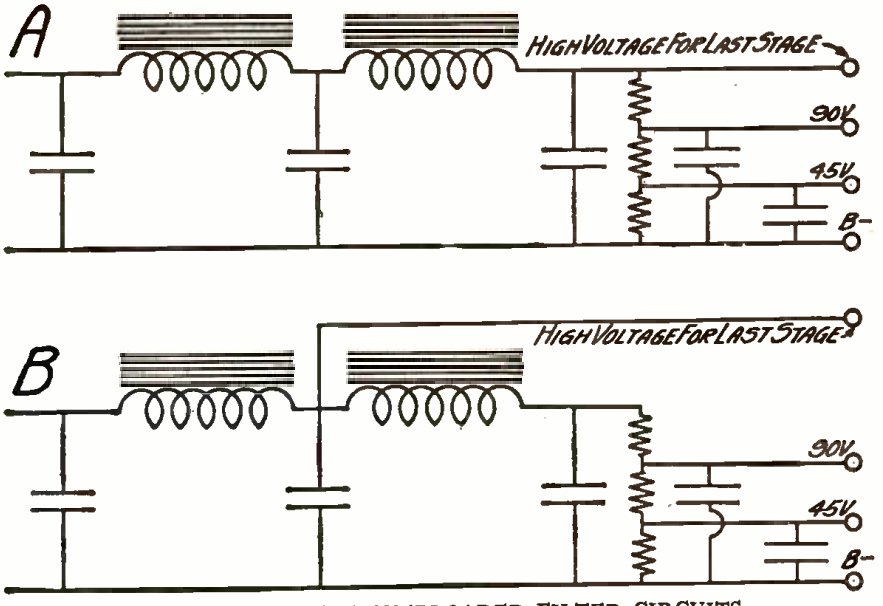
Usage: Wherever capacities of the values mentioned are required.

Outstanding features: Accurately rated. Permanent in capacity values. Moisture and heat proof. Equipped with convenient soldering terminals.

Maker: Carter Radio Co.

Trailing the Elusive Hum

(*Continued from page 52*)



HOW TO RELIEVE OVERLOADED FILTER CIRCUITS

FIGURE 3: *At the top is a standard power-pack circuit with two chokes, filter condensers, and the usual voltage dividing resistances. Under a heavy load, such as occurs when a large power valve is used in the last stage, the inductance of the chokes may decrease so as to let an AC ripple through to the receiver. If the high voltage for the last valve is taken off through only one choke, as shown at B, this source of hum may be eliminated.*

The power transformer, the filter choke and the first-stage transformer *must be kept a suitable distance apart* to eliminate this trouble. A suitable spacing is indicated by the arrows in Figure 1. This distance can only be determined by experiment.

In considering a hum generated by the use of AC valves, the most common trouble is due to the fact that the heavy alternating currents flowing in the filament circuits are liable to induce similar currents in the amplifying circuits.

A remedy for this trouble is to twist all the leads running from the heater transformer to the heaters or filaments of the AC valves. If these leads are twisted, the alternating-current fields of the wires will be neutralized and no current will be generated in adjacent instruments or circuits. A well-done example of this type of wiring is shown in Figure 2.

It is also sometimes found necessary to twist the leads running from the secondary of the transformers to the grid terminal of the vacuum valve socket and to the "C" negative (—) connection, as shown in Figure 4. This also helps eliminate AC pick-up with its accompanying hum.

Some additional precautions that may be of help are the following:

1. Keep the antenna lead-in wires well separated from the house-lighting lines.

2. Don't stand a floor lamp near the amplifier or the receiver.

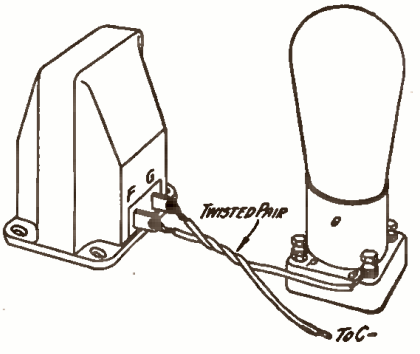
3. Don't run a reproducer extension cord parallel with, or near, lamp cords or other wiring connected with the house-lighting lines.

4. Don't place the reproducer near the house-lighting lines or wires attached thereto.

5. Don't run long battery wires to either the "A" batteries or the "B" batteries down through the floor to the cellar, where they may come near the house-current meter or wiring.

6. Don't place any kind of power-pack too close to the set, either above it, below it or in back of it.

These simple precautions should be of help to the experimenter who is trying to get silent operation out of a modernized receiver and to the set builder who is constructing a set to be operated from the AC lines.



ANOTHER WAY OF KILLING THE VAGRANT HUM

FIGURE 4: *Twisting the leads from the transformer secondary to the grid and "C" negative (—) connections also helps towards eliminating hums.*

Making Radio Pay

(Continued from page 38)

modest supply of testing instruments, I would show my neighbors why their sets would not function properly and would suggest to them things that might be done to improve reception. In many instances, I would rejuvenate their valves free of charge, just to show them that I knew what I was talking about. By persistently following this policy, I had developed within a few weeks' time considerable business, and I found that my effort in establishing faith on the part of the users of radio equipment in my neighborhood was a good investment. I did not rush in and rush out, leaving a job half undone when I knew it was possible to get better results.

After I had accumulated a few dollars in spare cash, I had letterheads and business cards printed, and I would pass the cards out, not promiscuously, but to those people whom I knew would appreciate real, honest service and who had the money to pay for it. After that things came more or less easily, and each satisfied customer that I had worked for turned out to be a powerful influence in the way of advertising my service.

The next step in my growth came when I found myself able to establish credit with two local distributors. Now I have credit arrangements as high as $1,000, which gives me more latitude for work and permits me to finance my work with less difficulty.

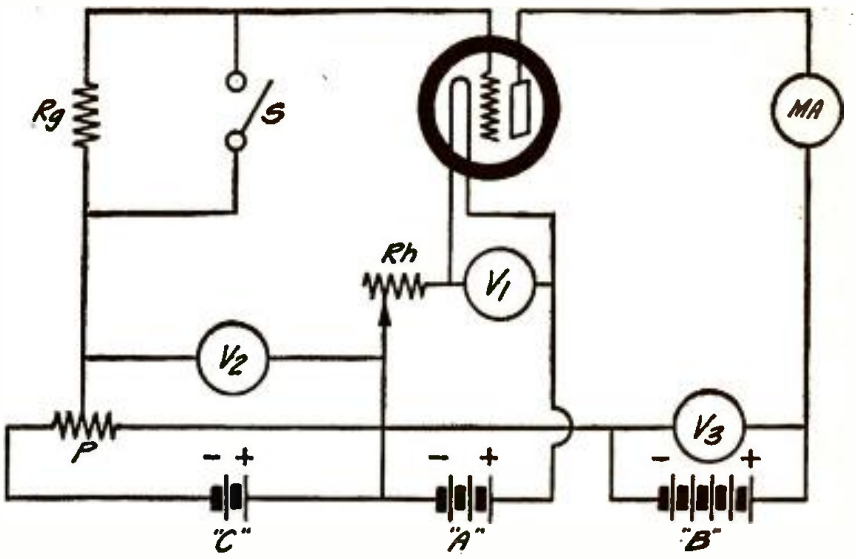
It is rather gratifying to look back and find that I have not as yet lost a single customer. I started with very few and now I have dozens of radio sets that I service regularly, some of them on a monthly payment basis. And the good will that I established has been built up entirely on trustworthiness and expertness.

First I determined that if success, even in a small way, should be mine, every service I did should be done with the same degree of effort as if I were doing it for myself; in other words, I determined at the outset to be an expert, to give expert service and with it expert workmanship, and to leave the satisfied customer to do my advertising. Also, and with emphasis, did I determine to use every customer openly and above board in all dealings. Upon these two qualities I have built my success.

Unfortunately, I do not have a sufficient command of words properly to impress the reader with the pure enjoyment that I have gotten out of my work and my little business. Some day I hope to be the recognized radio dealer in my home town, and if this dream comes true, it will have resulted from my sincere effort to give the people of Methuen, Mass., the best kind of radio reception that their receivers afford.

Measuring Grid Current

(*Continued from page 50*)



THE CIRCUIT USED IN GRID MEASUREMENT

FIGURE 4: *This schematic hook-up of the instruments used in the grid tests shows the simplicity and practicality of the new method.*

with the potentiometer and measuring the coincident plate currents with the grid resistance shorted by the short-circuiting plug S. If a grid resistance is now included in the circuit the plate current characteristic will be changed by the influence of the potential drop across the grid resistance, induced by the grid current flowing; up to the point of grid potential where grid current just begins to flow all the characteristics will be identical, but from that point they will diverge according to the value of the grid resistance in the circuit.

Figure 3 shows a group of characteristics taken in this way. It will be noticed that the higher the grid resistance is, the more does the curve diverge from the original valve characteristic taken with the grid resistance short-circuited. It will also be noticed that the point where grid current begins to flow lies at 1.3 volts negative grid potential with the Telefunken high-mu valve (mu 30).

The amount of grid current flowing can be taken from this group of curves in the following way:

The plate current at .5 negative grid volts and with the grid resistance short-circuited is .75 milliamperes, and this plate current is reached at about two volts positive grid potential, when a grid resistance of 26.9 megohms is in the circuit. Then the grid potential difference of 2.5 volts is divided by the grid resistance of 26.9 megohms to define the grid current flowing at .5 volts negative grid potential.

Figure 2 shows the characteristics of a special high-mu valve with a certain residue of gas.

It will be noticed that the characteristic taken with the grid resistance in the circuit rises above the one taken with the grid resistance short-circuited, crosses the other at about 2 volts negative grid potential and then rapidly diverges to the right, showing much lower plate currents than the other. This rise, crossing and fall in the plate current indicates that up to 2 volts negative grid potential the grid current was negative, due to gas ions. At 2 volts negative grid potential the grid current was zero and from then on the grid current became positive due to the electron stream reaching the grid from the filament. Thus not only the amount of grid current but also its direction may be determined at a glance from the plate current characteristics taken by this new method.

Figure 1 shows a grid-current curve taken on the same valve by this same method.

It will be seen that (as was already to be expected from Figure 3) the grid current is negative and ionic up to 1.9 negative grid potential, where it becomes zero. At more positive grid potentials the positive and electronic grid current rises rapidly. Naturally, as becomes apparent from Figures 2 and 1, this method is also well suited for determining the vacuum factor of a valve.

From the curve given in Figure 4 the vacuum factor of that valve was determined as

$$-\frac{Vg}{Va} = 8.5 \times 10^{-6}$$

It can be seen that the method of measuring grid currents outlined above possesses many advantages, especially for the experimenter who does not have at his disposal the delicate instruments necessary for direct measurement. The accuracy of the method, however, is sufficiently great for all the ordinary needs of experimentation.

The Harkness Counterfonic Six

(Continued from page 25)

red lines. The high-frequency choke coil, G, should be hooked up as shown in the picture wiring diagram.

When all of the wiring has been completed, the grid-leak, S, should be inserted in its mounting, T, and the receiver is ready for installation.

Installing the Counterfonic Six

The receiver is now complete and should be inserted in its cabinet or console, according to the builder's taste. A 6-volt storage battery should then be connected to the binding post marked "A" battery positive (+) and the binding post marked "A" battery negative (—). These are indicated in Figure 5 as V3 and V4.

The vacuum valves recommended for this receiver are the new Televocal valves. Place three TC-201-a valves in sockets Y1, Y2, Y3 and Y5. Place a TC-240 type valve in socket Y4 and a TC-171-a type in socket Y6.

When this has been done, turn the filament switch, M2, to the "on" position by flipping it "up." All the vacuum valves should now light as the rheostat, M, is rotated in a clockwise direction.

Next disconnect the storage battery and turn the filament switch to the "off" position, then reconnect the storage battery between binding posts V3 and V6 and again turn "on" the filament switch. If the wiring has been correctly done, the filaments should *not* light. Then connect it again to the storage battery between terminals V3 and V7. The valves should *not* light here. Again disconnect the battery and connect it between V3 and V8. The vacuum valves should *not* light in this position when the switch is turned "on." This is a check to show that the "B" battery lines are not short-circuited with the "A" battery lines.

Next connect the 6-volt storage battery exactly as shown in Figure 5 and connect up the "B" batteries and the "C" batteries, as indicated in this diagram.

It is recommended, with this receiver, that an Electrad light-socket antenna be connected to the antenna binding post, B1, and that the ground, consisting of a wire leading to the radiator or the cold water pipe, be connected to terminal V2. With the large amplification obtained in this receiver, adequate reception may be accomplished without any outside antenna, although an outside antenna may be used if desired.

The reproducer should be connected, as shown in Figure 5, to the two binding posts at the right end of the set, looking from the front. The new Utah type reproducer has been found

to work very satisfactorily with this set.

The set is now ready for use and the tuning operation is easy. Simply rotate the drum dial from one end of the scale to the other and the various stations will appear at their settings. Volume should be controlled by the lower knob operating the rheostat, M, in Figure 3.

The screws on the neutralizing condensers, U1 and U2, should next be adjusted for neutralization, and each may be set with a screwdriver at the position where no oscillation is encountered when turning the tuning dial from one station to another. These two adjustments will have to be set by experiment, but the neutralization is so simple that the proper settings may be found by even a novice within ten minutes' time.

The antenna switch, N1, may be tried in either the "up" position or the "down" position, according to the selectivity required. One position will be found to be broader in tuning and also louder and this switch should be used to suit convenience according to the location.

When the receiver has been in use for only a short period, the proper setting of the rheostat, M, will be found for the various stations, giving a reproduction that is truly lifelike in every particular.

I have one of these receivers at home installed in my study, and I get results that sometimes almost lead me to believe that I am in the broadcasting studio instead of by my own fireside. This new receiver, in my opinion, is by far the best that I have so far developed, and it should give many set builders and broadcast listeners satisfactory service and many thrills while listening to good programs.

A Resistance-Coupled Amplifier for the LC-28

(*Continued from page 30*)

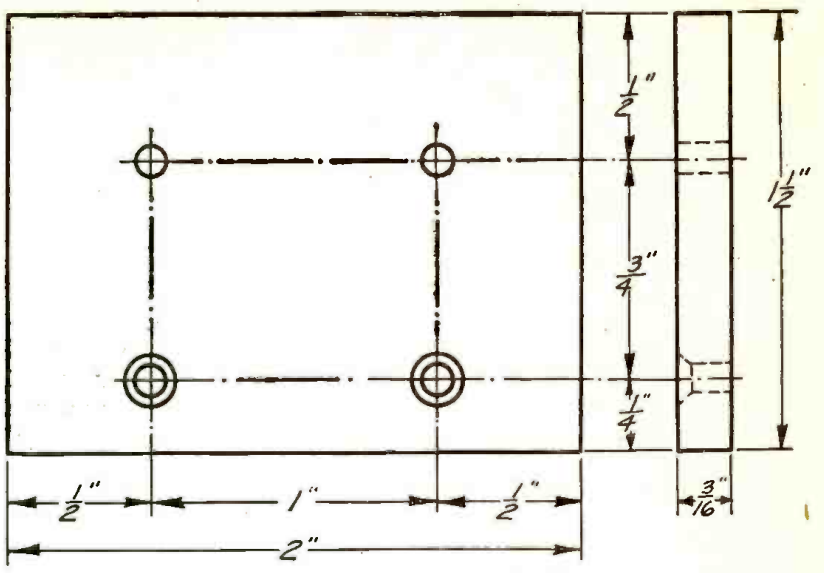
Prospective users of this device, in connection with the LC-28, will find that it gives more than sufficient volume with better tone quality and with more economical operation than are obtainable with any previous resistance-coupled amplifiers.

The complete installation is so easily done and the finished job has such a neat and businesslike appearance that it cannot fail to come into very popular usage among those who want the best in quality amplification.

The power-pack amplifier, of course, may be used with any other high-frequency pack or with an already constructed set or manufactured receiver to improve tone quality and to bring such receivers up to the standards of the best 1928 reception.

Power and Quality From the DC Lines

(Continued from page 42)



HOW TO DRILL THE PANELS

FIGURE 4: *The two small panels for the binding posts, I1 and I2, and I3 and I4, should be cut and drilled according to the above layout.*

cut the binding-post panels out of 3/16-inch Formica and drill according to the data given in Figure 4. Assemble the binding posts on the panels.

Refer to Figure 2 and the picture wiring diagram in Figure 3 when mounting the apparatus. Screw down the two sockets, D and E, with the plate and grid terminals towards the top of the baseboard, assuming the input of the unit to be at the left.

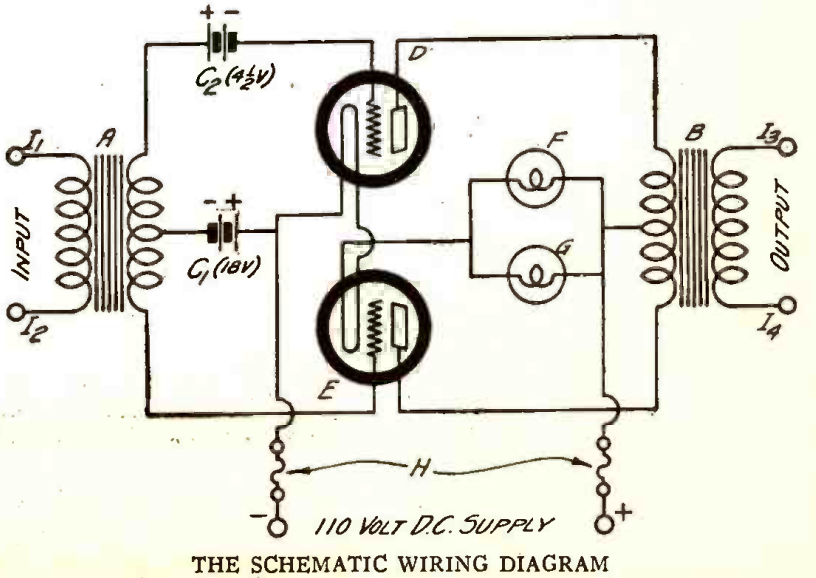
Place the push-pull input transformer, A, with the two terminals at the left and the three at the right and secure it to the base. Place the push-pull output transformer, B, with the three terminals at the left and the two terminals at the right and fasten it to the base.

Secure the fuse block, H, at the left of the base. Fasten the two porcelain receptacles, F and G, at the right of the base with their terminals at the lower left- and upper right-hand corners.

Using screws driven into the edge of the baseboard, mount the binding-post panels, J and K, so that the binding posts are centered with respect to the input terminals of transformer A and the output terminals of transformer B.

Wire up the amplifier exactly as shown in the picture wiring diagram in Figure 3. Place the "C" batteries in position and connect them in the circuit. From 16½ to 18 volts will be the proper "C" bias for C1 and 4½ volts for C2.

Connect to the fuse block a sufficient length of two conductor wire to reach



THE SCHEMATIC WIRING DIAGRAM

FIGURE 5: *The push-pull arrangement shown here uses two Mazda bulbs, F and G, for resistances in the filament circuit. Ordinary resistances could be used instead.*

the nearest lamp socket and put an attachment plug on the end of this wire.

How to Operate the Amplifier

Insert two CX-371-a type valves in sockets D and E. Place 15-watt, 120-volt Mazda lights in the receptacles F and G. Screw two 5-ampere fuses in the fuse block, H. A single Ward Leonard resistance (Cat. No. EB440) can be used in socket F if the light from the electric bulbs is found to be disagreeable.

At this point it might be well to mention that two 371 type valves can be used in this amplifier, and a single 60-watt, 120-volt Mazda light, or a Ward Leonard resistance (Cat. No. EB220) used in socket F.

Connect the input terminals, I1 and I2, of the amplifier to a cord with a plug and insert the plug in the radio set after the first low-frequency stage. If the radio set does not have a jack after the first stage, it will be necessary to disconnect the wires running to the plate and "B" positive (+) terminals of the last transformer and bring a lead from each of these wires out of the radio set to the corresponding plate and "B" positive (+) input terminals of the push-pull amplifier.

Connect the Amplion reproducer to the output terminals, I3 and I4, of the amplifier. Turn "on" the radio set with the battery switch. Insert the attachment plug in the 120-volt DC light socket, reversing this plug for the correct polarity, if necessary.

The amplifier should now operate continuously and should give an excellent quality of reproduction at suitable volume for home reception.

The 1928 Browning-Drake

(*Continued from page 18*)

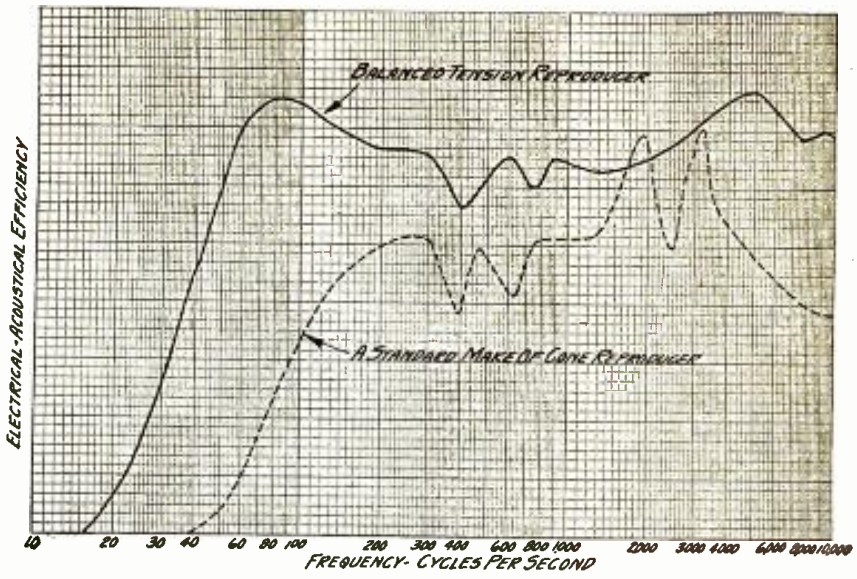
touching the finger to the stator plates of the second tuning condenser (the one to the right as one faces the set). The tickler coil should then be set back so that this circuit just goes out of oscillation. Adjusting the trimmer condenser will, if the set is not neutralized, throw this circuit into oscillation, which may be determined as mentioned above. Set the neutralizing condenser so that turning the trimmer condenser has no affect on the oscillation produced in the second circuit. The set is then completely neutralized.

The unit is designed especially to be used in connection with low-frequency amplifiers described in POPULAR RADIO magazine.

On pages 20-22 in this issue will be found the constructional details for a push-pull amplifier using two 210 type vacuum valves and a 227 type AC valve. This amplifier attaches readily to the two-valve tuner. The article on this unit incorporates complete operating details for the combination.

A New Discovery in Loudspeakers

(Continued from page 35)



THE AIRCHROME GETS THE LOW NOTES

FIGURE 2: *The solid black curve shows the electrical-acoustical efficiency of the Airchrome speaker over the audible frequency range. A comparison of it with the dotted curve of an ordinary cone speaker shows the superiority of the Airchrome, especially on the frequencies below 100—the low note of reproduction.*

proper tightness to be tuned to approximately 60 cycles, and the small stretched skin has a resonance at approximately 5,000 cycles.

Concentric waves are set up in the skins as the reproducer unit moves the combined apexes forward or backward, and the amplitude of this motion varies the tension in opposite directions for each of the skins, thus causing the resonant effect to slide along in both directions through the frequency scale. This action produces the reproduction curve shown in Figure 2. It will be noticed that the new loudspeaker covers the range over a wider area than other existing types of cone units.

In construction, the large skin is mounted upon a heavy square frame of well-seasoned wood, mortised at each corner so that it will not vibrate. The skin is then stretched tight by fastening it along each of the four edges. Two cross-pieces of heavy timber are then mounted between two of the opposite sides. These cross-pieces are held rigidly on the back of the large frame, and serve as two sides for holding the small skin. The two other sides of the small skin are mortised into these two cross-pieces. The small skin is then stretched tightly on the small square frame, and the two skins are drawn together at the center by the hollow fitting that serves to carry the compression lock nut. The lock nut fastens to the pin of the electro-dynamic unit that is used to operate the reproducer.

The unit itself is mounted on a rigid metallic frame that is, in turn, fastened securely to the two main cross-pieces that hold the small skin.

A front and back view of the two streched skins, with the reproducer unit mounted in place, is shown in Figure 1.

The unit that is used to operate the reproducer is of the balanced-armature type. It consists of a large, permanent magnet of high-quality steel mounted in a die-cast frame. The die-cast frame also holds the pole pieces and the windings through which the voice or music currents from the radio set are to pass. These currents set up a varying field that causes the balanced-armature to change its position and thus pull the pin in one direction or the other. The pin, in turn, actuates the two skins.

In external appearance the loudspeaker is dressed up to look like a small table with a decorated tapestry effect on the front and sides.

The reproduction afforded by this device, when used with the more modern amplifiers employing push-pull amplification with power valves, is truly a revelation. The new balanced-tension reproducer will handle more volume without distortion than any other type of loudspeaker now commercially available, and do it with a naturalness of tone in both the upper and lower ranges that is remarkable. The low tones of the drums are reproduced, if wanted, with the same full, robust and floor-shaking quality as if the listener were seated in the first row of the orchestra, while the high notes of musical instruments and the consonants of speech come through with startling definition and quality.

Engineers and experts who have heard and measured the new device have predicted a wide popularity for it.

The AmerTran Amplifier

(*Continued from page 22*)

posts. Then a twisted pair of standard No. 14 lamp cord leads should be connected from the two wires running to binding posts U5 and U6 directly over to the two filament terminals on the 5-prong socket, N. A twisted pair must be used here in order to eliminate any stray AC field that might otherwise be generated by the AC current flowing to the filament (heater) of the AC valve that is to be used in socket N.

All the rest of the wiring, except one short lead, may be done, as stated before, with Braidite and should follow the connection scheme given in detail in the picture wiring diagram in Figure 2. The wire leading from the binding post, U3, to the movable arm of the potentiometer, T, is the exception and should be made with flexible stranded rubber-covered wire. The 750-volt tap on the transformer, A, is not used and should be taped up.

In the picture wiring diagram all of the instruments and parts are outlined in black lines and the wiring is shown in solid red lines, except where it passes underneath an instrument, and here it is indicated by dotted red lines. All of the leads should be separated a short distance so that actual contact between two crossing wires is eliminated. A suitable length of twisted lamp cord should be connected to the terminal marked "O" and the terminal marked "120" on the primary side of the transformer, A. All the other primary leads should be taped up. A lighting plug should be attached to the other ends of the lamp cord for plugging the amplifier into the lighting lines.

When the wiring has been completed, each lead should be rechecked throughout all of the wiring for mistakes, so that the builder makes sure that it is correct before the amplifier is placed in operation. When this has been done, the unit is ready for installation.

Installing the Unit with the 1928 Browning-Drake

First of all, place the Browning-Drake receiver in the cabinet or console chosen for it, and install the push-pull power-pack amplifier underneath, in the radio compartment. Then make the connections between the power-pack and the Browning-Drake high-frequency pack, as indicated in the combination diagram in Figure 1. It will be noticed, in this diagram, that one binding post on the Browning-Drake unit is left unused. The two sets of twisted leads from the Browning-Drake set are connected to the binding post on the power-pack amplifier as indicated.

The ground wire is also put on, as well as a socket antenna unit; that shown in Figure 1 is a Tidmarsh "Sock-Antenna." Of course, an ordinary outdoor antenna may be used here if desired.

A Belden extension cord is connected to the output binding posts, U9 and U10, on the power-pack amplifier. This is connected over to the Air-Chrome reproducer, which should be placed, for best results, on the other side of the room.

There are no batteries whatsoever required for this hook-up.

Place two CX-327 type valves in the two sockets in the Browning-Drake high-frequency pack. Then place another CX-327 type valve in socket N of the power-pack amplifier. Place two CX-310 type valves in sockets O2 and O3 of the amplifier, and finally place a CX-381 type rectifier valve in socket O1 of the amplifier.

The complete installation is now ready for operation. Turn the main knob of the potentiometer, W, in the half-way position and turn the main knob of the potentiometer, T, three-quarters of the way in a clockwise direction, and turn the extension arm of the potentiometer, T, to about the half-way position. This is the arm that controls the "C" bias for the high-frequency valves in the set. These are approximately the correct settings for these instruments, when used with the valves that have been recommended in the above hook-up.

Next place the extension lamp cord and plug that has been connected to the primary of the transformer, A, in a nearby lamp socket and turn "on" the switch. The valves should then begin to heat up and after a period of about 15 or 20 seconds the set is ready for use and the tuning may proceed in a normal manner, with the main dial of the Browning-Drake receiver tuning the wavelength and the small left-hand dial being used for vernier setting, while the upper right-hand small dial is used for sensitivity and the lower left-hand small dial is used to control the volume of reproduction.

The complete installation should give exceptionally fine results for broadcast reception. On account of the elimination of all batteries, and the total operation from the lighting lines, it should also be of great interest to all radio set builders.

The complete unit when used with the recommended reproducer will furnish a quality and volume of reception that is truly astounding in its naturalness. Any volume may be obtained from the whisper of a violin to the swell of a great organ without the slightest sign of distortion. Future articles will tell how to use the power-pack as an amplifier with the LC-28, with other sets, and also for quality reproduction from phonograph records.

The Victoreen "Super"

(*Continued from page 41*)

down to the baseboard, V, by two small wood screws. The audio control unit, G, is also fastened down with two long wood screws of suitable length to grip firmly into the baseboard, V.

The antenna connection block, X, is first cut out of ⅛-inch micarta to a size of 3 inches by ⅝ inch, and is drilled with six equal-spaced holes for mounting the four jacks, S1, S2, S3 and S4, and the two mounting lugs. These consist of brass tubing 1 inch in length, through which are screwed two long brass wood screws directly into the wooden base.

The decorative wood panel, U, is already cut and prepared and on it the various instruments are mounted. The drum dial, T, is fastened on it according to the instruction sheet packed with the dial. The rheostat and potentiometer, L and K, are mounted as indicated in Figure 2. The antenna change-over switch, H, and the pilot light, W, are also mounted as indicated in this diagram.

The two condensers, E and F, require for mounting two pieces of micarta, X2 and X3, cut to sizes of 3½ by 1¾ inches. Each condenser is mounted by screwing two flat-head screws to the micarta pieces and into the two bottom holes in the frame of the condenser. The bottom side of the micarta panels must be countersunk so that the heads of the screws will set flush. Then the two condensers, E and F, are placed in about the positions shown in Figure 2, with the shafts inserted into the coupling units on the dial, T. The screws of the coupling units are tightened, the two condensers lined up, and the micarta bases, X2 and X3, then fastened by means of two screws, each in the correct position so that the dials turn freely. The construction work on the set is then complete, except for mounting the condenser, Q; the condenser, M2; the grid-leak, O2; the condenser, N1, and the grid-leak, O1, which are supported by the wiring and are fastened at the time the wiring is done.

How the Receiver Is Wired

All of the wiring in this set is done with regular bus bar, except where there is a possibility of short-circuit; standard solid celatsite is used in these places. The wiring of the set is done exactly as shown in the picture wiring diagram in Figure 2. In order to keep the filament wiring from short-circuiting, soldering lugs are placed under the positive (+) terminals of all the sockets, and each lug is turned at right angles so that a single length of bus bar is passed through the soldering lugs, making connection for all eight sockets. All of the wiring to the Yaxley cable

plug is done with celatsite. Care must be exercised in wiring the audio control unit, so that possible short-circuits will be avoided.

Installing the Victoreen Superheterodyne

The set itself is placed in a Corbett type C chest and connected up with the loop antenna, as shown in Figure 4. The two loop wires are connected to the terminals, S1 and S2, on the antenna connection strip, X1.

An Electrad socket antenna may be used and connected to terminal S3, with the ground wire connected to the water pipe or radiator on terminal S4. A socket antenna works extremely well with this receiver, although a regular outdoor antenna may be used, if desired.

The loudspeaker that was used in the laboratory was a Temple exponential type reproducer and its tip jacks are connected to terminals S5 and S6.

Three standard 45-volt "B" batteries are connected to the Yaxley cable leads, as shown in Figure 4, as well as three 4½-volt "C" batteries, one of which should have the 3-volt tap.

Place six CX-301-a type valves in the first six sockets and two CX-312 type valves in the last two sockets in the set.

For the "A" power, the most satisfactory solution for this receiver, using eight vacuum valves, is to use an "A" power-pack to do away with battery charging. One that has shown exceptional qualities for this high current drain, without the slightest sign of hum, is the new Knapp "A" power-pack, which may be obtained in kit form and which is described in detail in another article in this same issue. This unit is shown connected up in Figure 4. When the set is installed, exactly as shown in the instructions in this diagram, it gives very fine results from a tone quality basis, as well as being capable of bringing in distant programs with clarity and volume.

All of the tuning is done with the two middle drums on the illuminated dial, while the knob at the right is used for sensitivity, and the small dial at the left is used for turning the set "on" and "off." The pilot light, also at the right, indicates this condition at a glance. In using the set the Vee-coil antenna should be rotated to bring in the station desired with loudest volume. This, in itself, is a great help in eliminating interference from two stations on adjacent wavelengths, the signals of which come from two different directions.

The set has been working for the author for the last three months in a most congested metropolitan area without once giving the least bit of trouble from interference.

LISTENING IN

PRACTICAL *pointers from experimenters and broadcast listeners. What helpful hints can* YOU *offer to your fellow fan? Readers are invited to address their letters to the Editor of this Department.*

CONDUCTED BY DAVID LAY

Old Automobile Batteries May Be Used With the Radio Receiver

AUTOMOBILE storage batteries are usually made with heavier construction than those designed for radio work. The automobile battery receives severe usage and is usually discarded when it fails to turn the starter over snappily. The discarded battery will often be found to be suitable for the radio set, since radio service is less exhausting.

Most cars use a 6-volt battery—the same voltage that is used on radio sets. The storage battery voltage can be determined by counting the vent gaps—one to a cell. Each cell yields 2 volts, and they are connected in series to add up to 6 volts. The Dodge and a few other makes have a 12-volt battery (6 cells); to use one of them on a radio, you would have to make a tap at the center and use half at a time.

Be sure about the polarity, if you haven't a voltmeter to tell it to you. The positive is always the dirtiest terminal. Mark the polarity by scratching plus and minus signs on the wax coating.

Clean the battery thoroughly—a good wash with soap and water and scrubbing brush outdoors will do the job. To make contact with the terminals it is advisable to use regular battery clips.

You won't be able to charge the old automobile battery fully, but you will get a year or more of service out of it.

—LAURENT L. JACQUES, *Toutes Aides, Manitoba*

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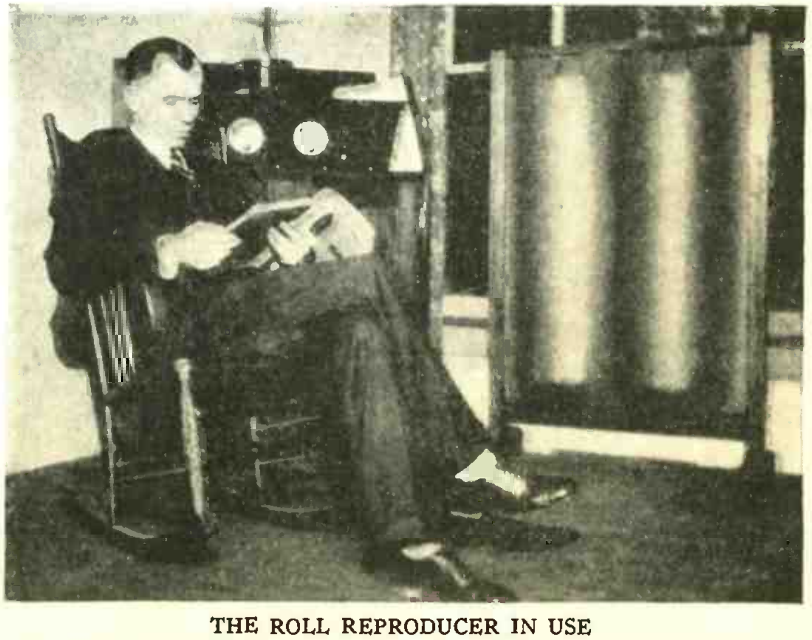
How I Built a Roll-Type Reproducer

HAVING tried most of the various types of speakers, I decided that there was a possibility of building one myself that would suit me better.

I chose the roll type, as it would lend



THE ROLL REPRODUCER IN USE

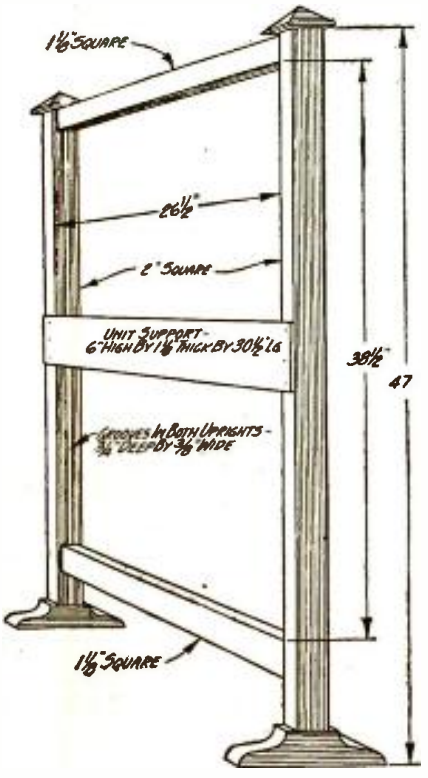
With a tasteful finish on the paper rolls and the wooden frame, this reproducer may be made into an interesting addition to the furniture of the radio room or library.

THE ROLL REPRODUCER READY FOR MOUNTING

FIGURE 1: *The two strips leaning on the frame are to be pressed into the grooves to keep the edges of the roll in position.*

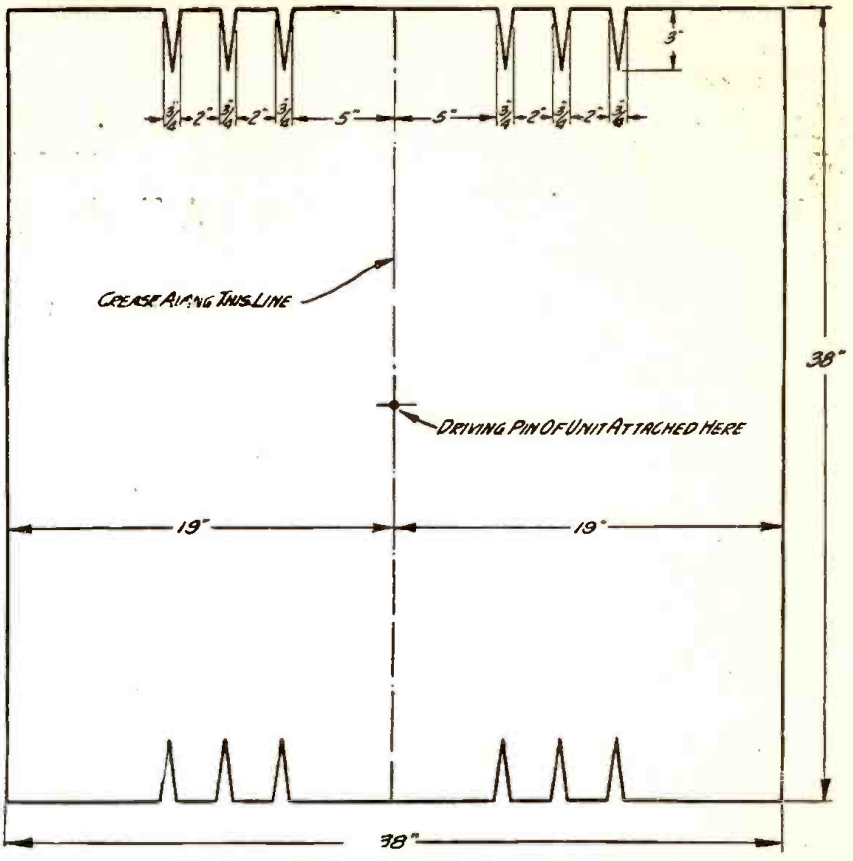
itself more to my room than other types. But after building one of the conventional weight and shape, I found that if it were hung on the wall it would beat a tattoo and if allowed to lean against the wall and rest on the floor, it would dance a jig. So I decided to build one according to my own ideas.

I found that a light framework would not do, as the roll was so large as to



THE FRAME FOR THE ROLL

FIGURE 2: *The heavy construction is necessary to prevent vibration.*



THE DIMENSIONS OF THE PAPER ROLL

FIGURE 3: *The roll should be cut along the solid lines around the edge and creased along the broken vertical line in the center.*

cause the frame to vibrate; and if the frame were not attached rigidly to some object large enough to hold it, it would make a noise due to the vibration of the frame against the object with which it was in contact. I also found that it was impossible to tack the edges of the roll to the frame and not have the edge vibrate against it.

The framework was made heavy, especially the base and upright part, as was also the cross-piece that supports the driving device. A glance at the framework shown in Figure 2 seems to show it as rather cumbersome, but it is none too heavy for good operation. In fact, if it were heavier it might be better. The two vertical sections of the frame are 2 inches square. The top and bottom cross-section are 1⅛ inches square, while the unit support cross-section is 6 inches by 1⅛ inches dimensions. The base pieces and the two top corner caps, while not so easily made, add much to the appearance of the speaker. All joints are mortised and glued. The upright pieces are grooved to receive the edges of the roll. The groove is ¼ inch deep and ⅜ inch wide. Two strips are made the exact size of the grooves, beveled so that when viewed from the end they will look like keystones; they are pressed in behind the rolls. Figure 1 shows the strips leaning on the frame. The base pieces are fourteen inches long. They were carved from stock a little heavier than two inches.

The roll is made from one piece of Alhambra Fon-o-Tex, 38 inches square. The roll is cut out according to the dimensions shown in Figure 3, and creased along the center. This is done by drawing a line through the center with a fingernail file, lengthwise with the way that it comes off the

THE DRIVING MECHANISM

FIGURE 4: *The heavy board supporting the reproducer prevents the framework from vibrating with the reproducer.*

roll. It is now folded and the crease is pressed with a cold iron. Midway along this crease the operating device is attached, as shown in Figures 1 and 4. I used a Western Electric unit. After the frame has been completed and the roll thus far made it is placed in the frame and six triangular sections taken out of each end; the edges are then brought together and glued. The pieces which are cut out are ¾ inch by 2 or 3 inches. The armature is now attached, and you have a speaker that is inferior to none.

—B. G. TILLEY, *Matoaka, W. Va.*

* *

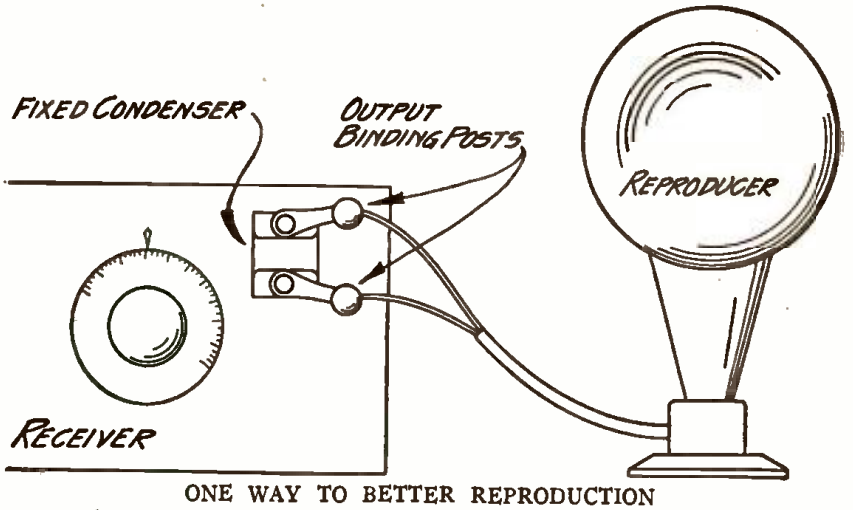
A Handy Test Meter for the Trouble Man

BURNED-OUT low-frequency transformers are one of the most common causes of receiving sets going "dead"; so this description of an instrument to test them should be of interest to the trouble man. In locating trouble in a receiving set that will not work, the proper procedure is to test the "A," "B" and "C" batteries; see that the aerial and ground are properly connected to the set; then test the valves, if a valve tester is available. If all of these things are all right, the trouble must be in a broken or burned-out connection.

An instrument that is of the greatest aid to the service, or "trouble," man, and to the set owner himself, is a pocket combination ammeter and voltmeter, which retails for about $2.50. This meter has two ranges: zero to 35 amperes and zero to 50 volts. It has three terminals: one terminal for one ammeter connection, one for one voltmeter connection, and a third terminal that is common to both ranges. Although this instrument is not very accurate, it is good enough to use for checking batteries. It can also be used to test for open circuits, and for burned-out transformers and loudspeakers, by connecting the voltmeter range of the meter in series with a "B" battery. To do this, one terminal of a 45-volt "B" battery should be connected to one terminal of the voltmeter, and test leads attached to the other terminal of the "B" battery and the other voltmeter terminal. The polarity of the "B" battery must be right for the voltmeter. If the two test lead terminals are touched together, the voltmeter should read 45 volts. To test a transformer, these two test leads should be connected to the ends of each of the transformer windings in turn; and if either winding will not allow the voltmeter to read, it is burned out.

The voltmeter will not read 45 volts when connected through a transformer winding—uhless the winding is short-circuited—but some value determined by the transformer's resistance.

—CHARLES C. FELSTEAD.
Los Angeles, Cal.



ONE WAY TO BETTER REPRODUCTION

FIGURE 5: *A small fixed condenser connected across the output binding posts brings out the low notes with great clarity.*

How to Improve the Operation of Loudspeakers

MANY types of loudspeakers and amplifying transformers give much better reproduction when small fixed condensers are connected across their terminals. With low-frequency amplifying transformers, the condenser is usually connected across the secondary winding; with a loudspeaker it is connected across the output jack in the receiving set, as shown in Figure 5. The clarity and tone of most of the older types of reproducers may be considerably improved by connecting .004 microfarad fixed receiving condensers across the speaker terminals. The addition of the condenser to the receiving set makes the music slightly weaker, but the improvement in quality more than compensates for the slight loss in volume.

—CHARLES F. FELSTEAD, 6CU, *Los Angeles, California*

* *

Packing Radio Sets for Shipment

IT is rather difficult to pack radio receiving or transmitting sets for shipment by express or parcel post in such a manner that they will not be damaged in transit. It is particularly difficult to ship a set that is not in a cabinet, as it is hard to support and protect the panel in order to keep it from getting broken. If perfect protection is desired, the set must be packed so tightly that there will be no danger of it jarring around inside of the packing box and becoming damaged. But if the set is packed too tightly in the box, there is always the chance that it will be crushed by the very tightness of the packing. If the set is to be shipped in its cabinet, it can be packed in a wooden box that fits closely around the cabinet on all sides except the front, where the panel is located. Layers of cloth or paper can be put between the shipping box and the sides of the cabinet to keep the latter from getting scratched. Several small blocks of wood may be fastened to the sides of the packing case on the inside to keep the set from sliding about.

If the set has no cabinet, or is being sent merely for testing, and the inclusion of the cabinet would be an added and unnecessary shipping expense, the packing problem is more difficult. In such a case a wooden box of slightly greater dimensions than the set should be made. The bottom of the box should be of ¾-inch or 1-inch stock. The set is placed inside of the packing box in such a position that it does not touch the sides, and several large wood screws run through the baseboard of the set into the heavy bottom of the box. Since there is space all around the set, there is no chance of it striking the sides of the box and being damaged, and thus perfect protection is provided for the panel. It is well to provide extra support for the panel in the form of wood blocks or cleats screwed to panel and baseboard.

For additional security, excelsior can be packed between the set and the walls of the packing box on all sides. In order to keep the excelsior from getting inside of the set, several layers of papers should be spread over the set before the excelsior is put into the box. If excelsior is not available, wadded newspapers may be used for the packing around the set. The tubes should be removed from the sockets before the set is packed. If they are to be shipped with the set, the best way to pack them is to replace them in their original cardboard cartons and put them in the excelsior that is packed on top of the set. Any small extra pieces of apparatus may be packed by fastening them to the inside of the back or top of the box.

The top of the box should be fastened on with wood screws, so that it can be removed easily and replaced if the set is returned in the same box. The box should be marked plainly with crayola, heavy pencil, or paint. It is best to write THIS SIDE UP on the top of the

box. The address of the party to whom the set is sent and the address of the sender must be plainly marked on the box in several places, taking care that TO and FROM are written before the address and return address respectively. It is better that printing be used for the addresses. As an additional precaution, HANDLE WITH CARE and RADIO EQUIPMENT—FRAGILE should be conspicuously printed on the box. It is also wise to insure the set; for no matter how carefully the set is packed, there is always the chance that it may be damaged or lost in shipment.

—CHARLES F. FELSTEAD, 6-CU, *Los Angeles, Cal.*

* *

"Keep Your Condensers Clean"

MUCH radio trouble can be traced to particles of dust getting between the condenser plates. The moral is—keep your condensers *clean*. A pipe cleaner is a very handy article for cleaning between the plates, as it is unnecessary to take the condenser apart.

—L. C. FERGUSON, *Ontario, California*

* *

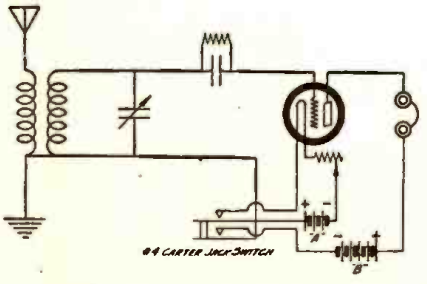
A Simple Battery Switch

A NEAT and simple switch for disconnecting the batteries in a receiving set is shown in Figure 6.

The switch that I used was a four-spring Carter jack-switch. An "on" and "off" indicator comes with this jack-switch, so a glance will tell whether the set is on or off.

As an added precaution, a small, six-volt, flashlight bulb may be connected across the filament to be operated by the switch. The bulb may be set flush with the panel in front and painted red so it will be more conspicuous. With a signal like this, there is hardly a chance of the set being left turned on at night. The use of a four-spring jack-switch is advantageous for it disconnects both the "A" and "B" batteries and there is no chance of a short-circuit ruining the batteries when the set is not in use.

—CHARLES F. FELSTEAD (6CU), *Los Angeles, Cal.*

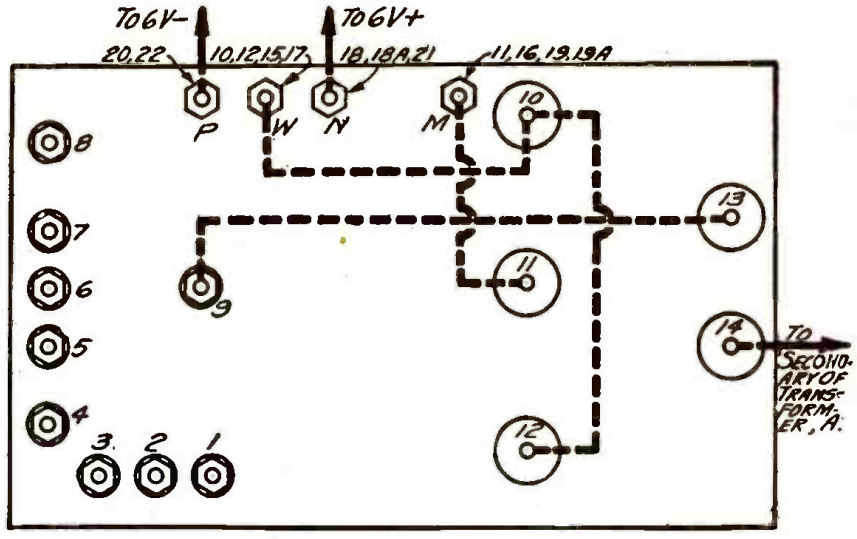


THE SWITCH CONNECTIONS

FIGURE 6: *The switch to disconnect both "A" and "B" batteries should be inserted in the circuit as shown here; the lamp should be placed across the filament circuit.*

"A" Power—Dry and Silent

(Continued from page 36)



THE WIRING OF THE TOP PANEL

FIGURE 4: *The various terminal and studs on the top panel are referred to in the text by the numbers in this diagram. The dotted lines indicate wires that run under the panel; these must be completed before the panel is mounted.*

At this point it would be well to start the screws, but not tighten them all the way down.

The builder is now ready to mount the input and output receptacle mounting. In this particular item two receptacles, one for the input of the transformer and another for the output of the rectifier, are mounted on a single metal bracket, together with a toggle switch, which is used to break the primary current of the transformer. The toggle switch, unlike the receptacle, is not supplied in place and must be attached to the plate, using the knurled lock rings supplied for this purpose. One of the switch leads is connected to the receptacle prong, B, and the other lead to the switch is connected to the input or primary side of the transformer. The other receptacle prong, Q, is connected to the other side of the transformer primary. After this operation, the switch and receptacle plate may be screwed into place with the 6/32 screws and washers intended for this purpose.

At this point the builder should mount all of the apparatus on the wooden baseboard. This should be done so that the steel base-plate carrying the transformer and choke is ⅜ inch from the end of the wooden board. This permits the receptacle prongs to protrude the correct distance, when the metal shield is finally put in place after the assembly work has been completed. Directly back of the transformer and choke are mounted two special dry condensers. Metal straps are provided for these, so that the condensers can be held to the baseboard with wood screws. The relative positions of all these parts is very clearly shown in Figure 3. The condensers, incidentally, are lettered C1 and C2 in Figure 3 and one is shown on top of the other.

When the work of mounting is completed, there is nothing left to do but to make the necessary connections, which are unusually few in number. That these connections may be made quickly and conveniently, the table below should be referred to. It shows the necessary lengths of wire used between the various points.

Lead	*Sleeve*
Lead from 11 to M— 3¾ ins.	2½ ins.
10 to W— 4 ins.	2¾ ins.
10 to 12— 5 ins.	3¾ ins.
9 to 13— 6¾ ins.	5½ ins.
P to 22—11⅝ ins.	10¾ ins.
N to 21—10¼ ins.	9⅛ ins.
14 to start of secondary, 9¼ ins. rubber-covered wire, with terminal on 14 end.	

Tap No. 8 (Figures 3 and 4) of the transformer, A, is shown connected to a small resistance, T. This resistance is supplied with a pig tail and connecting sleeve which can be instantly slipped over any one of the transformer tap studs, 1, 2, 3, 4, 5, 6, 7 or 8. In Figure 3, however, it is shown connected to No. 8. The resistance, T, is also supplied with a sleeve which slips over stud No. 9, shown in Figure 4. It will be seen that this stud No. 9 is connected underneath the bakelite panel to No. 13. The opposite end of the transformer secondary (see 14a, Figure 2) is now connected to the post, 14, of the rectifier unit. This completes the connections on the rectifier unit made to the transformer, A.

Being a full-wave unit, three output terminals are supplied to the rectifier; these are numbered 10, 11 and 12. It will be noted that 10 was connected to 12 previously, and that 10 was car-

ried on over to the post, W, in Figure 4. From W the connection is carried further to the red lead of the condenser C1. This connection to the red lead is very important, since the red signifies positive and this is the positive terminal of the rectifier unit. To cross connections here would ruin the condenser. From the condenser the connection is carried to one side of the choke L1, which happens to be the choke which is mounted beside the transformer under the bakelite connection plate. These two latter connections are referred to in Figure 2 as 15 and 17. The opposite side of the choke, L1, represented by connection 18a in Figure 2, is connected to the red terminal lead of condenser C2, and thence onto the positive side of the output receptacle, which is the horizontal one and marked 21 in Figure 2.

Going back to the output of the rectifier unit, it will be noted that a lead was previously brought from M, which is the binding post on the top of the bakelite panel, to 11, which is the center tap on the output side of the rectifier unit. Reference is again made to Figure 4, which shows these two terminals connected by a dotted line. From M the connection is made to the other side of the condenser C1 and to the other side of the condenser C2, the connections being represented by 16 and 19 in Figure 2. From 19 the connection is carried to connection 19a of the choke, L2. From connection 20 in Figure 2, which is the other side of the choke, a connection is carried to the binding post, P, on the bakelite panel. From this point a connection is made to the vertical prong of the output plug, marked 22. The necessary cord and plugs are supplied both for the output and input side of the power unit. As previously stated, the rectifier unit is supplied with lugs which are clamped under the nuts of the terminals 10, 11, 12, 13 and 14 (Figure 4). With the unit in place, the metal shield may be placed over the whole unit and securely screwed to the wooden base with the wood screws supplied for this purpose. If all connections have been made properly, and these should be checked over before the unit is actually connected to the lighting circuit, the device is ready to be connected to the radio receiver. Figure 1 shows the completed job.

It will be found that some adjustment on the output voltage will be necessary, and this is done by bringing a connection from T to the proper tap of the transformer. While the output taps are marked from one to eight, it should not be assumed that this signifies the number of valves to be used. It will be found, for instance, in the case of a five-valve set, that a tap somewhere between three and six may work best, when 201-a type valves are used.

The BEGINNER IN RADIO

CONDUCTED BY ARMSTRONG PERRY

Radio Parts Salvaged From the Junk Pile

ALONG with the stuffed owl, the hornets' nest, the squirrel skins and the deer's antlers in Roy Bates' den, he had a copper tank from the wreck of a bootlegger's boat.

Some boys will sell an old tank for money to go to the movies. But Bates had a better idea: he saw in it an improved radio aerial.

He set it on four insulators, soldered a lead-in wire to it and connected it with his receiver. And it brought in WTAM, Cleveland, Ohio, and other distant stations.

Bates joined the tank with his 110-foot outdoor aerial. Pulling together, the two brought in more stations than either could alone. For still better results he improved his ground connection.

The junk pile yielded an old pail and ten feet of pipe. He cut a hole for the pipe in the bottom of the pail and punched others in the bottom and sides with a hammer and a spike. He dug a pit in the cellar and sunk the pail in it. Through the pail he drove the pipe down eight feet. He attached his ground wire to this and to a water pipe; two grounds halve the resistance. Filled with water, the pail automatically kept the ground wet and the connection good.

The wintry wind howled its defiance; there was a thrill in sitting in his cozy den, bringing in the far-off voices.

"This is WMBF," said an announcer. Miami Beach, Florida! That was reaching out!

The man at the mike announced an intermission. "It is very warm here—we are all going to have some ice-cream," he said.

Ice-cream! Bates looked at his frost-covered thermometer outside. Fourteen below zero! He smiled:

"Anyhow, I have proved that there is a lot of junk that is good for something in the radio game."

MUSIC FROM THE OLD DISTILLERY

With this old copper tank salvaged from the wreck of a bootlegger's boat, Roy Bates improvised an antenna that brought in broadcasters from across the continent.

"Murdering" the Vacuum Valves

MANY beginners find their valves dead several months before they should be. Usually they have been "murdered." Too high voltages have been applied to the filaments.

Some receivers have meters to show when the filament current has the correct voltage, but more have none. Operators usually judge by the brightness of the filament, or by the sound; both of these methods are inaccurate.

Men who temper steel can judge its temperature by its color, but that takes years of experience. Even highly trained vision cannot tell by the glow of a filament whether it is receiving the proper voltage or not. Sound is equally unreliable, for atmospheric conditions change the volume.

Beginners sometimes crowd the filament because increase of voltage usually increases the sound and seems to promise better results. Reducing the voltage suggests loss of power to a beginner, although, in fact, it often is the only thing that will bring in the broadcast clearly. Even the ear sometimes becomes an accessory to the murder of the valve, because after hearing loud sounds, lower ones of great clarity and beauty may seem weak.

After a filament is damaged by too high voltages, it may be unable to emit enough electrons without excessive voltage. It is then a sick filament and will die an untimely death. The thousand hours or more of service that it might have given if used properly may be reduced by more than half.

Most valves used in receivers do not need to burn brightly, as they are not intended for use as electric lights. They may operate efficiently at such low temperatures that the glow cannot be seen in daylight unless a deep shadow is thrown on the filament.

The way to make a valve give the best results for the longest time is to give it the minimum current that will produce clear tones. Those who cannot be happy without making a loud noise will find it cheaper to turn off the juice in the radio set and use a horn operated by hot air.

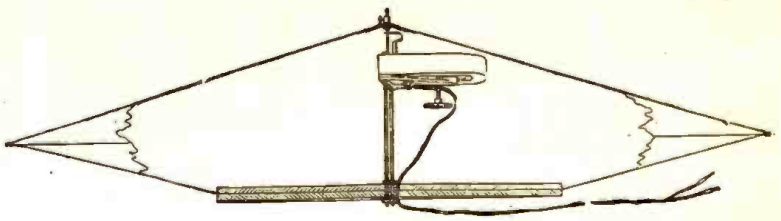
* *

Rheostat Regulates Loudspeaker Volume

S. R. HIPPLE, a radio inventor of Williamsport, Pennsylvania, reports that a filkostat, or pressure type rheostat, inserted in the circuit between the "B" battery and the plate of the last amplifier valve will control the volume of the loudspeaker. Other types of rheostats might be employed, but only those wire rheostats that have vernier attachments give as smooth and continuous adjustments as a good rheostat of the pressure type.

3-Foot Double Cone Speaker

(*Continued from page 45*)



A CROSS-SECTION OF THE COMPLETED UNIT

FIGURE 4: *In this cut-away diagram of the cone the method of attaching the driving unit is clearly shown.*

force the apex of the big cone. This is cut along the solid line, smeared with cement to the edge of the segment and held in shape until it dries, thereby forming a tiny cone which will later be fitted snugly inside the front cone.

This particular speaker is supplied with an extra-heavy back ring, which is cut out of very heavy, durable board of special composition. The cement is poured on one side of the back ring and spread freely over the outer ring. Care should be taken to see that none of the cement gets on the cross-arm The back ring is now ready to place on the back cone at the points indicated on the prepared paper. Heavy weights should be applied and sufficient time allowed to insure adequate drying.

Now apply the binding braid to the outer edge of the cone, making sure that it folds over the outer edge in such a manner that half of it is bound to the front cone and half to the back. A few clothes-pins will help in holding the braid until it is dry.

Next, the builder must fasten the back ring latch to the back with a nail or scriber, or some other sharp-pointed instrument. Reference to Figure 3 will assist the builder in visualizing this important step.

The builder now takes the adhesive fabric which is supplied and cuts off a strip about 18 inches long. From the part of the fabric that is left the builder should cut as many ¼-inch strips as possible. The cone is then held as shown in Figure 3, and the latch closed, making sure that the tongue slides into the groove. The cone should adjust itself, conforming perfectly to the proper shape. If it should fail to do this, due to some slight inaccuracy, the constructor should carefully bring it into shape with his hands.

It will be noted that the edges of the wedge-shaped piece, which were cut from the front cone in an earlier part of the construction, come to a butt joint. Lay the cone on a smooth, hard surface with the slit down, as shown in Figure 3. Work should be done on the inside, with the edges of the slit tight up against one another. They should be held down tightly with one hand while the other hand is used to glue the ¼-inch strips, which had been previously cut from the adhesive fabric, across the slit.

Now the builder is ready to examine the job. If that is right, the 18-inch strip of adhesive fabric is dampened and run from the apex of the cone to the edge on the inside of the cone.

The little reinforcing cone which was previously cut out and cemented together should now be spread with cement and fastened onto the inside of the apex of the front cone. With a sharp instrument punch a hole in the exact apex, working from the inside of the cone out.

There is now nothing left to do but assemble the driving unit which is supplied. First thread the smaller of the two conical discs on the chuck. The chuck should be run from the outside through the hole at the apex of the front cone, and the larger of the two discs threaded on the chuck inside the front cone. A nut is run under the thread and fastened securely. Figure 4 shows the position of the parts.

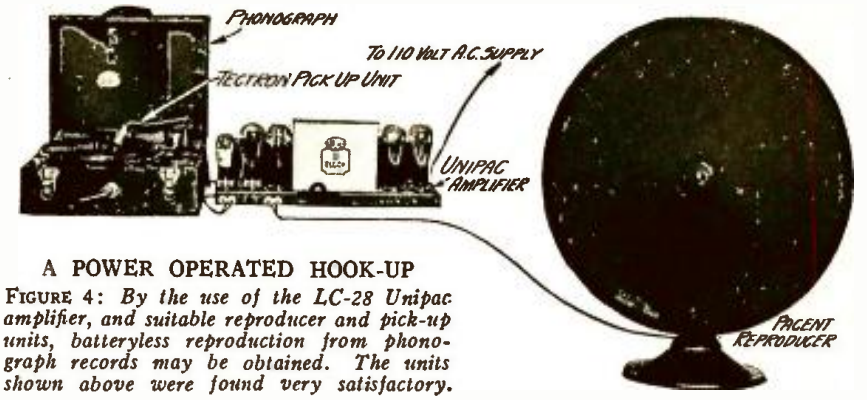
The builder must now take steps to fasten the cross-arm to the back ring securely by means of the nuts, bolts and washers supplied.

Onto the long thread at one end of each of the two unit mountings place a nut, and run it all the way up the thread. Slide a washer against it. Working from the inside, run the remainder of the long thread through the holes in the back ring which are on each side of the center hole. Still another washer should be placed on each of the unit mountings, together with a nut which is run up so that the nut is flush with the end of the unit mounting. The special cone speaker unit may then be put in place, holding the speaker with one hand with the apex pointing straight down. The driving rod or stylus should be carefully guided so that it will thread into the chuck. And here the builder must be careful not to bend the driving rod or to puncture the cone.

The remainder of the parts involved in bringing the cone to a workable condition are so simple that it is not necessary to describe them fully. The mounting of the accessories that come with the kit is accomplished in a short time, and the unit is ready to be hooked up to the receiver output.

"Radioize" Your Phonograph

(Continued from page 46)



A POWER OPERATED HOOK-UP

FIGURE 4: *By the use of the LC-28 Unipac amplifier, and suitable reproducer and pick-up units, batteryless reproduction from phonograph records may be obtained. The units shown above were found very satisfactory.*

frequency amplifier, just described, is connected with "B" and "C" batteries and with an Abox "A" eliminator, that replaces the ordinary storage battery, and with a Racon exponential type reproducer, equipped with a Baldwin unit. This combination, in which each part properly co-ordinates with every other part, gives exceptionally fine tone results with the new electric-cut phonograph records.

A Zetka ZAF vacuum valve has been found to operate best in socket D1, and a Zetka ZAO type vacuum valve works best in socket D2 of the low-frequency amplifier. These are new type valves especially designed for quality reproduction.

In setting up this combination, the "A" eliminator and the "B" battery, as well as the low-frequency amplifier, may be placed in a portion of the phonograph cabinet with the Racon reproducer, connected by a Belden extension cord, on the other side of the room. The old sound box on the phonograph is not used, and this space is, therefore, made available for most of this apparatus.

This combination is suitable for ordinary home reception and will give plenty of volume for this use—many times more than the old-style phonograph, with a beautiful tone quality.

The Second Combination

Another combination that is totally power operated from the 110-volt, 60-cycle AC lighting lines, is shown in the pictorial hook-up in Figure 4. The nucleus of this unit is the LC-28 Unipac amplifier, the details of construction of which were given in the November, 1927, issue of POPULAR RADIO. This amplifier, as said before, is completely power operated, and when connected, as shown in Figure 4, to an electric pick-up unit and a suitable reproducer, will give exceptionally high volume with excellent tone quality. It needs no external batteries of any kind for its operation, as it uses one 227 type amplifier valve in the first stage and a 210 type amplifier valve in the second stage. There is also included in the Unipac an 874 voltage-regulator valve and two 216-b rectifier valves. An extension cord is fitted to the unit for plugging into the lighting lines whenever the phonograph is to be used.

This combination is satisfactory where exceptionally large volume is desired. With this combination the new electric-cut records reproduce with such startling quality that the listener is almost led to believe the song or music is being executed for the first time, while it is being played. The reproduction sounds like the original.

The complete installation on either of these two units can be done in less than fifteen minutes, once the low-frequency amplifier is constructed.

A phonograph so improved will compare favorably with the latest type of electrically operated commercial phonographs, as it will then contain substantially the same type of apparatus. And while a completely new phonograph would cost many hundreds of dollars, either one of these units can be installed at comparatively low cost.

The New Home Receiver

(Continued from page 33)

Home receiver is quickly neutralized within the set, and once this adjustment is made the drums may be tuned over the entire waveband without a circuit howl or whistle.

How to Assemble the Instruments

The first job is to mount the condensers, D, E and F, against the flat surfaces of the brass frames. The drums are then slipped over the shafts of the condensers until the worm gears mesh with the flanges of the drums. As these condensers are to be mounted facing in opposite directions, it will be necessary to substitute, on one of the drums, the extra worm gear that is supplied with the frame, and also to transfer the knob shaft which holds the gear from the top to the bottom of the frame. When completely assembled, the units should be affixed to the panel, Z. The rheostat-switch, S, should then be fastened to the panel with the switch terminals pointing to the baseboard, Y. This will complete the panel assembly and it should be laid aside until the wiring of the instruments on the baseboard has been completed.

Next prepare the small binding-post strip, X, and mount the two binding posts, V1 and V2, and the pup jacks, U1 and U2.

Before screwing the various parts on to the baseboard, each part should be carefully examined and tested for any faults. This can be quickly done with a small "C" battery and headphones. The location of the parts is so clearly shown in Figures 1 and 2 that a further detailed description is hardly necessary. Follow the diagram in mounting all of the parts on the baseboard.

How to Wire the Set

If the instructions given for wiring in Figure 2 are carefully followed out, no trouble should be experienced. A hot, well-tinned iron is absolutely necessary for a permanent job, and extreme care is advised in the bending and fitting of the various leads to assure a neat and efficient appearance in the finished job. Make absolutely sure of each connection before proceeding to the next and remember that this part of the construction is to "make or break" your finished set.

Constant reference should be made to Figures 1 and 2. Black celatsite bus bar is recommended for connections to give the set a finished appearance. All references as to "right" or "left" should be considered when facing the baseboard with the back edge of the set nearest the builder.

Starting at the cable connector plug, W, the "A" positive (+) lead should be run along the baseboard to within 1 inch of the front edge and thence

over to a point where it will eventually be soldered to one terminal of the switch, S. To determine this point, the panel should be held temporarily in position against the baseboard, and the wire fitted for future connection. From the remaining terminal on switch S run a wire to one outside terminal of the potentiometer, K. This wire should be looped slightly from the base directly in front of the left filament post of socket J2, and a connection made between these points. From the socket the wire should continue between instruments J3 and H2 and connected to a wire connecting the two right-hand terminals of sockets J3 and J4.

Now connect the "A" negative (—) and "B" negative (—) posts of plug W together and run a wire from here to the right lug on amperite O. To this same wire connect the ground binding post and one terminal of the rotating winding (white wire) of coil A, and the left-hand bottom terminal of the secondary winding (enamel wire) terminal of the same coil. Also, from this same wire, run a lead along the base between the impedance units and coils, and connect this wire to the front terminal of amperite P. From this wire make connections to the "F" negative (—) terminal of impedance H1, and also to the "F" negative (—) and "B" positive (+) terminals of transformer G, and thence to the remaining outer lug of potentiometer K.

From the "B" Det. terminal of the cable plug, W, run a wire to the center terminal of the primary of coil B, and make a connection from this lead to the nearer terminal of condenser Q1. From the "B" Amp. post of W run a wire along the extreme back edge of base to the "B" positive (+) lug on unit H1. From the green terminal of the plug, W, run a wire, beside the one just fastened, to the "F" negative (—) lug of impedance H2; and beside this lead run a wire from the brown post of W to the "B" positive (+) terminal of choke I.

Now connect the remaining terminal of amperite P to the two remaining filament posts of sockets J3 and J4; and from this lead make a connection to the remaining filament post on socket J2. Run a wire from the antenna post to the remaining terminal on the rotating winding in the center of coil A. The two terminals of the rotating winding are at the top right of the large cylinder, as shown in the picture wiring diagram in Figure 2. The green winding is left unused. This will complete the long leads, all of which are run along the base, and we have but the short leads between the instruments to wire.

Beginning with the output filter condenser, Q2, connect one terminal to one of the pin jacks, U, and connect the other terminal of Q2 to the S1 lug of choke I. Connect the remaining jack to the "A" negative (—) to ground wire. Connections should now be made between the following points: P lug of choke I to plate post of socket J4, and from grid post of this socket to G lug of impedance H2; from P lug of this unit to plate of socket J3, wire from grid of this socket to G lug of impedance H1.

Now connect the left-hand terminal of primary of coil C to the P terminal of impedance H1. Connect the condenser, R, between this lead and the "A" negative (—) lead to amperite P beneath. Connect the remaining terminal of primary of coil C to plate of socket J2. From the grid of this socket run a wire to the front secondary terminal of coil B. From the remaining secondary terminal of the same coil run a lead to the G lug of transformer G. Connect one outside terminal of the primary of this same coil to the plate post of socket J1. The remaining primary terminal should connect to the left lug of condenser M. The other lug of this condenser should be connected to the grid post of socket J1, and thence to the right-hand bottom terminal of the enameled wire winding of coil A. The right-hand filament post of this socket should be connected to the remaining terminal of amperite O. The remaining lug of condenser Q connects to this same lead.

The panel should now be screwed to the baseboard for the completion of the wiring. First solder the two leads to the terminals of switch S. Connect the two extreme outer terminals (these point upward) of the dial lights, and run a wire from this connection to the left terminal of rheostat S. Also make a connection from this wire, just placed, to the set side of the "A" positive (+) lead. The right terminal of the rheostat should now be connected to the remaining filament post of socket J1.

Connect together the two long lugs of the dial lights (these lugs run parallel to the baseboard), and from this wire run another wire to the terminal nearest the panel of condenser D, and from there to the battery side of amperite O. The remaining post of this condenser should be connected to the grid lead of socket J1.

The four terminals of condensers E and F should now be connected to the proper coil leads. Starting with those terminals nearest the panel, the right-hand one, or that nearest the drum, should connect to the lead between the G terminal of transformer G and coil B. The other should connect with the left secondary terminal of coil C, and a connection made between this lead and the middle post of potentiometer K. Place condenser T between this lead, just run, and the "A" negative (—) lead to the potentiometer.

On the rear side of condensers E

and F the terminal nearest the drum should connect to the wire leading from coil B to grid of socket J2. The remaining terminal should be connected to the remaining secondary terminal of coil C, and this wire should be looped to take care of the G end of the crystal L, the "A" end of which should be placed in a small bus loop, which is soldered to the P terminal of transformer G. The arm of potentiometer K should now be swung entirely to the "A" negative (—) side, and we are ready to hook up the set to the proper power source and put it in operation.

How to Operate the Receiver

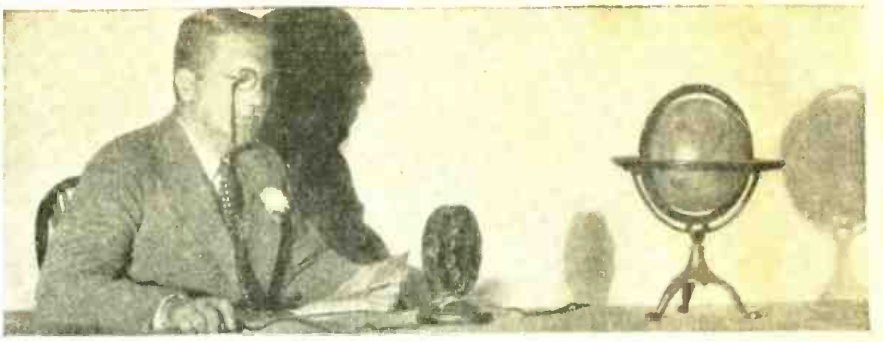
The batteries should now be connected to the cable as shown in Figure 4, and the plug connected to the set. Three 201-a valves should now be placed in sockets J1, J2 and J3, and a 171 valve placed in socket J4. The antenna and ground leads are next connected to their respective posts, and the loudspeaker connected to the pin jacks.

After tuning in a signal, the rheostat should be turned back to the lowest audible volume and the small compensating condensers on the double condenser, E and F, adjusted to maximum resonance. In this operation both condensers should be turned counter-clockwise to cut as much of this extra capacity from their circuits as possible, yet still keeping the circuits in resonance.

It will then be necessary to tune in a station of a low wavelength, and adjust the neutralizing condenser, M, to that point where no squeals will be heard when tuning. If such a point cannot be found, it will be necessary to reverse the two outer primary connections of coil B, which accordingly changes the phase of the high-frequency current flowing to the grid of the second valve. The arm of potentiometer K should now be advanced slightly to maximum signal response, always keeping this adjustment on the negative side of the instrument.

The new receiver will be a revelation in quality reproduction and should be of exceptional interest to those who prefer the crystal detector with the added amplification of vacuum valves acting as high-frequency and low-frequency amplifiers. Furthermore, if the receiver has been properly built and wired, its upkeep, both in time and money, will be considerably less than that of sets which employ a greater number of valves.

It will be found that the receiver will operate very economically with "B" batteries, as shown in Figure 4. If it is desired to use a power-pack to furnish the "B" voltages, it is quite easy to construct one that will deliver full voltage at the light load which this receiver places upon it.



BROADCASTS

Telling Fortunes by Radio

A NOVEL "radio game" that requires only a radio receiver for its equipment has recently been originated—if newspaper reports are to be credited—by Dr. Edwin E. Slosson of Washington, D. C. How fortunes may be told by this novel game is described as follows:

In order to play the game, select a person who wishes to have his fortune told. Blindfold him, direct him to the radio set, and have him tune in a station. Whatever comes in first is supposed to be applicable to the one who tuned in. No matter whether music or words are received, it is seldom that some significance cannot be attached to what is heard.

Dr. Slosson was entertaining friends the other night. He proposed his game. Most of his guests, scientific and dignified, were intrigued with the idea. Dr. Slosson was elected to have his fortune told first. So he went to the set and tuned in.

"Many people have lice without suspecting it," said a voice from out of the nowhere.

Red of face, Dr. Slosson turned the set off.

Next an elderly lady tried her luck. After being shown, she tuned in a station.

"Suppressed desires frequently are responsible for your unnatural actions," said a voice from some unknown station.

They abandoned the game.

* *

A Radio Scarecrow

RADIO has been introduced as the newest farm implement by Gustav Schmitz, owner of a huge orchard near Hornburg, in Germany. Despairing of saving his valuable harvest of apples and pears from the clouds of voracious sparrows unmoved by ordinary scarecrows, he installed a loudspeaker in the orchard and at the announcer's first words the winged pests fled, terrorized, never to return.

* *

Radio Resuscitates the Furniture Business

WHEN the automobile and the moving picture started taking men from the parlor and the fireside, the furniture business took quite a flop. But now, says Harry C. Sorden, Secretary of the National Association of Upholstered Furniture Manufacturers, radio is bringing the family back home to enjoy broadcast programs, and home furniture is again finding its place in the sun. Of the $900,000,000 spent for furniture sold last year, a third was put into furnishings for the parlor and living-room, large armchairs being in particular demand.

* *

Radio Demonstrates Its Reach

A SPECTACULAR demonstration of radio's marvelous powers in bringing together all parts of the world was given recently when A. M. Morton, of the Radio Corporation of America, directed an almost instantaneous interchange of messages between himself, at the Pennsylvania Hotel in New York, and several foreign countries and sixty-seven ships at sea. The demonstration was given before the Export Managers' Club, as an example of what radio has accomplished for international communication. Within three minutes of a broadcast call for positions of ships at sea, messages started pouring in from ships in the North Atlantic and the North and South Pacific. Then a broadcast request for weather reports brought replies from such widely separated places as Honolulu, Paris, Buenos Ayres, Berlin and Bogota—all within another three minutes' time.

* *

United States Has Over Half of World's Broadcasters

MORE than three-fifths of the broadcasting stations in the world are located in the United States, according to the figures of the electrical division of the Department of Commerce. The 1,116 broadcasting stations of the world are distributed as follows: United States, 685; Europe, 196; North America, outside of the United States, 128; South America, 52; Oceania, 28; Asia, 18; Africa, 9.

Division of stations by countries gives the following order: Canada, 59; Cuba, 47; Sweden, 30; Russia, 28; Australia and Germany, 24 each; Argentina, 22; United Kingdom, 20; France and Mexico, 18 each; Spain, 15; Brazil, 12.

The most powerful broadcasting stations, outside the United States, are those at Motala, Sweden, and Moscow, Russia, broadcasting with 40,000 watts.

Transoceanic Calls Heard

POPULAR RADIO'S "Calls Heard" Department is ready to serve all American amateurs by forwarding their calls heard (QSL) cards to their proper destination in foreign countries. These cards are delivered through agents in those countries who have or can obtain knowledge of the present address of foreign amateurs. POPULAR RADIO is also doing the foreign amateur the service of forwarding his QSL cards to the proper destination in this country. In addition, the magazine will publish a monthly list in the "Transoceanic Calls Heard" column. Address your cards to the foreign amateurs by call number and enclose them in envelopes to—

The Calls Heard Editor
POPULAR RADIO
119 West 57th Street, New York

E. J. F. SAMPSON, operator of amateur station NU-1DI, Brockton, Mass., reports the reception of the following European stations, using a low-loss receiver with one stage of low frequency:

EB-4WW, EF-8CL, EF-8EO (fb.), EF-8FK, EF-8IX, EF-8JF, EG-6YQ, EI-1DM, EI-1ER.

STATION EF-8CC, operated by M. Suquet, Chatillon-sur-Seine, France, reports the reception of the following stations in the United States, using a Schnell circuit with detector and one stage of low frequency:

1AGT, 1BHM, 1CAR, 1MV, 1SZ, 2AZK, 2BAD, 2HC, 3AHL, 3MB, 3SH, 4SN, 8BPL, 8CXH.

AMATEUR station EF-8IX, operated by R. Simon, Choisy-le-Roi (Seine), France, reports the reception of the following stations in the United States, using a Schnell circuit with detector and one stage of low frequency:

1ASU, 1BAT, 1BYV, 1CMX, ICNZ, 2BOW, 3LD, 7VH, 9DR.

J.-L. MÉNARS, the operator of amateur station EF-8FJ, Longchamp-Bordes (B.-P.), France, reports the reception of the following United States stations:

1AKM, 1BKC, 1CAW, 1CMX, 1KD, 1XV, 2HC, 4AK, 5KC, 8BGO, 8DKX, 9DNG.

THE amateur station of R. Huchet (EF-8DDH), Nantes, France, reports the reception of the following stations in the United States:

1ALS, 1BDW, 1CK, 1CMF, 1DL, 1ID, 1MR, 2AYJ, 3BCO, 3BUW, 3ZM, 4AAH, 4SI, 8BUN, 9AEB.

AMATEUR station EF-8AKL, France. reports the reception of the following stations in the United States, using a Bourne circuit with detector and two stages of low frequency:

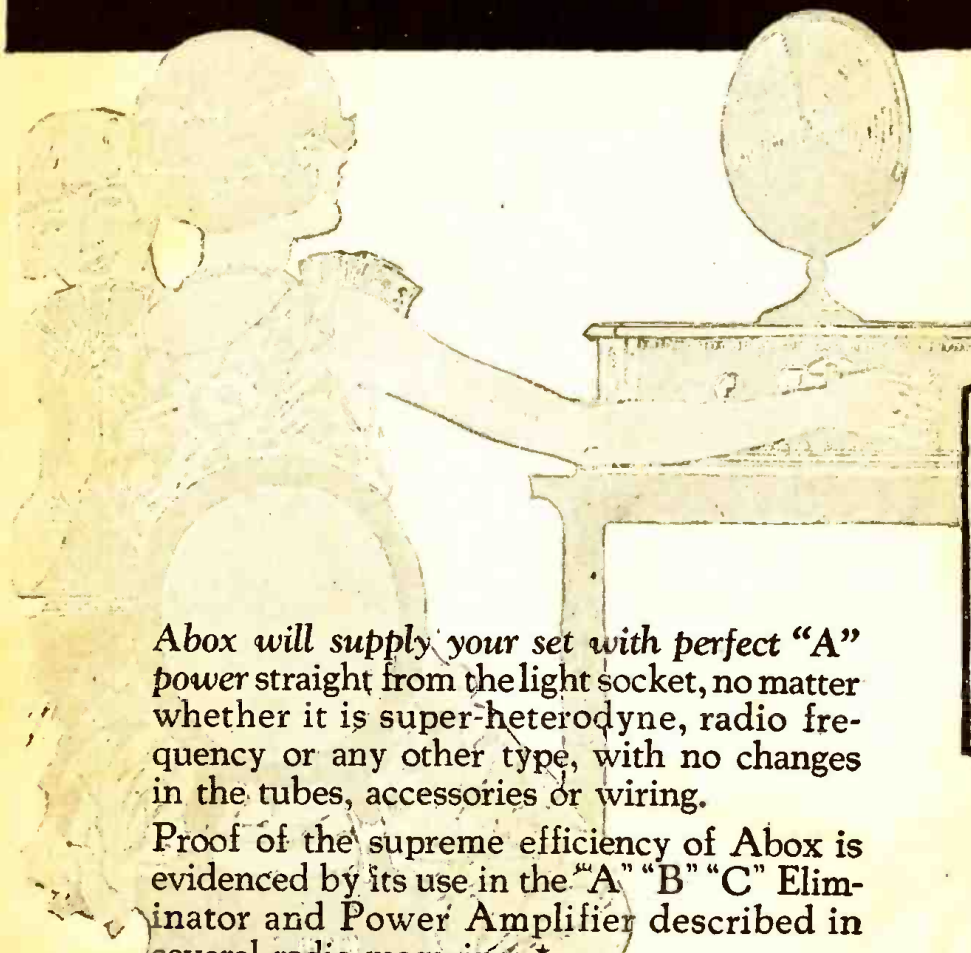
1AKM, 1ATG, 1BFX, 2BEM, 3GF, 3JN, 3LD.

LUCIEN BENSIMHON, operator of amateur station FM-8MB, Casablanca, Morocco, reports the reception of the following stations in the United States, using a detector and one stage of low frequency:

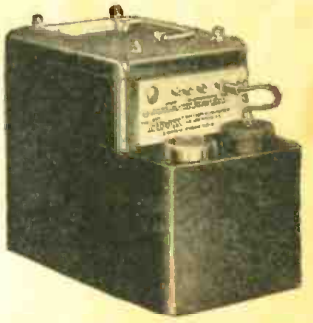
1DI, 3AHL, 6AM, 6HU, 6KBC, 8BZU.

Abox

"A" BATTERY ELIMINATOR



Licensed by The Andrews-Hammond Corporation, under Patent No. 1,637,795 and applications



$32.50

Input—110 volts, 50-60 cycles A. C.
Output—6-volt direct current, 2 amperes.
Shipping weight, 25 lbs.

Abox will supply your set with perfect "A" power straight from the light socket, no matter whether it is super-heterodyne, radio frequency or any other type, with no changes in the tubes, accessories or wiring.

Proof of the supreme efficiency of Abox is evidenced by its use in the "A" "B" "C" Eliminator and Power Amplifier described in several radio magazines.*

Abox works perfectly in this power unit, where the tremendous amplification of the 210 tube would reveal any defect.

Made in two models: the 6-volt for use with sets using eight or less ¼ ampere tubes, including the new A-type power tube; and the 4-volt model that will operate any set using ten or less 199-type tubes.

Abox is on display at your radio store.

**Send for free reprints*

Four-volt model for sets using 4-volt tubes. Fits Radiola battery compartment. Size, 8¾ inches long, 4 inches wide, 6⅛ inches high. Output—.6 amperes, 4 volts D.C. Price **$27.50**

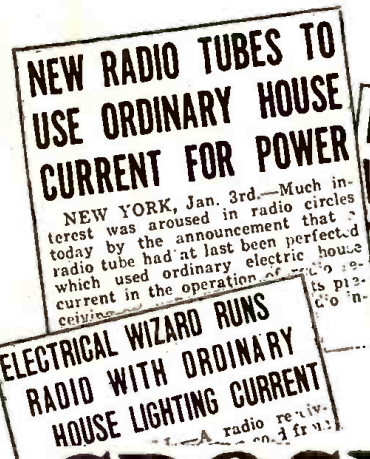
All prices slightly higher on West Coast

For specific uses see "How to Build a Phonograph Amplifier" and the "New Receiver" in this issue.

The Abox Company

215 North Michigan Avenue — Chicago, Illinois

Amazing *New* A C radio tubes eliminate batteries by use of electric house current



in the CROSLEY AC BANDBOX

6 tubes — Genuine Neutrodyne

STORIES in regard to the coming of AC tubes which would operate from houselighting circuits have appeared in various newspapers, arousing a climax of anticipation in the public mind last spring.

With the acquisition of a license by The Crosley Radio Corporation under a large group of patents controlled by The Radio Corporation of America, American Telephone and Telegraph Company, General Electric Company, Westinghouse Electric and Manufacturing Company, etc., the Crosley AC Bandbox is possible through the use of the new R.C.A. alternating current tubes—UX226 and UY227. These tubes utilize for their filaments and heating regular alternating current from the houselighting circuit.

The current is stepped down by means of a transformer without need of rectifiers to supply the heat necessary for the functioning of the tubes. The converter box, which is included with the Crosley AC Bandbox can be tucked away out of sight. It is connected to the Bandbox by a cable and also supplies the current for the plate voltages on the tubes, replacing B batteries.

Thus the Crosley AC Bandbox functions entirely from the regular houselighting current without need of batteries, battery chargers, or any of the other usual paraphernalia which requires attention, care and early replacement.

Now $110 without tubes

This set incorporates the famous Mershon self-healing electrolytic condenser. It eliminates the danger of blowing out paper condensers which have caused so much difficulty in electrically operated sets.

The Crosley AC Bandbox with the new alternating current tubes is truly revolutionary, and brings to the radio user an entirely new conception of care-free radio. This AC model together with the battery type BANDBOX which works with standard power supply units and storage batteries, is the country's most talked of radio! The popularity centers around two major factors:

1. *The imposing array of patents under which it is built.*
2. *The number and quality of the features Powel Crosley, Jr., has built in it for the price!*

—And what value Crosley has added in:

1. Complete shielding of *all* elements.
2. Absolute balance (genuine Neutrodyne).
3. Volume control.
4. Acuminators for sharpest tuning.
5. Single cable connections
6. Single station selector.
7. Illuminated dial.
8. Adaptability to ANY type installation.

Today's radio must be adaptable to the home. It must fit into all kinds of conditions. Perhaps you have a bookcase corner—a desk compartment—a chest—or even a bureau drawer where it could be tucked away. Maybe you want it to be part of the furnishings, as an impressive console or credenza cabinet. The Bandbox fits in everywhere.

The metal outside case is easily and quickly removed.

The set is solidly mounted on a stout steel chassis. As all controls are assembled together in the front, cabinet panels are easily cut to allow their protrusion. The metal escutcheon is screwed on over the shafts and the installation has all the appearance of being built to order.

Two large furniture manufactures have designed console cabinets in which the Bandbox can be superbly installed. (*Showers Bros. Mfg. Co. of Bloomington, Ind., and the Wolf Mfg. Ind. of Kokomo, Ind.*) Powel Crosley, Jr., has approved them mechanically and acoustically and has seen to it that the famous Crosley Musicones are built in them so that the best type of loud speaker reproduction may be insured. This is the kind of a radio you have been waiting for—the real *direct* electric set that requires absolutely *no* attention.

What if it does run all night! Who cares? No run down batteries greet you in the morning. You owe it to yourself to see the Bandbox and listen to its remarkable performance. If you cannot easily locate the nearest Crosley dealer, his name and address will be supplied on request. Write Dept. 16.

Montana, Wyoming, Colorado, New Mexico and West, prices slightly higher

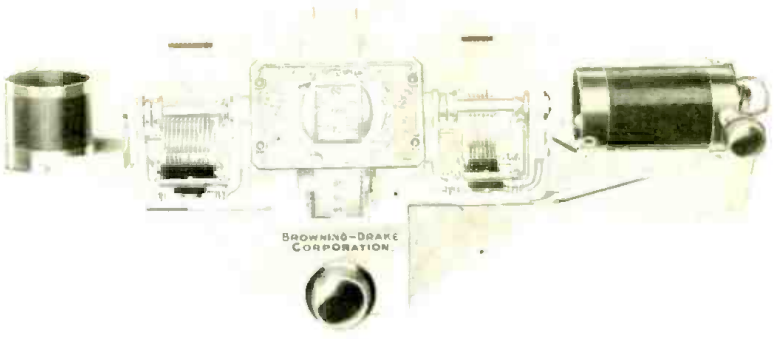
CROSLEY RADIO

The CROSLEY RADIO CORP.
Powel Crosley, Jr., Pres.,
Cincinnati, Ohio

"You're there with a Crosley"

Crosley is licensed only for Radio Amateur, Experimental and Broadcast Reception

HERE IT IS!



The New Official
BROWNING-DRAKE KIT

BETTER than ever, the new Browning-Drake Kit, pictured above, carries forward the Browning-Drake tradition of fine and efficient radio apparatus. Electrical design, incorporating the famous slot-wound primary developed by Messrs. Browning and Drake, is enhanced by an advanced mechanical assembly. Now it is even easier to build a fine, dependable radio receiver using this new Browning-Drake Kit.

A new and efficient type of small coil is used in the new Kit. A single-control illuminated drum dial is operated by a knob below a beautiful escutcheon plate. Two precision-built condensers are driven by the drum dial which develops no backlash whatever. This Kit comes mounted as a single unit and may be easily mounted against the front panel.

Radio engineers who have seen this new Kit pronounce it one of the finest pieces of radio apparatus that has yet appeared.

New constructional booklets describing the new Official Five Tube assembly and special Two Tube Tuner for Amertran or other specified power amplifiers, may be secured from your dealer or direct for 25c.

BROWNING-DRAKE CORPORATION
CAMBRIDGE :: MASS.

Genuine BROWNING-DRAKE Apparatus
Bears This Trade Mark

LOOK FOR IT!

BROWNING DRAKE

CABINETS
PARTS

RECEIVERS
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