HOW I GOT TELEVISION!

BY *James Millen*

SEPT. 1st Vol-13 No-24 *FIFTEEN CENTS*

1928

RADIO WORLD

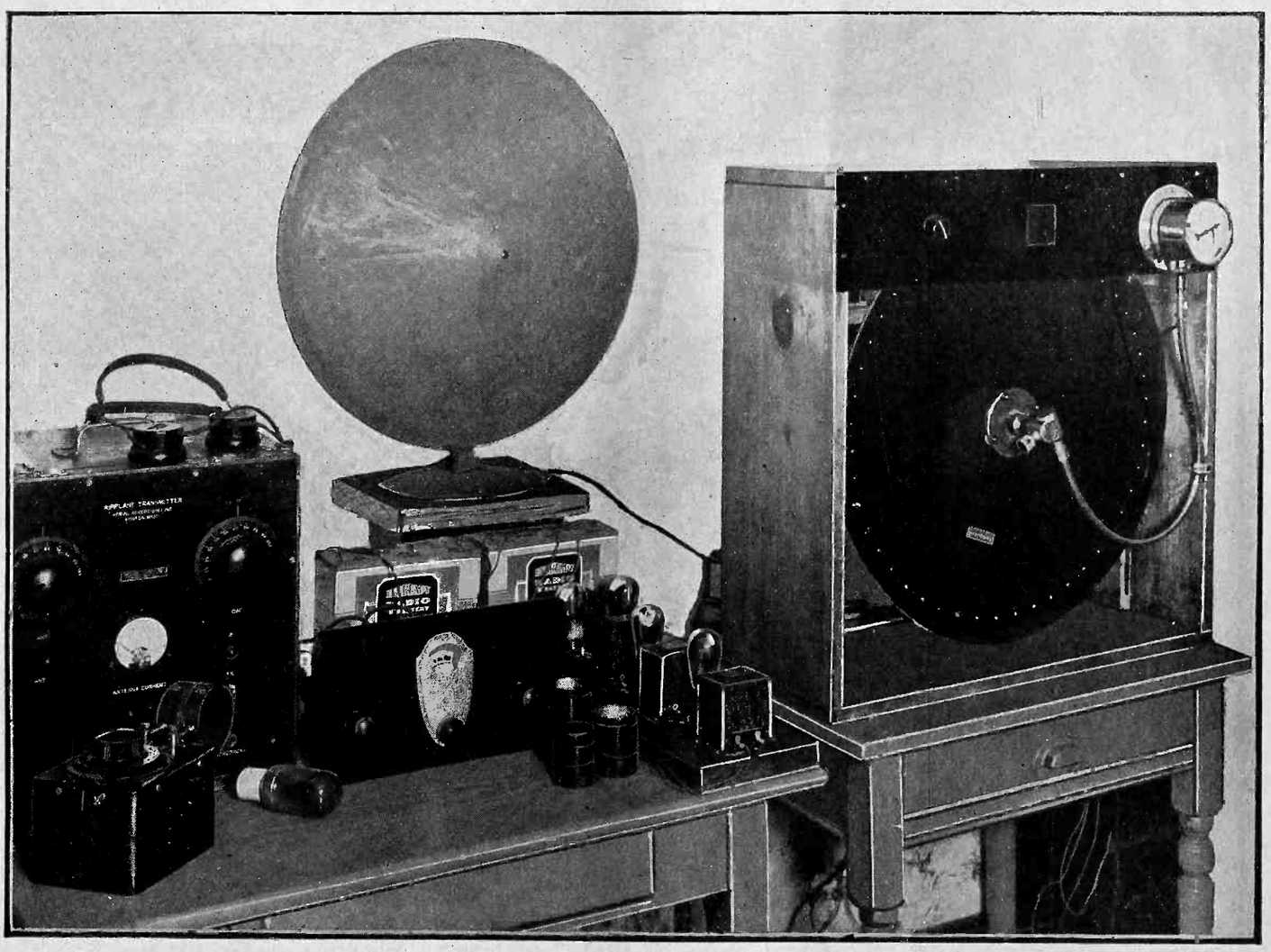
REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

336th Consecutive Issue—Seventh Year

See pages 3, 4, 5, 6, 7, 8, 9 and 10 For Full Reports on Television Transmission and Reception of KDKA, 3XK, WOR, WGY, WRNY, WLEX, WCFL!

TELEVISED MOVIES SEEN 500 MILES!

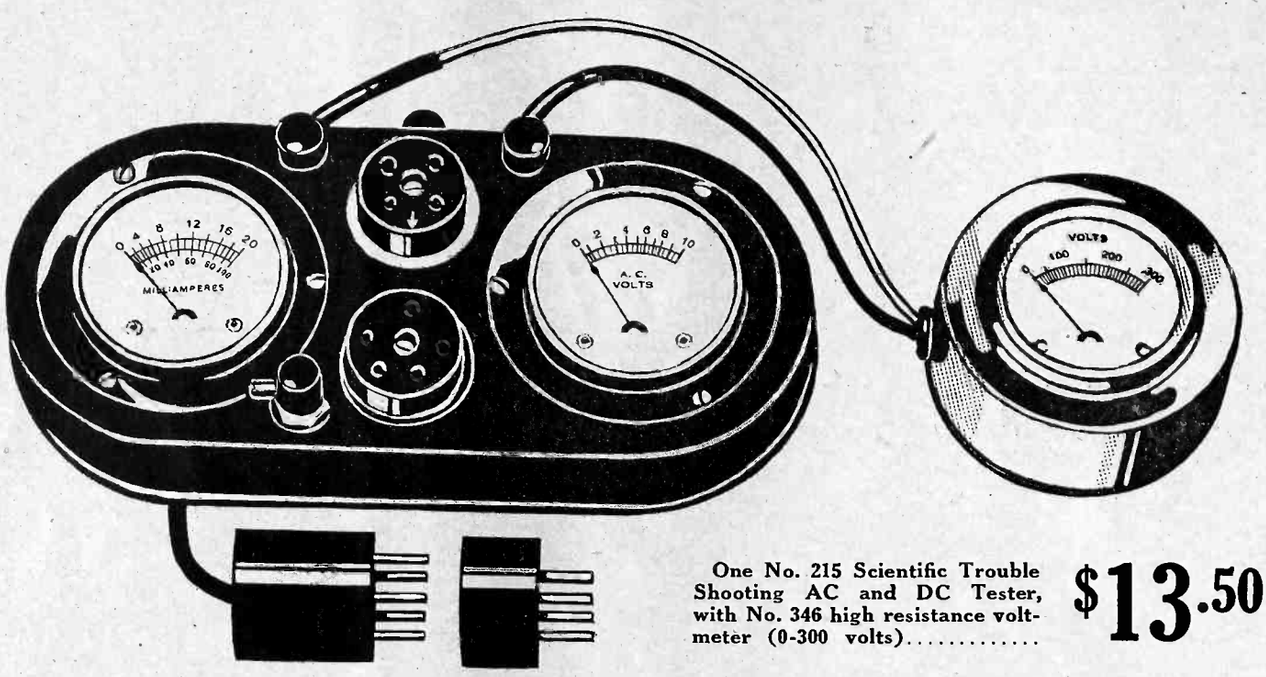


THE TELEVISION EQUIPMENT WITH WHICH JAMES MILLEN RECEIVED MOVING PICTURES BY RADIO FROM WASHINGTON, D. C. AT LEFT IS AN AIRPLANE RADIO TRANSMITTER AND AT LEFT IS THE SCANNING DISC OF THE TELEVISION RECEIVER. BETWEEN THESE TWO IS THE SHORT-WAVE RECEIVER USED IN PICKING UP THE SIGNALS FROM WASHINGTON. IT CONSISTS OF A TWO-TUBE SHORT-WAVE SET FOLLOWED BY A FOUR-TUBE AUDIO FREQUENCY AMPLIFIER. THIS AMPLIFIER FEEDS THE NEON GLOW TUBE PLACED BEHIND THE SQUARE HOLE AT THE TOP OF THE SCANNING DISC.

All in a Jiffy!

Tube Any Good?
Set Getting Proper Voltages?
Any Shorts or Open Circuits?
Universal Tester Answers 12 Questions in a Jiffy!

You are lost without meters when you shoot trouble and seek remedies. The Universal Tester is your reliable diagnostician for both AC and DC.



One No. 215 Scientific Trouble Shooting AC and DC Tester, with No. 346 high resistance voltmeter (0-300 volts)..... **$13.50**

The Scientific Trouble Shooting AC and DC Tester (at left) and high resistance meter (at right) Make Twelve Vital Tests in 4½ Minutes. The instruments are exactly TWICE the size pictured. They are handy and handsome.

Amply Accurate, Even for Service Men!

SERVICE men, going out on calls, must have a reliable test set. The Universal Tester and separate Voltmeter are reliable and versatile. The readings are accurate to 5% plus or minus, which is ample. Twice as great accuracy as this costs four to five times as much money, and isn't really necessary, except for engineering work in laboratories.

The Universal Tester and Separate Voltmeter can be used to make ALL the following twelve tests in 4½ minutes:

(1) to measure the filament voltage, up to 10 volts, of AC and DC tubes. (2) to measure the plate current of any one tube, including any power tube, from less than 1 milliampere up to 100 milliamperes; (3) to measure the total plate current of a receiver or amplifier, up to 100 milliamperes. (Hardly any set draws more.) Open common A and B of set and connect to P of tester socket and to P prong under adapter plug; (4) to measure the B voltage applied to the plate of tube; the voltage across B batteries or B eliminators, up to 300 volts. (5) to determine the condition of a tube, by use of the grid bias switch. (6) to measure any tube's electronic emission (tester cuts in at no load, hence plate current equals filament emission). (7) to regulate AC line, with the aid of a power rheostat, using a 27 tube as a guide, turning rheostat until filament voltage is 2.5 or 2.25 volts. (8) to test continuity of resistors, windings of chokes, transformers and circuits generally. (9) to find shorts in bypass and other condensers, as well as in inductances, resistors and circuits generally. (10) to read grid bias voltages including those obtained through drops in resistors (bias read by noting plate current and voltage and consulting chart). (11) to determine the presence of distortion and overloading, by noting if milliammeter needle fluctuates. (12) to determine starting and stopping of oscillation, as milliammeter needle reads higher current for oscillation and lower for no oscillation.

Fits Your Needs, As Well As Your Purse!

GUARANTY RADIO GOODS CO.,
145 West 45th Street, New York City.

☐ Please send me at once, by parcel post, on a five-day money-back guaranty, one complete Two-in-One (AC and DC) scientific trouble-shooting test set, consisting of one No. 215 and one No. 346, for which I will pay the postman $13.50, plus a few cents extra for postage.
☐ If 0-500 v. high resistance voltmeter No. 347 is preferred, put cross in square and pay $14.50, plus postage, instead of $13.50, plus postage.

☐ One No. 215 and one No. 346, with two adapters for UV199 tubes $14.50
☐ One No. 215 and one No. 347, with two adapters for UV199 tubes $15.50
☐ One No. 215 alone, $10.00.
☐ One No. 346 alone, $4.50.
☐ One No. 347 alone, $5.50.

NAME .....

ADDRESS .....

CITY ..... STATE.....

FIVE-DAY MONEY-BACK ABSOLUTE GUARANTY!

Try out the combination tester and high resistance voltmeter, if you are a service man, custom set builder, home constructor, experimenter, teacher or student. You run no risk. These instruments are guaranteed. Money back if you're not satisfied after a five-day test.

High value and low price combine to give these instruments a field all to themselves, because they meet your needs fully in quality as well as in economy.

HERE'S WHAT YOU GET FOR ONLY $13.50:

(1) One two-in-one 0 to 10 voltmeter for AC and DC. Same meter reads both. Scale specially legible at 1½ to 7½ volts. This meter reads the AC and DC filament voltages.
(2) One DOUBLE reading DC milliammeter, 0 to 20 and 0 to 100 milliamperes, with changeover switch. This reads plate current, which is always DC in all sets.
(3) One 0-300 volts high resistance voltmeter, No. 346, with tipped 30" cord to measure B voltages.
(4) One 5-prong plug with 30-inch cord for AC detector tubes, etc., and one 4-prong adapter for other tubes.
(5) One grid switch to change bias.
(6) One 5-prong socket.
(7) One 4-prong socket.
(8) Two binding posts.
(9) One handsome noire metal case.
(10) One instruction sheet.

[If 0-500 voltmeter No. 347 is desired instead of No. 346, price of combination is $14.50.]

No. 215 Universal AC-DC Tester Alone.....$10.00
No. 346 high resistance 0-300 voltmeter alone..... $4.50
No. 347 high resistance 0-500 voltmeter alone..... $5.50

GUARANTY RADIO GOODS CO.
145 West 45th Street
New York City Just East of Broadway

"UNINTERRUPTED READER INTEREST EVERY WEEK — EVERY YEAR

RADIO WORLD

SEPTEMBER 1, 1928
Vol XIII, No. 24. Whole No. 335
15c Per Copy
[Entered as second-class matter, March 1922, at the post office at New York, N. Y., under Act of March, 1879.]

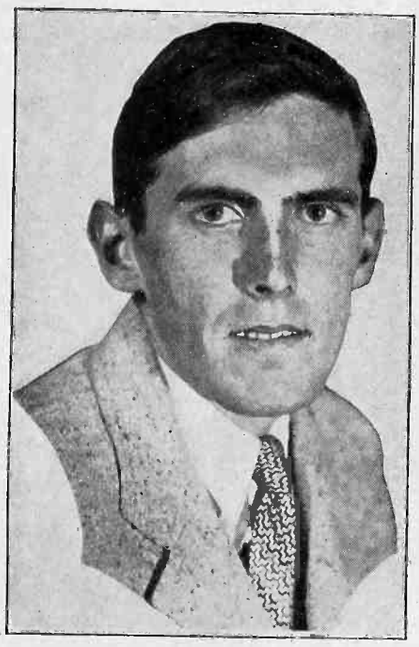
Technical Accuracy Second to None

A Weekly Paper published by Hennessy Radio Publications Corporation, from Publication Office, 145 West 45th Street, New York, N. Y.
(Just East of Broadway)
Phone: BRYant 0558 and 0559

How I Got Television

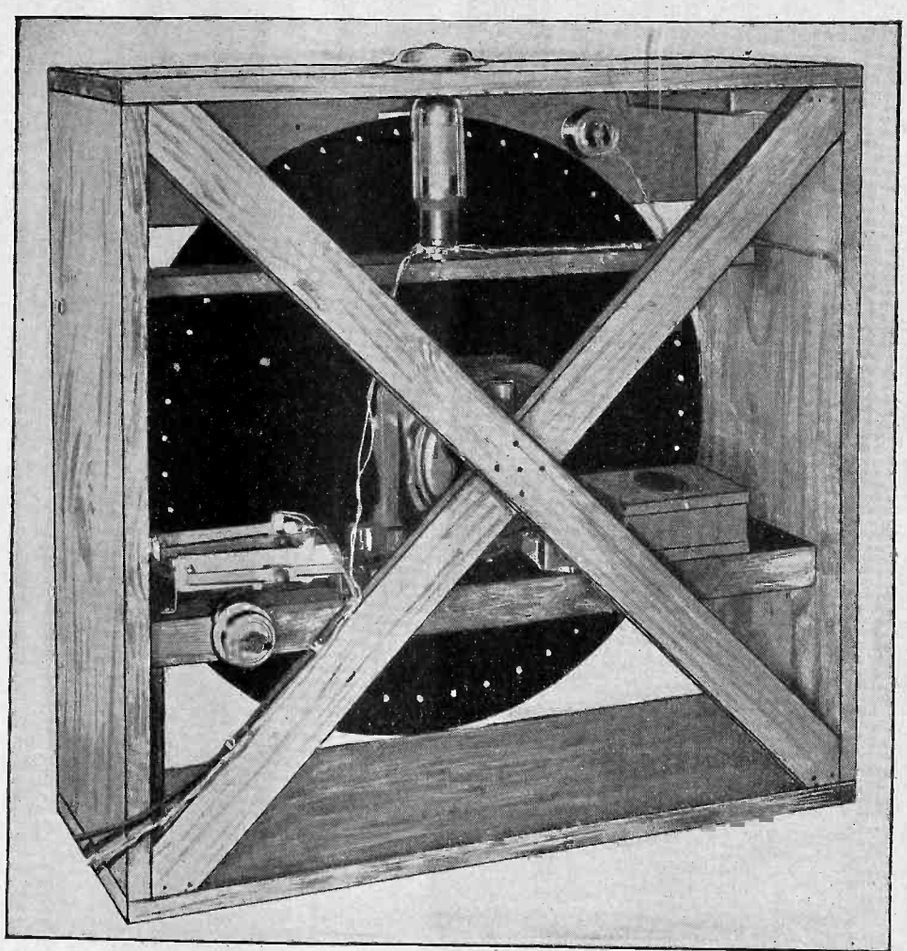
By James Millen

Holder of the World's Record for Distance Reception of Televised Movies



(Herbert Photos, Inc.).

JAMES MILLEN, RADIO ENGINEER OF MALDEN, MASS., WHO ESTABLISHED A LONG-DISTANCE RECORD IN RECEIVING MOVING PICTURES BY RADIO FROM WASHINGTON, D. C., A DISTANCE OF 500 MILES. MR. MILLEN IS A CONTRIBUTOR TO RADIO WORLD.



BACK VIEW OF THE SCANNING DISC USED BY JAMES MILLEN IN RECEIVING MOVING PICTURES FROM WASHINGTON

WHILE I was listening in on a new two-tube short wave receiver one Friday evening, a few weeks ago, the code and voice announcements of 3XK at Washington, D. C., stating that a television broadcast was about to begin, were picked up.

Then followed a rough low-pitched buzzing noise that sounded somewhat like a cross between a saw mill and a worn-out automobile horn. There was plenty of static and the signal faded badly, nevertheless the television signal was held for the full hour.

As a result it was felt that perhaps something might be seen if a Kino lamp, motor, scanning disc and the other necessary "gear" that goes to make up a television receiver, were hooked on to the output of the short wave receiver.

A wire to C. Francis Jenkins brought a prompt reply that he was regularly transmitting his radio movies on 46.7 meters every Monday, Wednesday and Friday evening from 8 to 9 p. m. E.S.T., over 3XK.

By five o'clock the following Monday—three days having elapsed—the Kino lamp, motor, scanning disc and other special apparatus had been gathered together and loaded into the car for transportation home.

All that was needed was a little help in putting the apparatus together in a hurry. A few casual remarks about "DX television from Washington" soon resulted in Philip A. Eyrick and Dana Bacon, two of the engineers from the research laboratory of the National Company, offering to help assemble the outfit.

At Last—the Image!

Well, it was about six o'clock when we started and by 9.15 the disc was whirling, the Neon lamp burning, and a faint signal being heard from the speaker. Manipulating the different controls until nearly 9.30 brought all kinds of streaks and designs into view, yet nothing that anyone with even the wildest sort of imagination might think was intended to be a picture.

The excitement of the first few minutes had just about died out and each one was waiting for one of the others to announce that "he always thought this television stuff was the bad news," when instead, the signal, which had been fading quite a bit, suddenly swung in very strong for a few seconds. Just then the motor happened to be going at the right speed.

There in the little window appeared the clear image of a small girl bouncing a rubber ball!

Even the ball itself could be plainly seen going up and down.

Then the signal faded and the image was gone as quickly as it had arrived.

The thrill of hearing a bit of badly distorted phonograph music with a crystal detector for the first time back in 1920 was not even comparable with the overwhelming emotion of seeing the fleeting glance of an image some 500 miles away.

Realizing that all that was necessary for constant results was a strong signal, another

(*Continued on next page*)

Girl's Shadow Skipped Rope 500 Miles Off

Jenkins Televised

Regular Reception of Signa Enjoyed at Malden, Mass.

The special moving pictures sent out by C. Francis Jenkins from Washington, D. C., are known as shadowgraphs. These are not detailed photographs but silhouettes, such as would be obtained by photographing a shadow cast on a wall. These are somewhat easier to transmit and receive than true photographs because there is no detail. The only chance of distortion due to lack of transmission of the high frequencies is at the edges of the shadow. These would be blurred if the high frequencies were missing. That is, the change from dark to light areas would be gradual and not abrupt.

It would be necessary to transmit and receive a frequency range of about 20,000 cycles in order to make the edges of the shadow sharp and clear-cut. But, a little blurring, such as would result by narrowing the frequency range to 5,000 cycles, is of little importance.

Thrill In It

It was these shadowgraph moving pictures which were received and reproduced by James Millen in his home in Malden, Mass. While there was no detail in the shadow the pictures were moving, and the thrill of watching the animated shadows was just as great as if they had been true photographs.

The receiver used is equally suitable for receiving true moving pictures or television. It is only necessary to tune in on such transmission and to synchronize.

The picture sent out by Mr. Jenkins in Washington is that of a little girl bouncing a ball and skipping a rope. Her antics were clearly seen by a group of men assembled at the home of Mr. Millen. It is true that the rope was going in the wrong direction but that was merely a detail of adjustment of the scanning disc at the receiver, and it in no way detracted from the interest in the reception. The ball-bouncing episode was also reversed but that made no difference.

Sends Shadow Movie

The film used by Jenkins for transmitting the pictures is a shadow movie in the form of an endless belt, for action repeats at regular intervals without any interruptions. Such transmission is perfectly satisfactory as long as the novelty of television reception endures..

(*Continued from preceding page*)

stage of audio amplification was hastily added and the picture tuned in and held for several minutes before the hour was over.

Range Surprisingly Large

The reception of Jenkins' shadowgraphs, which might be described as shadow movies, is not all that can be picked up on the rather simple apparatus that I used, because a few other stations are using the same scanning disc for transmission, and of course if you can get the signal, and can synchronize the motor of the receiver in whirling an identical disc in your home, you have television reception.

WLEX, Lexington, Mass., was one station that was tuned in with the same televisor as brought in Jenkins' transmission. Also, WCFL, Chicago, is using the same kind of disc, I am informed, and is on the air for an hour each morning.

Of course, by using another kind of disc, that is, one with differently spaced apertures, with a different number of holes—always the same, however, as the disc used at the transmitter—you can tune in the other stations, if in range. It is surprising to find that the range is so great. Most of us supposed that it was rather limited.

I tried to ascertain in what territories Jenkins' signals were coming in pretty strong. Most of my friends to whom I wrote had short wave sets like mine, and therefore could check up on the voice, or perhaps on voice and code, since the Jenkins transmission of shadowgraphs is preceded by a vocal and a code announcement. The voice comes in weakly, just barely audible, in my location and in others, but the code comes in fine, and the sending is slow enough for any amateur to read it plainly.

Field for the Multitudes

Well, the result of my canvass proved that Jenkins' transmission is reaching out very well throughout the United States, with the usual dead spots associated with high frequencies, the usual inexplicable bursts of volume, and areas and periods of silence, nevertheless an excellent record of territorial coverage. It means that hundreds of thousands of persons can enjoy these televised moving pictures of shadows playing against the background of blood-red orange.

Some unexpected happenings added to the interest of the television signals I receive regularly—thrice a week—from Jenkins and which are going full blast as I pen these lines and let my friends have exclusive enjoyment of this rare treat—radio vision.

I tried a plain regenerative detector, followed by suitable audio, and found that the signals faded badly, disappeared for long periods, came back almost as unexpectedly, and "teased" us so much that an investigation had to be made. I do not refer to the swinging in and out that characterizes the reception, but to a more pronounced presence and absence, accompanied, I began to notice, by the movement of my friends about the room.

Best Friends Worst Offenders

The explanation was not long in coming. So sensitive was the receiver to capacity changes in the antenna, that the body capacity of people moving about the reception room (a fitting name for the room, I think) so altered the wavelength as to tune the station out. Then, upon leaving the proximity of the aerial coil, my friends would innocently permit the return of signals.

For a while we thought maybe a "Keep Off" sign near the antenna coil would help, but we finally decided that the only real solution was an untuned stage ahead of the detector, and that is what I used in my television reception and with that hookup I obtained best results.

Be my visitors near to or far from the antenna, or the RF choke coil in that circuit, signals come in just the same.

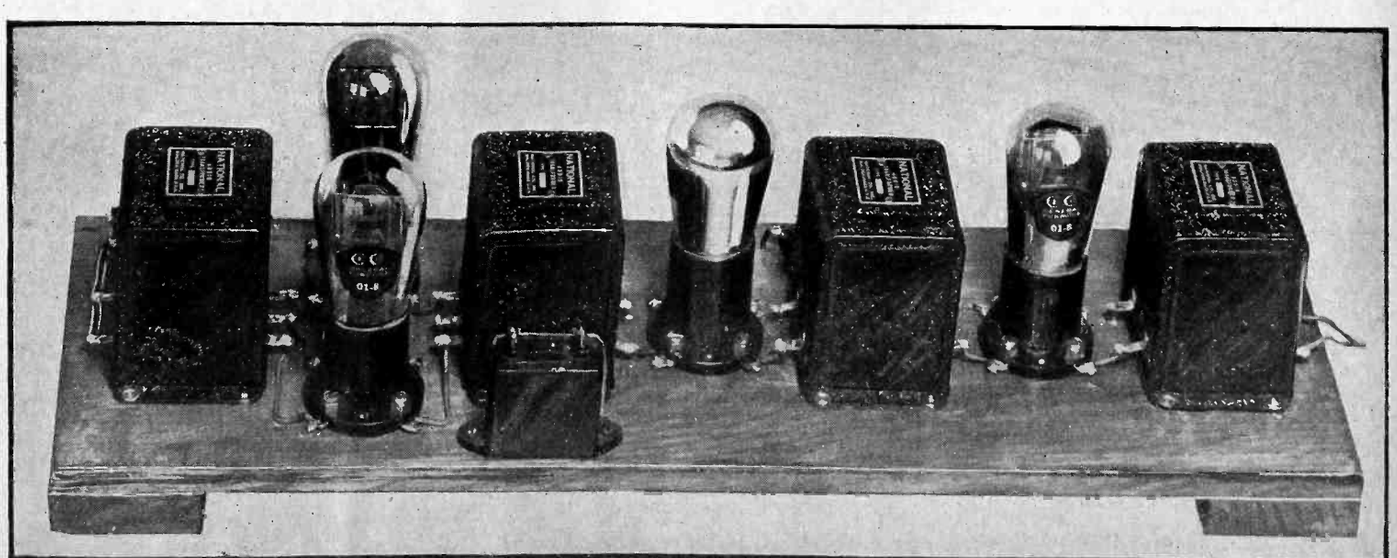
Some funny effects in reception were noticed, one in particular being the "negativing of the image. What we had been seeing as the shadow suddenly turned into a lighter figure against a darker background.

In other words, the positive image turned negative.

Phase Displacement?

What the reason for this was I do not know, but it may have been due to phase displacement between the ground wave and the sky wave. If so, this displacement would be susceptible of measurement, and the height of the Heaviside layer might thus be determined.

I am using an induction motor, but I am



THE THREE-STAGE TRANSFORMER COUPLED AMPLIFIER USED BY JAMES MILLEN IN RECEIVING MOVING PICTURES FROM WASHINGTON. THE LAST STAGE, AT LEFT, IS PUSH-PULL.

Movies Tuned in

Washington, D. C., ance 500 Miles, Record

trying to get a synchronous motor. The timing of the induction motor is too difficult for easy enjoyment of reception and certainty of visible reception at any given time the signal is "in." The manual adjustment of motor speed is all right for experimenting with the reception of signals, but once you have established yourself as the lucky recipient of moving images by radio you want a motor that doesn't need so much attention.

Nevertheless, my advice to all who would duplicate my installation, or make one of their own along the same general lines, would be to start with the induction motor, see what the difficulties are, knowing that you can get images, if the signal is obtainable, even when you use an induction motor. Then, once established as a television-receptionist, you will feel the urge toward the synchronous motor, and I am sure will try to get one.

I used to think the world was full of synchronous motors, until I tried to get one. I inquired at a large plant and they reported they had just one on the premises, and wanted $45 for it!

Get Started!

My advice to all interested in television is to get started. Prepare for the full dimensional and other details on how to put together a televisor. These details will be published in RADIO WORLD, and you will find a big instalment in the Show Number, dated September 15th.

There is no need to hesitate any longer. You don't have to go to any big expense. You need a motor, a scanning disc, a Neon lamp, a means of regulating the motor speed, not necessarily a tachometer. A variable resistor will serve the speed regulating purpose for a while.

As for the rest of the equipment, a short wave receiver you will want, anyway. Next week's issue of RADIO WORLD (dated September 8th) will show how to build the short wave set I used for getting Jenkins and WLEX. The audio amplifier should be a good one.

I use three stages of good transformers. A resistance stage or two may be used, but all tendency toward motorboating must be eliminated.

I tried two stages of good transformers and one stage of poor-transformer (list price, $2.50) and the edges of the pictures were blurred. But I must stress this point: you can get reception even with poor transformers, and if that's all you can afford, go to it! Better transformers give better definition.

Peep Into His Hopes

If lack of money is keeping you back, I say to you: build a televisor with what you have. You can always improve a televisor, once you've got it working, and I myself am constantly feeling the urge to improve my own. The audio is fine now, the short wave reeciver is good, and now I'm hankering for a synchronous motor.

Some later day I shall attempt to devise a plan for throwing the pictures on a large screen, instead of seeing a picture about 1½ inches square. The problem is a big one and it probably will not be solved quickly by anybody.

I've tried lens systems, and I've increased the size of the image 100 per cent., but not to much advantage, for what you gain in size by that method you lose in sharpness.

The problem is to influence a sufficiently large source of light with a shutter or equivalent device, but shutters sensitive to 60,000 cycles have yet to be invented. A most interesting theoretical solution has been proposed to me by Neal Fitzalan and I understand he will discuss it in the Show Number of RADIO WORLD.

In days to come, also, there will be developed much more sensitive (and more expensive) short wave receivers, and stronger pictures will result. For the time being I am sticking contentedly to my tried-and-true two-tube short wave receiver, with its three-stage transformer audio amplifier.

Get into the television swim now—the radio parts you have, plus about fifty dollars outlay, may give you the thrill of your life!

How Millen Set World's Record

By Ronald Ross

Radio World's Malden Correspondent

ALTHOUGH there are thousands who experiment with television there are few who succeed in receiving satisfactory pictures from any of the several transmitters of television or moving pictures.

One of the more successful experimenters is James Millen, of 61 Sherman Street, Malden, Mass. He is a well-known radio engineer. His success has not only been notable, but he has established a long distance record in television reception.

Working in his laboratory at Malden with a standard National short wave receiver, he has succeeded in picking up and reproducing the shadowgraph transmission from the Jenkins laboratory in Washington, D. C., a distance of over 500 miles. This is a record for reception by radio of this kind of signals.

Mr. Millen not only succeeded once in reproducing the pictures sent out by Jenkins, but he has succeeded several times. In fact he repeats every time he tunes in on the signals.

The transmission from the Jenkins laboratory is on a wavelength of 46.7 meters and takes place every Monday, Wednesday and Friday, 8 to 9 P. M., Eastern Standard Time (9 to 10 Daylight Time). Although the same picture is transmitted every time, there is a real thrill in being able to pick it up and far from Washington watch a little girl bounce a ball and skip a rope.

Results Compared

The fact that the same picture is transmitted every time makes comparison of successive receptions possible, to note the improvements effected in the receiving apparatus.

The pictures received are not perfect, for they are affected by fading and other transmission difficulties as well as by imperfect scanning. Nevertheless they are encouraging and constitute an animated promise that satisfactory television and moving pictures by radio will be with us before long.

Encouraging to those fans who would like to experiment with this latest fascinating pastime is the fact that the receiver used by Mr. Millen was assembled out of standard parts in only three

(*Continued on next page*)

Discs in Use Differ Much; Mar Progress

One thing that retards television at this time is the lack of a uniform system. There are too many scanning speeds as well as too many scanning rates employed. The scanning speed is not a serious deterrent because the same motor can be run at different speeds, so long as it is not synchronous. But the scanning rate is important because for each type a different scanning disc is required.

WGY System

In the system used by the General Electric Company on WGY the scanning disc contains 24 holes and it is driven at the rate of 20 revolutions per second. A few others follow this method. Previously WRNY had employed a disc having 36 holes driven at a rate of 10 revolutions per second. The system used by most of the other television transmitters employs a disc with 48 holes driven at a rate of 16 revolutions per second. In the system developed by the Bell Laboratories 50 scanning holes and a speed of 16 revolutions per second are used. But this is not on the air. In the moving picture transmission from KDKA there will be 60 scanning lines per picture and the speed of repetition will be 16 per second.

A repeating speed less than 16 per second will result in a flutter more pronounced than that in a moving picture. Hence the pictures received from WRNY will have a decided flutter. Most use a rate of 16 per second because this is the minimum that can be used without a flutter. When the speed is 20 per second the flutter will not be noticeable, and it is for this reason that WGY employs this speed.

Details in Scanning

The number of holes in the scanning disc determines the amount of detail which will show in the picture. With only 24 holes, as in the WGY system, the picture will be quite coarse, notwithstanding the absence of flutter. The WRNY pictures with 36 holes will show considerably more detail, and the 48 line pictures will show still more. The finest scanning so far used is that of KDKA with 60 lines to the picture. This will show as much detail per square inch as a newspaper half tone picture.

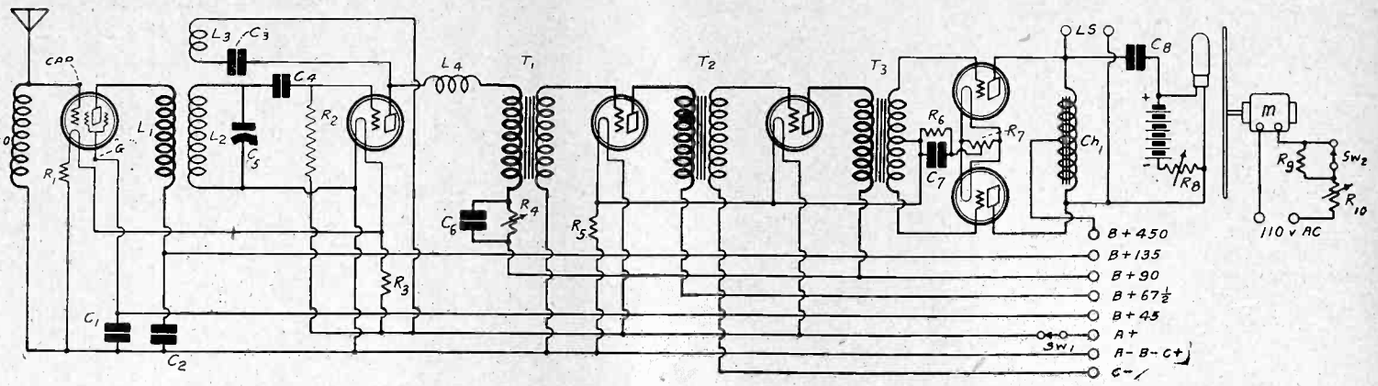
The most widely used speed of the scanning disc is 16 per second, and that undoubtdly will be accepted. It seems to be natural, for it is the slowest speed that can be used without objectionable flutter. When that has been fixed there is still the question of the number of holes to be used in the scanning disc, or the number of scanning lines per picture frame.

Greater Detail

The more lines the finer will the picture be provided that the necessary frequency range can be transmitted and received The Federal Radio Commission has allowed a channel width of 100,000 cycles for each television station. That seems to be wide enough to permit satisfactory radio transmission. But the channel width permitted is not the only limitation on the frequency range. A wire channel cannot be made economically to transmit such a frequency range, and the signal will traverse a wire line over part of the course, even when the signal originates in the studio.

The number of holes in the latest scanning disc now used by WRNY is 44, and this was used in the public demonstration held recently at New York University.—J. E. Anderson.

Jenkins' Movies



COMPLETE CIRCUIT DIAGRAM OF JAMES MILLEN'S TELEVISION RECEIVER WITH WHICH HE RECEIVES MOVING PICTURES FROM WASHINGTON.

(*Continued from preceding page*)

hours' time. In this period Mr. Millen and two friends not only built the receiver, but they tuned it in on the signals from Washington and synchronized the apparatus so that the picture could be seen clearly.

Description of Set

A description of the set used by Mr. Millen will be of interest to those who are experimenting with television.

The scanning disc used was the 24-inch National with 48 radial shaped holes. It was driven with a Baldor variable speed motor. A regular Blanchard tachometer was used as an aid in attaining synchronous speed. This device is not essential, but is a great convenience. A 0-75 ohm rheostat R12 in the motor supply line was used to vary the speed of the motor and to hold it at synchronous speed once it had been attained. An additional 10-ohm resistor R11 is put in series with the line, but this is provided with a short circuit switch.

The output of the receiver was impressed on a regular Raytheon Kino lamp, which is of the Neon type. When this lamp was viewed through the scanning disc running at synchronous speed the moving pictures appeared.

The picture carrying signal was tuned in with a standard National short-wave receiver employing a screen grid amplifier tube and a -12A detector in a regenerative circuit.

The output of the detector was amplified by a three-stage National transformer coupled audio amplifier, the last stage of which was push-pull. The first two tubes in the amplified were of the -12A type and the two in the push-pull stage were of the -10 type.

The complete circuit diagram of the television receiver is illustrated herewith. The impedance, L0, in the grid circuit of the screen grid tube is a National No. 10 RF choke, L4, is a radio frequency choke, Type 90, of the same make.

Plug-In Coils Used

The tuning coils L1, L2 and L3 are the National short-wave plug-in coils. There is a set of four of these coils which cover the entire short-wave range.

R1 is a 15-ohm Lynch Equalizor and R3 is a Lynch Type 2 Equalizor. R2 is a 6-megohm metallized grid leak and R4 is an Electrad 0-to-500,000-ohm variable resistor. This is the regeneration control.

Condensers C1 and C2 are .5 mfd. units. C3 is a .001 and C4 a .00025 mfd. C5 is a National 125 mmfd. variable condenser. C6 is a 1 mfd. unit. Sw is a Yaxley filament switch.

The grid bias for the first audio tube is derived from the drop in the ballast resistor R5, which may be a Type 2 Lynch Equalizor. R6 is a grid bias resistor of 750 ohms. This is by-passed by a condenser of 2 mfd. The grids of the push-pull stage are returned through R6 to a 50-ohm center tapped resistor R7.

The grid bias on the second audio stage is obtained from a battery which should have a voltage of either 4.5 or 6 volts.

Loudspeaker and Kino Lamp in Parallel

The loudspeaker and the Kino lamp are connected in parallel across the mid-tapped output coil. The speaker is used to aid in tuning in the signal. When the signal is tuned in the loudspeaker may be cut out so that all the output may be delivered to the Kino lamp.

The Kino lamp is separated from the loudspeaker circuit by a 1 mfd. C8. This allows the AC signal to pass to the lamp but separates the DC voltages applied to the lamp and the tubes.

A voltage of 180 volts is applied to the Kino lamp in series with a variable resistor R8. The object of this variable resistor is to limit the direct current in the lamp to a value of 10 to 15 milliamperes.

[*How to build the National Short Wave circuit alone, for reception of broadcasting, television, televised movies and code,* 14.5 *to* 115 *meters, will be described in next week's issue, dated September 8th. All persons interested in television or short wave reception generally may now send their queries to James Millen, c/o Radio World,* 145 *West* 45*th Street, New York City.*]

LIST OF PARTS

L1, L2, L3—One set of four National short-wave plug-in coils.
C1, C2—Two .5 mfd. Aerovox condensers, 200 volt test.
C3—One .001 mrd. Aerovox condenser.
C4—One .00025 mfd. Aerovox condenser.
C5—One .000125 mfd. National tuning condenser.
C6—One 1 mfd. Aerovox condenser, 200 volt test.
C7—One 2 mfd. condenser, 200 volt test.
C8—One 4 mfd. condenser, 400 volt test.
R1—One Lynch Equalizor, Type 15.
R2—One Lynch 6 megohm metallized resistor.
R3—One Lynch Equalizor, Type 2.
R4—One Electrad 0-500,000-ohm resistor.
R5—One Lynch Equalizor, Type 2.
R6—One 750-ohm resistor.
R7—One center tapped 50-ohm resistor.
R8—One power Clarostat.
R9—One Lynch 10-ohm resistor.
R10—One 0-75-ohm rheostat.
Sw—One Yaxley filament switch.
L0—One National choke, Type 10. 10.
L4—Ose National radio frequency choke, Type 1.
Two National audio transformers.
One National push-pull input transformer.
One National push-pull output choke.
One Kino lamp.
One National 24-inch, 48-hole scanning disc.
One small AC motor.
Seven standard sockets.
Three CeCo F12A tubes.
Two CeCo L-10 tubes.
One National dial with pilot light.
Sixteen binding posts.

An Ingenious Coil Keeps Voltage Right

Resistovolt is a handy and timely product, developed by the Insuline Corporation of America, 78 Cortlandt Street, New York City, specialists in Insuline panels, television equipment, radio parts and insulating materials for radio and electrical uses. It fills a long-felt want on the part of electric set owners and experimenters with AC tubes. Resistovolt is a compact device, easily and quickly installed by anyone and its purpose is to check excess voltage before it can blow the delicate filaments of any type of AC tube.

It has a specially constructed coil of an imported material which reacts only when the line output is higher than 110 volts and conversely does not decrease the voltage when below 110 volts.

Acting as a valve, it allows only the working voltage to enter the set, holding back the excessive line voltage and preventing damage to tubes and circuit. It also fills a useful purpose to this end in the case of A and B eliminators.

In case of excessive line surges or short circuits this inexpensive device also acts like a fuse, blowing out and saving the set, AC tubes or power equipment.

Resistovolt is a small cylindrical bakelite product, shaped like a plug, with prongs at one end that plug into the electrical outlet, the other end being a socket to receive the set plug which is usually connected therein. For the users' convenience there are two types, Type I.C.A.-7 operates any electric set up to seven tubes; I.C.A.-10, operates seven to ten tubes, both working on AC or DC. Full information may be had from the above concern upon application. Mention RADIO WORLD.

WRNY Shows Television

A DEMONSTRATION of television reception held recently at Philosophy Hall, New York University, before a group of newspaper men, radio engineers and members of the trade, marked the inauguration of a regular television transmission schedule over WRNY. Hugo Gernsback, editor of "Radio News" and head of the transmitting station, spoke briefly before the demonstration and outlined the problem of television. He called attention to some of its difficulties.

He emphasized that television as it is today is not for the general public but only for the experimenter.

He expressed the confident hope that within six months or a year the art would be developed to the point where television receivers could be offered to the public.

Woman Televised

While Mr. Gernsback was speaking John Geloso of Pilot Electric Co., who had developed the television apparatus used both at the transmitter and receiver, was tuning in the station and synchronizing the scanning element. Mr. Gernsback invited all present to pass by the television apparatus to watch the animated image of Mrs. Geloso who at that moment was sitting many miles away in the transmitting station in Coytesville, N. J.

The received image was of sufficient definition to enable the observers to see the woman's features distinctly. The animated image did not stay in one place but continually shifted in one direction. This was due to lack of perfect synchronization. But this movement did not interfere with the clarity of the image.

Image Striated

The field of view clearly showed the effects of imperfect scanning, for it contained clearly defined striae. This indicated that the scanning disc used had not been made as carefully as it could have been.

But this defect was of minor importance and can be overlooked very easily at this stage of television development. The streaky appearance of the received image will be cleared up as quickly as the distortion was cleared up in broadcast reception —more quickly, in fact, for the cause is better understood.

During his remarks Mr. Gernsback explained that the lack of detail in the received image was due to the necessity of keeping the sidebands within the prescribed limit of 5,000 cycles.

"If a side band of 60,000 cycles could be used," he said, "much better images could be reproduced in the receiver."

Good Demonstration

The television signals transmitted by WRNY, 326 meters, also go out simultaneously over 2XAL, 30.91 meters. The transmission is on the hour, every hour WRNY is on the air.

The demonstration was a good one and experts present praised it.—J. E. Anderson.

Televised Music Drama Enjoyed by Wire

The television transmission of a puppet drama accompanied by music and spoken explanations was effected by L. Bamberger & Co., Newark, N. J., operators of WOR for the first time recently.

Puppets were used in place of living actors because of the limitations of present television equipment.

The received image was only three inches square but large enough to enable all present to view the performance. Each of the witnesses of the demonstration was supplied with a headset with which he could hear the music and speech at the same time that he was veiwing the action.

The transmission took place over a wire system and was not broadcast over the radio station. It is a simple step to put the television signals on radio, for it is only necessary to substitute the televisor for the microphone.

However, for radio transmission two separate channels are necessary to effect simultaneous transmission of both sight and sound.

The apparatus was developed by Dr. Paul A. Kober, director of Daven Radio Corporation Laboratories, and by engineers of WOR. Dr. Kober was formerly associated with the Radio Corporation of America and with the General Electric Co. He has been specializing in television.

Quality Aspects of Indian's Receiver

[*The circuit discussed by the author in the third and final instalment, which follows, was shown in diagrams and amplified by text in the August 18th and 25th issues*].

By Gerald Mohawk

Full-blooded Native American Indian.

There can be no good quality of any considerable volume unless a power tube is used in the last stage. The preferred tube is the —50, and this must be supplied with plate voltage of the order of 450 volts, a grid bias of about 84 volts, and a filament voltage of 7½ volts, although a —10 tube may well be used.

The output circuit of this tube should be arranged so that the alternating component of the plate circuit is returned directly to the filament and not through the power supply. There is only one method of doing this, and that is by a choke coil and a condenser. Condenser C11 is connected between the plate and the speaker and the speaker is then connected to the midtap of the filament transformer T.

The object of returning the signal component directly to the filament rather than through the power supply is to prevent as far as possible the feedback through the common impedance and hence to reduce the tendency to motorboating and distortion from this effect. The effectiveness of this is greater the higher inductance of choke coil Ch4 and the larger the capacity of C11.

Therefore the capacity of C11 should not be less than 4 mfd. It would be much better if a capacity as large as 16 mfd. could be used. Also the inductance of the coil Ch4 should be at least 30 henries when the full plate current of the tube flows through it. A 100 henry coil would be much better.

Grid Voltage Arrangement

A necessary condition for continued good operation of the receiver is that all the grid voltages be negative at all times, no matter what the signal level may be. In the first AF amplifier the signal level will be low so that the voltage drop in the amperite R4 will be enough. This drop is one volt, which allows a signal amplitude of nearly ½ volt.

In the second stage the drop in the amperite is not enough. An additional voltage of from 3 to 4½ volts is necessary. If the total bias is 5½ volts an amplitude of a little over 5 volts is permissible. This will develop a possible voltage amplitude of more than 84 volts on the grid of the power tube.

A bias of 84 volts should be put on the grid of the power tube when the plate voltage is 450 volts.

The Additional Eliminator

In Fig. 2 is shown a low power B battery eliminator suitable for supplying the voltages for the radio frequency tube and first audio tube in the resistance coupled amplifier outlined in Fig. 1. This use of a separate B eliminator is consistent with the arguments set forth in the first column on this page.

The highest voltage of the additional B supply is assumed to be 135 volts. This is just right for the plate of the screen grid tube and it is also correct for the plates of the detector and the first audio tubes. The 45 volt tap is used for the screen grid.

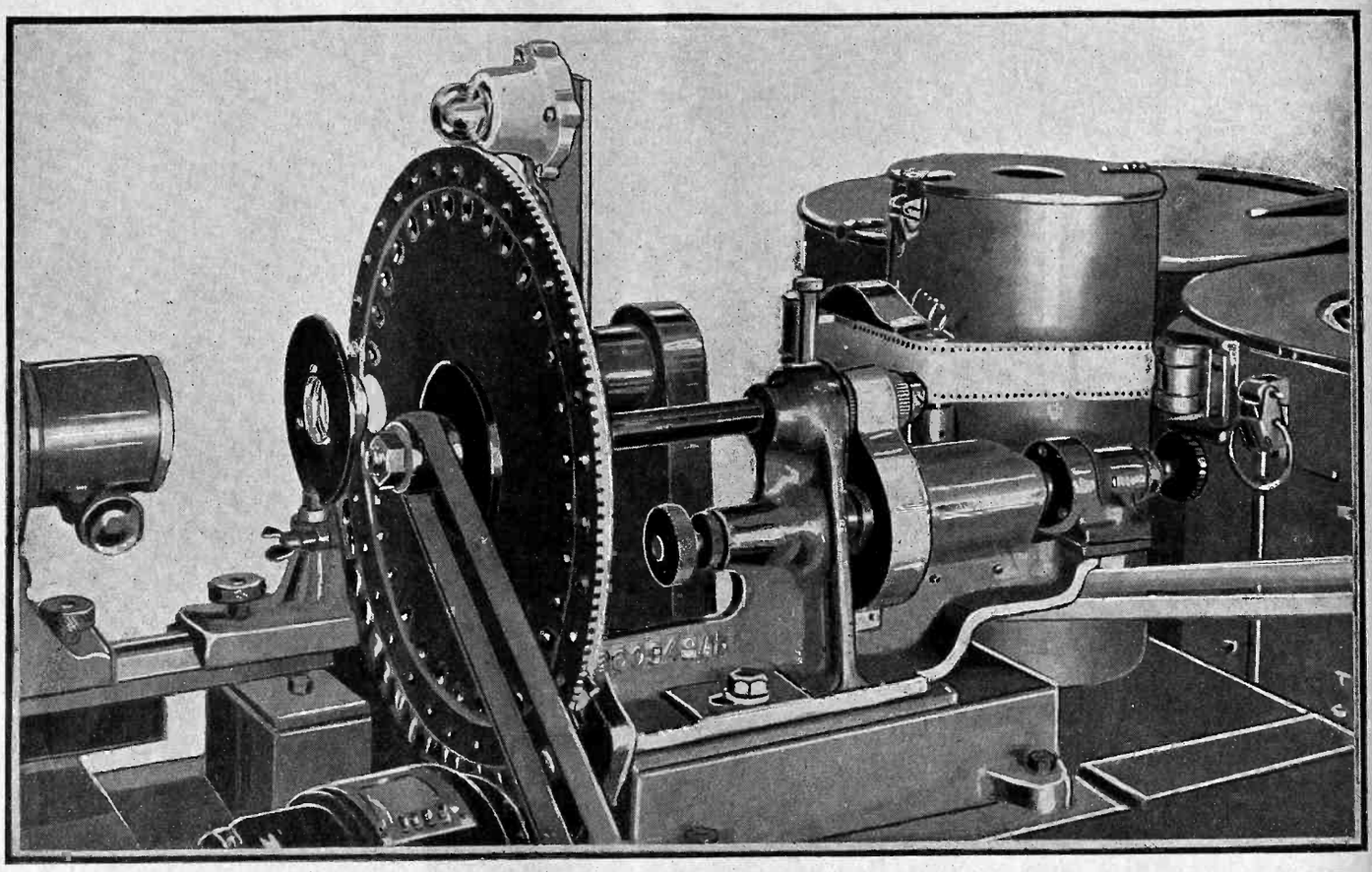
High Voltage Supply

Fig. 3 shows the circuit of the high voltage supply. It has a maximum voltage of 450 volts and one tap at 180 volts. The higher voltage is used for the plate of the power tube and the lower for the second audio tube in Fig. 1. If the voltage divider contains other taps they may be ignored.

A rectifier tube of the —80 full wave type is shown in this circuit. Ordinarily the two —81 tubes for full-wave rectification are used for such high voltages. The smaller tube may be used, for it will deliver all the current required without overtaxing it, and it will stand the voltage unless the tube should be defective, with the plates too close to the filament. This can be determined by inspection.

There are also several full-wave gaseous tubes which could be used in the high power battery substitute.

Get Ready to Tune in



THE MACHINE USED BY DR. FRANK CONRAD FOR TRANSMITTING MOVING PICTURES BY RADIO. THE OPTICAL SYSTEM IS AT LEFT AND THE SCANNING DISC IN THE CENTER. THE LARGE CYLINDER BACK OF THE FILM CONTAINS THE PHOTO-ELECTRIC CELL.

Westinghouse Phones Impulses Two Miles and Returns Them to KDKA by Radio—Standard Film Used — Results Clear as a Photograph in a Newspaper—How It Is Done

By Neal Fitzalan

THE development of television by radio has turned to motion pictures, and already the results are so gratifying that that Westinghouse Electric and Manufacturing Co. plans to include motion pictures as a part of the regular schedule of KDKA at Pittsburgh, to be started in a few weeks.

It will be recalled that KDKA was the first broadcasting station to go on the air. And now it will also be the first to go on the air with television in the form of motion pictures.

The man responsible for the initiation of broadcasting was Dr. Frank Conrad, assistant chief engineer of the Westinghouse Company. He is also responsible for the development of the apparatus by which motion pictures will be broadcast and received.

Since broadcasting of moving pictures is more complex than either still picture projection or television transmission, much special and delicate equipment had to be designed before the pictures could be transmitted.

One of the main difficulties was exact synchronization of the transmitting apparatus with the receiver. This the Westinghouse engineers accomplished in an ingenious and positive manner under the direction of Dr. Conrad.

The transmission of moving pictures is done from standard film. The film moves in front of the lens and illuminating light at the rate of sixteen pictures a second, the same as in motion pictures, except that the film moves at a uniform rate and not intermittently.

Sixty Lines Per Picture

As the film moves along it is scanned by a disc somewhat like that used in television transmission. The disc used contains a large number of square holes, all at the same distance from the center. In this it differs from a television scanning disc in which the holes are arranged in a spiral.

The scanning disc causes a pencil of intense light to sweep across the film in parallel lines that are perpendicular to the length of the film. There are sixty lines per picture frame. Since the length of a picture is about ¾-inch, the scanning is considerably more detailed than any used in television, and produces a definition as good as that of a newspaper half-tone.

The light that passes through the film enters a large photo-electric cell of the caesium type. This cell converts the light and shade gradations on the film into corresponding electric current variations. These are amplified and sent to the radio transmitter in the same manner as the output of a microphone.

Wide Frequency Range Involved

The electric current which is the equivalent of the picture contains a wide range of frequencies. Since there are sixty lines per picture and sixteen pictures per second the light will cross the picture 60x16, or 960 times per second. This would indicate that the lowest frequency contained in the current is 960 cycles per second.

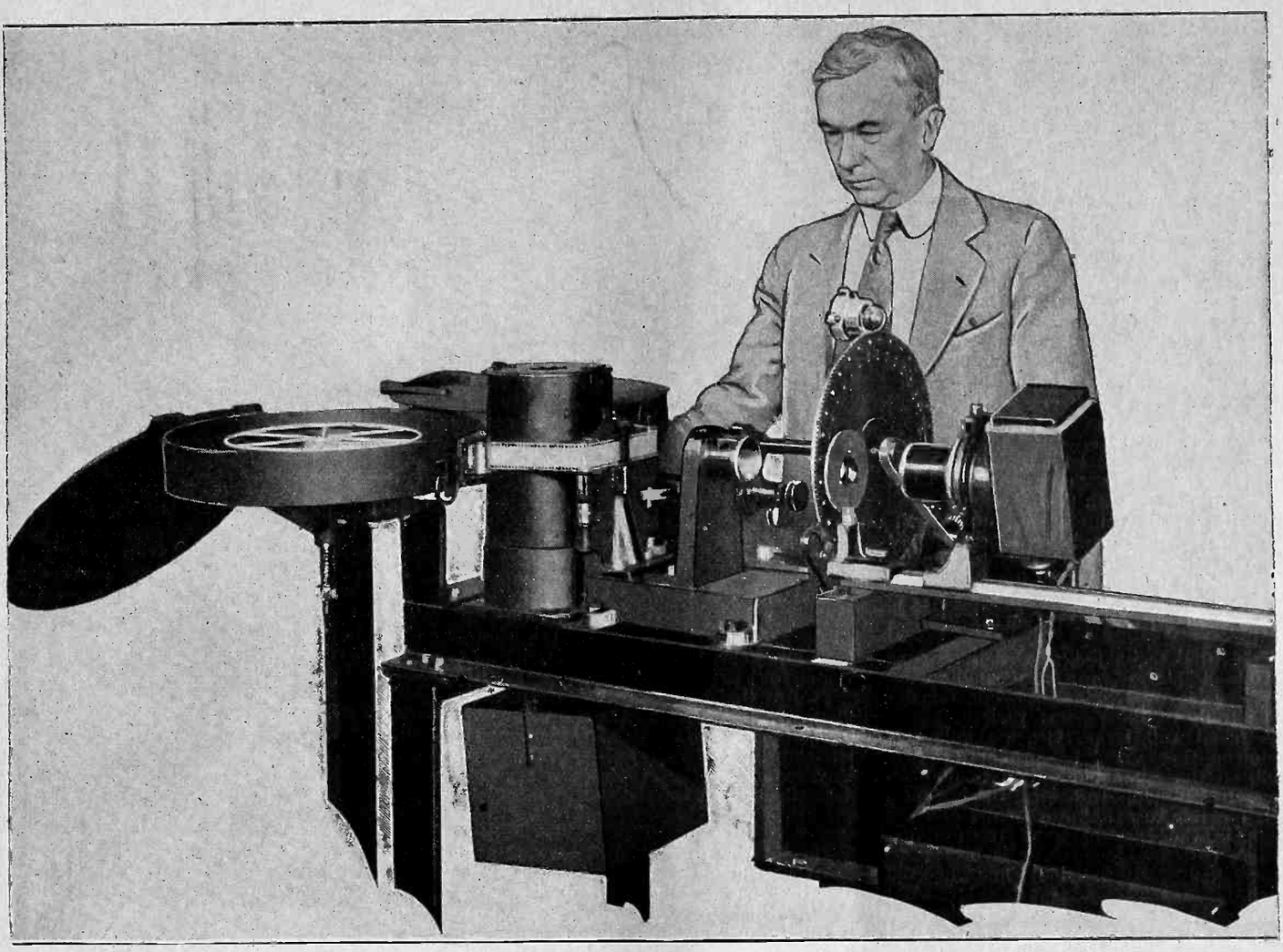
Since the intensity of the picture in any strip varies, the current will also vary at much higher frequencies, the rate depending on the variation. Where there are sharp contracts between light and dark areas extremely high variations in current intensity will occur. In fact for true reproduction there would have to be radio frequencies present.

Dr. Conrad states that the output contains frequencies from 500 to 60,000 cycles per second. The lower limit may be due to a sub-harmonic of the 960 cycle frequency and the upper is an arbitrary value set by the limitations of the transmission equipment.

Since such a wide range of frequencies is transmitted the same range must be received in order that the true value of the picture may be brought out. No ordinary receiver is capable of doing this, for very few receivers cover a band wider than that between 100 and 8,000 cycles per second. But it is a relatively simple matter to design a receiver which will be efficient over the 500 to 60,000 cycle range.

Although the average radio receiver is not capable of receiving the entire range of frequencies involved in the transmission of moving pictures, fairly good re-

KDKA Radio Movies!



DR. FRANK CONRAD, ASSISTANT CHIEF ENGINEER OF WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, WITH HIS APPARATUS FOR THE TRANSMISSION OF MOVING PICTURES BY RADIO.

sults may be obtained with an average set. The only difference will be that the pictures will appear to be slightly out of focus.

At the receiver a scanning disc of the ordinary type is used and this distributes the picture strips on a stationary screen in the same order as they were transmitted.

A necessary condition for successful reception is that the receiver scanning disc rotate at exactly the same speed as the transmitter, and in the same phase. If the speed is not the same the picture will not appear. If the phase is not right the picture will not be framed properly. It may be that the left half of the picture will appear at the right or that the top half will appear at the bottom. This type of phase displacement is often seen in the movies when the feet of the actors appear at the top and the heads at the bottom.

In the Westinghouse system the synchronization is done with an auxiliary frequency of 5,000 cycles which is transmitted on a carrier separate from that carrying the picture signal. It is produced by a tuning fork, the frequency of which controls both the transmitter and the receiver. The received 5,000 frequency is caused to operate a synchronous motor which in turn drives the scanning disc.

The received and amplified picture current is made to control a strong mercury arc light, the intensity of which varies in accordance with the strength of the signal current impressed on it. Hence it varies as the light and shade gradations in the picture sent out. The mercury light responds instantaneously to the changes in the incoming signal so that there is no lag in the response.

The use of a mercury lamp in the receiver permits the projection of the received images on a ground glass. This is the first time that this has been done in the transmission of moving pictures or television.

During a recent demonstration of motion pictures by radio the pictures traversed a distance of four miles—two miles by wire from the laboratory to the transmitter of KDKA and back again by radio.

The speed of the scanning disc is determined by the number of holes in the disc and the number that must cross the moving film per second. Since there are 960 picture strips every second, as many holes must pass every second. If there are 32 holes in the disc the speed must be 960/32, or 30 revolutions per second, 1,800 per minute, which is only a moderate rate of rotation. This is not difficult to duplicate.

Women, Busy in Home, Attentively Listen-in

The idea that any infinitesimal part of the national audience denies itself the privilege of hearing Jeritza or Damrosch, or any other artist on the air, because some well-known manufacturer sponsors the program, is contrary to all ones' knowledge of the habits of the American people.

It doesn't require scientific research to prove the absurdity of this—but the research, nevertheless, has been made, thoroughly and painstaking.

I do not say that it is impossible for national advertisers profitably to use the air to carry some of the same kind of advertising that is used in newspapers and magazines. Much of our best national advertising is highly educational—that is, it gives useful information about products and their uses—information that the buying public is keen to have.

And this is particularly true about products that women buy for use in the home.

Women turn on the radio during the morning and afternoon when they are busy with their household duties. During these hours, as many investigations have shown, women are glad to have not only fine musical programs, but also helpful and instructive talks by national advertisers about household products.

Broadcast advertising pays.

Thrills of Television

By Fred B. Williams

Vice-President, Raytheon Mfg. Co.

THAT television has arrived cannot be denied. It is here, even if as a crude yet mighty interesting experiment. In fact, it is going to be the broadcasting story all over again.

Most of us can recall those days when a lone radio amateur, here and there, operated a radio telephone transmitter and gave phonographic concerts over the air for such radio enthusiasts as were willing to build a receiving set and tune in.

And just as broadcasting was fostered and developed and popularized by the efforts of a handful of radio amateurs, so may we expect radio television to develop until it attains that ultimate perfection we have every reason to expect.

It is well, however, to issue a note of warning at this time. In the first place, let us be reasonable with television technique. Those who hope to see large screen images, with detail comparable with the excellent motion pictures of today, and with the entire world before them, are doomed to keen disappointment.

We might as well disillusion them from the very start.

Picture is Small

Television technique, at this time, cannot handle more than a very small screen size, say 1½ by 1½ inches, while the detail is only of the modest variety.

A face, hand, large type, a simple mechanism—these can be produced fairly well, so that the imagination is not too severely strained. In a face, for instance, it is possible to see the eyebrows and the teeth in the case of good transmission and reception. However, it is useless to expect to identify individual hairs or gold teeth.

Nevertheless, one gets a tremendous kick out of television experiments. The wonder of flashing living images through space even exceeds that of flashing the human voice or music through space.

I have seen a group of hard-boiled radio experts just as fascinated by the television reception of the WLEX signals from Lexington, Mass., as a group of boys performing an autopsy on an old phonograph.

What I mean is that the results themselves are of perhaps secondary interest, for it is the technique itself that is so fascinating.

Wonderful Thrill

Imagine, if you will, the transmitting end, with its powerful arc light, its whirling scanning disk sweeping a beam of light across the face of the sitter, the reflection picked up by the marvelous electric eyes or photo-electric cells and translated into modulations of the transmitted wave; and then step over to the receiving end, with its sensitive receiver, its amplifier, its glowing neon tube, the scanning disk, and the tiny image flickering before you, in perfect step with the prototype in the distant broadcasting studio!

The thrill of the thing is wonderful.

There is vast room for research and development and even true invention in the television technique. Just as the early radio workers were more greatly interested in their circuits than in the signals they intercepted, so must it be with television for some time to come.

Two of the main elements, namely, the photo-electric cell and the neon glow tube, have been solved. Most of the transmitting stations are employing the Raytheon Foto-Cell, while most receivers are utilizing the Raytheon Kino-Lamp.

Solved by Experts

The solution of these problems naturally has fallen in the field of gaseous conduction, and has been successful in the hands of specialists in those fields.

But the problems of scanning disk patterns, synchronism, distortionless amplifiers and many others still invite the inventive boy or man. And there may be fame and fortune—just around the corner.

List of Stations Sending Out Images

As the number of television experimenters increases there will be a greater variety of subjects transmitted.

A this time Jenkins is on the air three times a week on the 46.72 meter wave of station 3XK.

In a few weeks KDKA will go on the air with a regular schedule of moving pictures.

WGY of Schenectady has been on a regular television schedule for several months.

WRNY of New York is also sending out television as a regular feature.

WCFL of Chicago is another station which is on the air with television.

WMCA of New York is sending out still pictures as a regular feature.

WLEX at Lexington, Mass., sends out television. By the time good reception weather sets in this fall there will be many more. Hence this year promises to be rich for the television experimenter.

It is estimated that in New York alone already 2,000 television receivers are in operation, and there may be 50,000 within two months.

Selectivity's Effect On the Reception

The range of signal frequencies for television needs "high pass" audio. Transformers and chokes act as such over moderate frequency band. Hence either resistance coupling must be used throughout in both the transmitter and the receiver, or else transformer and impedance circuits of best design.

One of the greatest limitations is that of selectivity. Broadcast receivers capable of separating two stations operating 10 kc apart will cut out most of the picture carrying side frequencies. In the case of the KDKA 500 to 60,000 cycle picture transmission they will cut out practically all. Hence receivers used for receiving television in all its forms must be made comparatively non-selective. Roughly one-tenth as selective as a good quality broadcast receiver.

Such broadness is not possible in the broadcast band, and therefore most of the selectivity is gained on the short waves, approximately one-tenth as long as those used in broadcasting. And it is on these waves that television may now be found, from 20 to 50 meters.—Frank E. Johnson.

Radio Music Played As Silent Light Patterns

In the absence of television signals the radio enthusiast may conduct some interesting experiments with a television lamp and the usual broadcast receiver.

One of the most interesting phenomena available with the use of such a lamp is the production of endless musical patterns in response to the usual broadcast signals.

May Be Spun By Hand

In this instance the lamp is inserted in place of the loudspeaker, so that the ampliefied signals are converted into varying luminosities rather than into audible effects.

The lamp is now studied through a revolving disk with a suitable pattern of holes. This disk, known as the scanning disk, may be home-made, of light metal such as iron, aluminum or cardboard, with ¼-inch holes arranged in a suitable spiral of a turn or two. Experimentation will soon indicate the most suitable arrangement for the holes.

The disk may be spun by hand for the preliminary experiments, and later by a small electric motor with variable speed control.

Great Variety

When viewing the neon tube through the scanning disk, many patterns will be seen.

These patterns are of almost infinite variety, and are formed in accordance with the kind and strength of the radio signals, together with the speed of the scanning disk and the arrangement of the holes. In this manner we can get to recognize a jazz pattern, a speech pattern, and so on—perhaps.

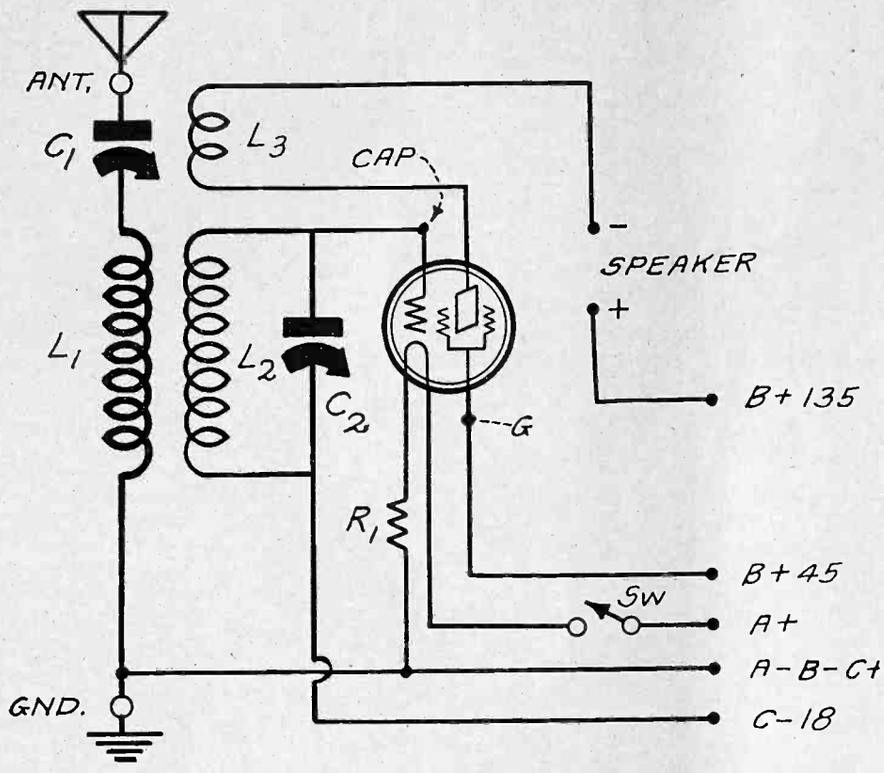
The main consideration is to employ a lamp which is sufficiently responsive to delicate signal variations, and which has a sufficiently large glowing surface. The Raytheon Kino-Lamp answers both these requirements, experimenters report after careful tests.

SMITH TAKES ON NEW LINE

Howard F. Smith, 142 Liberty Street, New York City, for many years has been doing a good selling and promoting job for the well-known Electrad products and also for the Allen D. Cardwell line, and he now announces that he has taken on also the line of products manufactured by the Rotor Corporation of America. The first featured item of this company is the Rotor, a synchronous motor for phonographs. Those interested should write to Mr. Smith at the above address. —J. H. C.

Simplest 1-Tube Set

By Herbert E. Hayden



REGENERATION OBTAINED AT ONE END OF THE FREQUENCY SPECTRUM REMAINS GOOD ENOUGH FOR USE AT THE OTHER END, WITHOUT ADJUSTING THE TICKLER, BY USE OF THE ABOVE CIRCUIT, EMPLOYING A SCREEN GRID TUBE USED AS A NEGATIVELY BIASED DETECTOR.

A ONE-TUBE set may be built around a screen grid tube used as a grid biased detector by using fixed regeneration and tuning only with the condenser C2. The coupling, such as a pair of transformer stage, will give good operation for a speaker.

Such a circuit is all right for the reception of locals, but can not be expected to "step out" very much, although some distance reception may be counted on.

The fact that regeneration may be used without altering the tickler setting is due to the characteristics of the screen grid tube. The plate to control grid capacity of the tube is .02 mmfd. This is so tiny that no feedback takes place through the elemental capacity.

Moreover, the use of grid biased detection adds to the possibility of obtaining a fixed setting of the tickler that will apply well throughout the broadcast band.

The tickler should be tried in parallel aiding and in parallel opposing, as the action is different, as will be explained.

Function of C1

The series condenser in the antenna circuit is of the pressure type and may be used as an aid to the suppression of oscillation, where too much feedback is encountered.

This condenser reduces the capacity in the antenna circuit, hence lowers the effect of the antenna resistance upon the tuned secondary.

As oscillation is governed in part by the amplitude, or signal strength, some very strong stations may cause the set to "plop," therefore adjust the series condenser C1 until you get no free oscillation at those strong values of signal voltage, whereupon you should get no such trouble from any other station.

The primary and the secondary of the antenna coupler are of the usual sort. For a solenoid these windings, both on the same 3-in diameter form, may consist of 14 turns for L1, 50 turns for L2 (for .0005 mfd. tuning), No. 24 wire, of any type insulation, being used. The tickler may consist of the same kind or finer wire, also insulated, and have 42 turns. All windings are in the same direction.

The separation between respective windings is ¼ inch.

Use Earphones First

The circuit may be tried out as a one-tube receiver, using earphones. The wiring is done in the usual way, with antenna connected to the beginning of the primary, at top of the coil, ground and A minus to the end of the primary, C minus to that terminal of the secondary that is adjacent to the end of the primary, while the remaining free terminal of the secondary goes directly to grid.

The beginning of the tickler, which is the terminal right next to the grid connection of the secondary, may be connected through the earphones to B plus 135 volts, while the other terminal of the tickler goes to plate of the tube. This affords parallel aiding. The tickler field aids the secondary field and bucks the primary or antenna circuit field.

Under these conditions regeneration at the highest received frequency may be adjusted so as to be just below the point of oscillation, either by slightly reducing the B voltage on the plate or on the screen grid (G post of socket), or by adjusting also the antenna condenser C1.

After having tried this system, see whether improved results are obtained by reversing the tickler connections, and using regeneration on the highest receivable wavelength (lowest frequency) as your basis of testing. The two methods of tickler connection work in opposite direction: the parallel aiding method affords greater regeneration in direct proportion to increase in frequency, while the parallel opposing method affords regeneration suppression in the same direct proportion.

(*Concluded next week*)

LIST OF PARTS

L1L2—One three-circuit coil, as described.
C1—One .0005 to .0001 mfd. pressure type condenser.
C2—One .0005 mfd. variable condenser.
R1—One 622 Amperite.
SW—One switch.
Nine binding posts.
One standard socket.
One 7x7-inch front panel.
One 6x7-inch baseboard.
One dial.
One screen grid tube.
One pair of phones.
A, B and C supply.

Circuit Designed to Keep Up with New Developments

While every designer of a popular circuit generally takes pains to assure the prospective builder that his particular set "will not be out of date for years to come," and although yearly models generally follow one upon another with the regularity of the seasons, it is well to point out that the original Shielded Six described by McMurdo Silver in 1926 still represents as fine a TRF receiver employing —201A tubes as is available upon the market; and that with information recently made available this set could easily be adapted to use screen-grid tubes in its RF stages, so that its performance would be brought up to a level closely approaching that of the new Screen Grid Six.

No Obsolescence Worry

Mr. Silver says:

"There consequently seems little justification for worry on the score of early obsolescence. There will always be new yearly developments in radio, however, as in other lines of engineering endeavor (automobiles, for example), and these developments in radio probably will take the form of slight simplifications and reductions in cost, for nothing stands perfectly still.

"One salient fact to be noted is that certain sets built at home two years ago could have been brought up to the minute as soon, for instance, as screen grid tubes became available, and there is every reason to anticipate as much for the Screen Grid Six if new developments arise.

Better Than Factory-Made

"This was emphatically not true of ready-made sets. In any case, the curves and figures presented in the Aug. 11 instalment of the Screen Grid 720 article gave every assurance the new Screen-Grid Six represents probably as fine a set as can be built this season, and a finer one than can be procured ready-made—actually. This proves conclusively that no better receiver could possibly be bought or built at equal cost."

Screen Grid Detection

ALL TESTS SHOW GOOD EFFICIENCY

By J. E. Anderson

Technical Editor

IN the Aug. 18th issue were published curves taken on a screen grid tube working into a high resistance. One of the curves was for low screen grid voltage. This curve indicated rather high detecting efficiency.

More curves have been taken on the same tube under the same conditions, and these curves are shown in Fig. 1. The curve marked 3.3 volts in this graph is the same as that marked 6 in the preceding curve. It is marked 3.3 because that was the actual voltage applied to the screen grid. The other two curves were taken with screen voltages of 4.6 and 6 volts as indicated.

These curves were taken with the filament ballast in the positive leg, and the applied grid bias measured from the negative end of the filament. For the lowest curve the screen grid post on the socket was connected to the positive filament post, for the middle curve the screen grid was connected to the tap on the ballast resistor, and for the highest curve it was connected to the positive terminal of the filament battery.

Curves Are Similar

All the curves are similar and indicate the same detecting efficiency. The grid bias required to get the highest detecting efficiency is not the same for all the curves. It is about 1.32 volts for the lowest curve, 1.6 for the middle and 1.9 volts for the highest. The voltage drop in the 1 megohm load resistor is about the same at all these points, namely 5 volts.

The maximum voltage drop in the load resistance when the grid bias is zero is 40 for the lowest curve, 51 for the middle and 69 volts for the highest. The signal voltage swing permissible is the grid bias used in each case.

If the lowest curve is used the filament ballast may be connected in the negative leg of the filament and the required grid bias may be obtained by connecting the grid return to the midtap on the ballast. If the middle curve is used half of the ballast may be connected in the positive leg and half in the negative. The screen grid is then connected to A plus and the grid return to A minus. The grid bias will be very nearly correct for that particular connection of the screen grid. Two ten-ohm resistors should be used in this case.

If the highest curve is used all the ballast is put in the positive leg and the grid return must be connected to a point which is about 1.9 volts below the negative end of the filament. A grid battery may be used or the bias may be obtained from a resistance drop in the plate circuit, depending on the kind of voltage supply that is used. The middle curve is the most convenient to use.

Calibration Curve

The curve marked A is the calibration curve of the vacuum tube voltmeter, which was taken at the same time as the other curves in order that there should be no doubt about the accuracy. The abscissas of this curve are arbitrary units of current and the ordinates are the grid bias in volts.

The method of obtaining the voltage drop in the 1 megohm resistor is as follows: The current reading on A for a given bias on the screen grid tube was noted. Then the bias on the voltmeter tube giving that current was taken from A. That was the voltage drop in the resistor. For example, at a bias on one volt on the (6) curve the reading on the meter was 7.2 units. On curve A this is found to correspond to a grid bias on the voltmeter tube of 21.2 volts. Hence the (6) curve has one point at 1 volt and 21.2 volts. The method was described in detail in the August 11th issue.

The detecting efficiency for all curves in Fig. 1 was tested qualitatively and was found to be as expected. However, on each curve a greater detecting efficiency was shown at zero bias than at any other. The reason for this is not evident on the curves. The reason might have been brought out if the curves had been extended to positive grid bias values. This was not done, for there was considerable distortion accompanying the high detecting efficiency and for that reason it is better to operate at the points of greatest curvature on the negative side of the zero bias line.

Next week curves will be published on a —40 type high mu tube working into a high resistance.

All these curves on screen grid and high mu tubes are taken in the interest of a new audio amplifier which will be based on the information given by these curves.

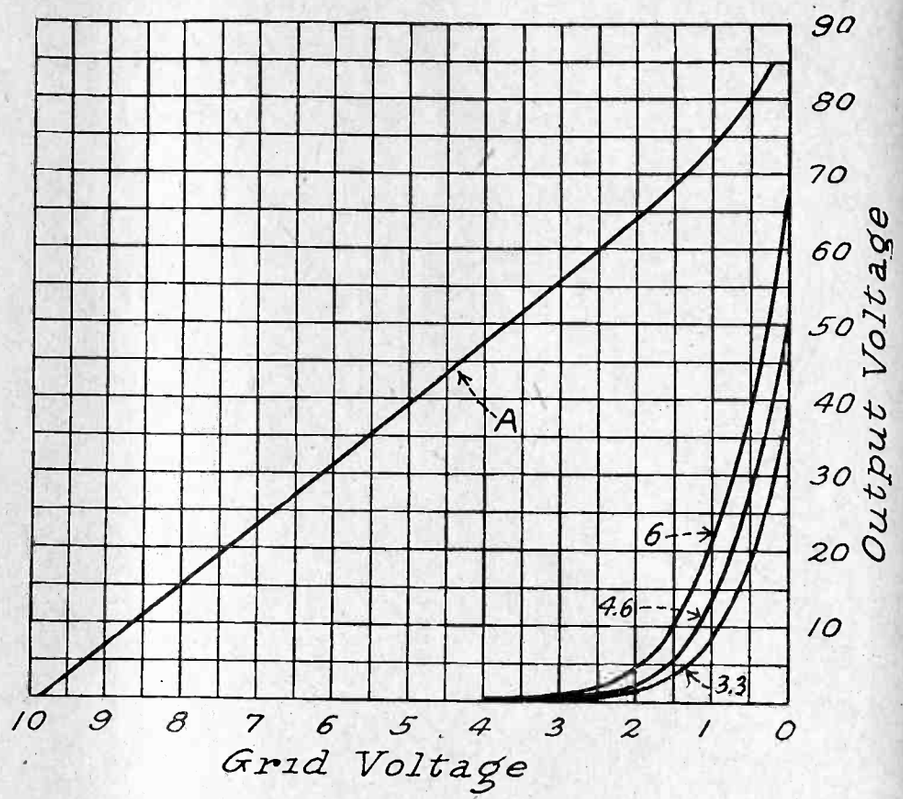


FIG. 1

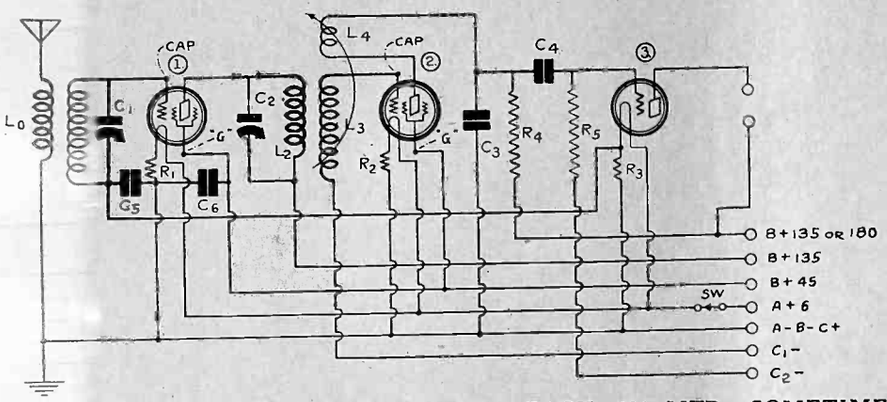
CURVES SHOWING THE GRID VOLTAGE, PLATE VOLTAGE CHARACTERISTICS OF A SCREEN GRID TUBE WORKING INTO A 1 MEGOHM RESISTOR WITH 130 VOLTS IN THE PLATE CIRCUIT AND 3.3, 4.6 AND 6 ON THE SG

Volume is Assured

ON THE SCREEN GRID ECONOMY THREE

By Herman Bernard

Managing Editor



THE BY-PASS CONDENSERS C5 AND C6, EACH .006 MFD., SOMETIMES IMPROVE OPERATION OF THIS CIRCUIT

THE looking table model of the Economy Screen Grid Three, as related in last week's issue, has the tubes in it upside down, as the sockets are mounted on the upper level of the table top. The radio frequency socket is at left, as you face the front of the table, and the detector socket is at right, with the one and only audio socket in between.

Some doubt naturally will arise as to whether this circuit will operate a speaker satisfactorily. The best answer is that such a circuit has been operating a speaker for three months, and not a word was said about the novel and effective design until full satisfaction had been demonstrated to a long list of radio experts.

The reason for satisfactory volume is very simple, mathematically, since one need compute only the amplification of the screen grid radio frequency amplifier, square the voltage at the detector input to obtain the detector output voltage, and determine whether that output, which is the input to the single audio tube, is enough to work a 112A or similar power tube.

Can Overload 112A

It is indeed enough—more than enough—for some stations it may overload a 112A tube that is negatively biased 10 volts (the 9 volts applied from a C battery and the extra volt bias obtained from the drop in the 1A Amperite R3). The remedy for overloading is to turn back the tickler—make it buck instead of aid, if need be. This bucking is necessary only with WOR in my location.

The swing at the last grid is 15½ volts for WOR.

As to assurance of regeneration, this is not so easy with a screen grid detector tube, and particularly with the negative grid bias method of detection, as with the leaky-condenser system. The inter-electrode capacity of the screen grid detector, used in the illustrated fashion, is so small as to be negligible, and this is the only tube where such negligibility exists.

Three Conditions Met

If space charge detection were used the plate-to-filament capacity would be high enough to constitute a radio frequency by-pass condenser. With our present method the by-pass condenser is included externally (C3, .00025 mfd.).

The small self-capacity therefore puts a larger burden on the tickler itself in providing regeneration. You will meet one of three conditions: (1) no regeneration; (2), uncontrollable regeneration; (3), change in volume without any squeal so characteristic of regeneration.

If you can not get regeneration, it may be due to a run-down condition of the C battery used for negatively biasing the detector. If the battery is not fresh, by all means include a large condenser to reduce the impedence of the battery. This condenser is shown as C5 and should be .006 or more. An auxiliary method is to increase the capacity of C3 to .0005 mfd. or .001 mfd., but do not make it any larger than .001 and do not use higher than .00025 mfd. unless necessary for regeneration.

If you can't control regeneration, reduce the voltage applied to the screen grid (G post) of the detector socket, so that oscillation is just present at the highest wavelength. Turn the tickler to parallel-aiding. Both coils are in the same position under such circumstances, and it is the position that gives most volume, contrasted with an equal but oppositely phased position, which gives least volume.

The mere change in volume as you turn the tickler is a good sign, since it denotes the actual presence of regeneration. In fact, mere volume change is an excellent condition, affording best stability and finest control. The sensitivity is increased very considerably when valume is increased a little. The circuit itself is sensitive without regeneration, and to use feedback as a volume control agency is good practice. The effect is noticed only on weak signals.

Lesser Resistor Values

The set may be made to regenerate more pronouncedly by adopting the methods outlined for curing utter absence of regeneration.

The only other causes for diminished or absent regeneration would be poor condition of the tubes, improper voltages on the tubes, too high a value of plate resistor (R4) and too large a winding on the secondary (L3). There are plenty of poor screen grid tubes being sold. These tubes evidently are hard to make.

Incorrect voltages obtain where B eliminators are used without high resistance meters to measure the output voltages of these B supplies. Too high a value of plate resistor (R4) may result from a resistor being of greater resistance than that rated, so try lesser marked values. It is assumed throughout that the negative bias is correct, as constructors were requested to experiment with this (C_1-). If a smaller resistor is used for R4 you may have to increase the negative bias.

In the set working in my home the negative biases from batteries and filament resistor drops were 8.7 for the detector and 10 for the 112A.

On the detector and last audio plates the voltage was 157.

CHOICE IS EMBARRASSING

Editor Radio World:

Most of the comments that I read on radio broadcasting by various correspondents in the radio magazines are against the chain system. The principal objection is that the listener gets the same program no matter to what station he tunes his receiving set.

My pet peeve is that with three good chains on the air they sometimes each broadcast a good program at the same time and I find it difficult to choose among them. Although we have four receiving sets working, I have not yet found out how to listen to three good programs at the same time.

As we are located in the country, when well-sponsored chain programs go off the air radio will lose its interest for us.

A. B. GARDNER,
511 Green St., Dowagiac, Michigan.

Screen Grid Detection

ALL TESTS SHOW GOOD EFFICIENCY

By J. E. Anderson

Technical Editor

IN the Aug. 18th issue were published curves taken on a screen grid tube working into a high resistance. One of the curves was for low screen grid voltage. This curve indicated rather high detecting efficiency.

More curves have been taken on the same tube under the same conditions, and these curves are shown in Fig. 1. The curve marked 3.3 volts in this graph is the same as that marked 6 in the preceding curve. It is marked 3.3 because that was the actual voltage applied to the screen grid. The other two curves were taken with screen voltages of 4.6 and 6 volts as indicated.

These curves were taken with the filament ballast in the positive leg, and the applied grid bias measured from the negative end of the filament. For the lowest curve the screen grid post on the socket was connected to the positive filament post, for the middle curve the screen grid was connected to the tap on the ballast resistor, and for the highest curve it was connected to the positive terminal of the filament battery.

Curves Are Similar

All the curves are similar and indicate the same detecting efficiency. The grid bias required to get the highest detecting efficiency is not the same for all the curves. It is about 1.32 volts for the lowest curve, 1.6 for the middle and 1.9 volts for the highest. The voltage drop in the 1 megohm load resistor is about the same at all these points, namely 5 volts.

The maximum voltage drop in the load resistance when the grid bias is zero is 40 for the lowest curve, 51 for the middle and 69 volts for the highest. The signal voltage swing permissible is the grid bias used in each case.

If the lowest curve is used the filament ballast may be connected in the negative leg of the filament and the required grid bias may be obtained by connecting the grid return to the midtap on the ballast. If the middle curve is used half of the ballast may be connected in the positive leg and half in the negative. The screen grid is then connected to A plus and the grid return to A minus. The grid bias will be very nearly correct for that particular connection of the screen grid. Two ten-ohm resistors should be used in this case.

If the highest curve is used all the ballast is put in the positive leg and the grid return must be connected to a point which is about 1.9 volts below the negative end of the filament. A grid battery may be used or the bias may be obtained from a resistance drop in the plate circuit, depending on the kind of voltage supply that is used. The middle curve is the most convenient to use.

Calibration Curve

The curve marked A is the calibration curve of the vacuum tube voltmeter, which was taken at the same time as the other curves in order that there should be no doubt about the accuracy. The abscissas of this curve are arbitrary units of current and the ordinates are the grid bias in volts.

The method of obtaining the voltage drop in the 1 megohm resistor is as follows: The current reading on A for a given bias on the screen grid tube was noted. Then the bias on the voltmeter tube giving that current was taken from A. That was the voltage drop in the resistor. For example, at a bias on one volt on the (6) curve the reading on the meter was 7.2 units. On curve A this is found to correspond to a grid bias on the voltmeter tube of 21.2 volts. Hence the (6) curve has one point at 1 volt and 21.2 volts. The method was described in detail in the August 11th issue.

The detecting efficiency for all curves in Fig. 1 was tested qualitatively and was found to be as expected. However, on each curve a greater detecting efficiency was shown at zero bias than at any other. The reason for this is not evident on the curves. The reason might have been brought out if the curves had been extended to positive grid bias values. This was not done, for there was considerable distortion accompanying the high detecting efficiency and for that reason it is better to operate at the points of greatest curvature on the negative side of the zero bias line.

Next week curves will be published on a —40 type high mu tube working into a high resistance.

All these curves on screen grid and high mu tubes are taken in the interest of a new audio amplifier which will be based on the information given by these curves.

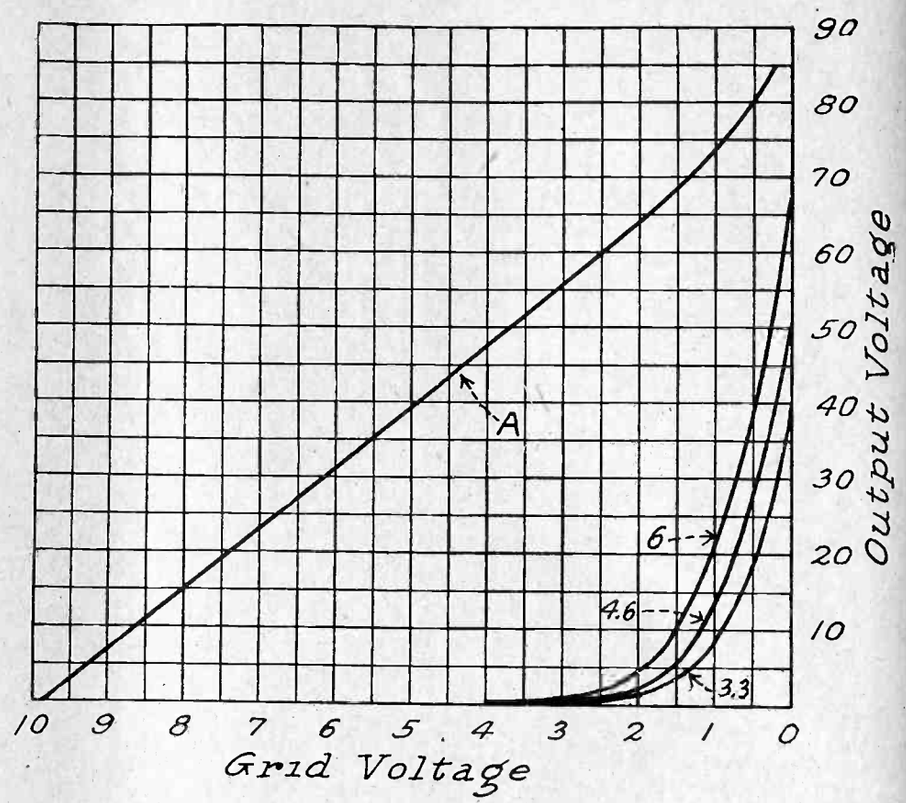


FIG. 1

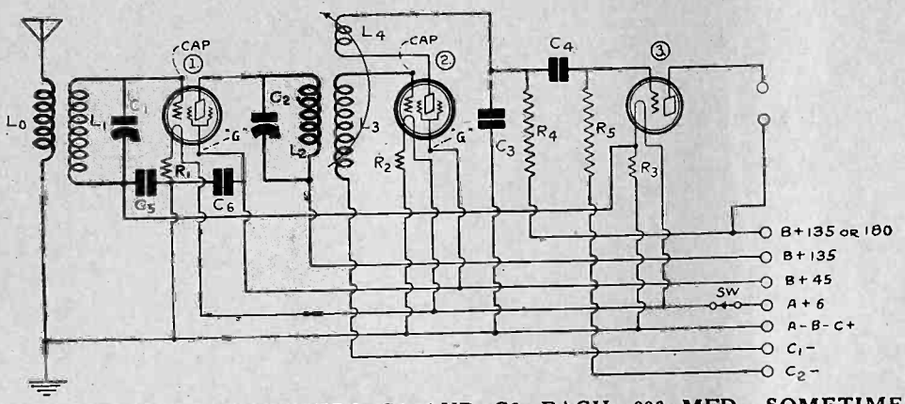
CURVES SHOWING THE GRID VOLTAGE, PLATE VOLTAGE CHARACTERISTICS OF A SCREEN GRID TUBE WORKING INTO A 1 MEGOHM RESISTOR WITH 130 VOLTS IN THE PLATE CIRCUIT AND 3.3, 4.6 AND 6 ON THE SG

Volume is Assured

ON THE SCREEN GRID ECONOMY THREE

By Herman Bernard

Managing Editor



THE BY-PASS CONDENSERS C5 AND C6, EACH .006 MFD., SOMETIMES IMPROVE OPERATION OF THIS CIRCUIT

THE smoking table model of the Economy Screen Grid Three, as related in last week's issue, has the tubes in it upside down, as the sockets are mounted on the lower level of the table top. The radio frequency socket is at left, as you face the front of the table, and the detector socket is at right, with the one and only audio socket in between.

Some doubt naturally will arise as to whether this circuit will operate a speaker satisfactorily. The best answer is that this very circuit has been operating a speaker for three months, and not a word was said about the novel and effective design until full satisfaction had been demonstrated to a long list of radio experts.

The reason for satisfactory volume is very simple, mathematically, since one need compute only the amplification of the screen grid radio frequency amplifier, square the voltage at the detector input to obtain the detector output voltage, and determine whether that output, which is the input to the single audio tube, is enough to work a 112A or similar power tube.

Can Overload 112A

It is indeed enough—more than enough—for some stations it may overload a 112A tube that is negatively biased 10 volts (the 9 volts applied from a C battery and the extra volt bias obtained from the drop in the 1A Amperite R3). The remedy for overloading is to turn back the tickler—make it buck instead of aid, if need be. This bucking is necessary only with WOR in my location.

The swing at the last grid is 15½ volts for WOR.

As to assurance of regeneration, this is not so easy with a screen grid detector tube, and particularly with the negative grid bias method of detection, as with the leaky-condenser system. The inter-electrade capacity of the screen grid detector, used in the illustrated fashion, is so small as to be negligible, and this is the only tube where such negligibility exists.

Three Conditions Met

If space charge detection were used the plate-to-filament capacity would be high enough to constitute a radio frequency by-pass condenser. With our present method the by-pass condenser is includ d externally (C3, .00025 mfd.).

The small self-capacity therefore puts a larger burden on the tickler itself in providing regeneration. You will meet one of three conditions: (1) no regeneration; (2), uncontrollable regeneration; (3), change in volume without any squeal so characteristic of regeneration.

If you can not get regeneration, it may be due to a run-down condition of the C battery used for negatively biasing the detector. If the battery is not fresh, by all means include a large condenser to reduce the impedence of the battery. This condenser is shown as C5 and should be .006 or more. An auxiliary method is to increase the capacity of C3 to .0005 mfd. or .001 mfd., but do not make it any larger than .001 and do not use higher than .00025 mfd. unless necessary for regeneration.

If you can't control regeneration, reduce the voltage applied to the screen grid (G post) of the detector socket, so that oscillation is just present at the highest wavelength. Turn the tickler to parallel-aiding. Both coils are in the same position under such circumstances, and it is the position that gives most volume, contrasted with an equal but oppositely phased position, which gives least volume.

The mere change in volume as you turn the tickler is a good sign, since it denotes the actual presence of regeneration. In fact, mere volume change is an excellent condition, affording best stability and finest control. The sensitivity is increased very considerably when volume is increased a little. The circuit itself is sensitive without regeneration, and to use feedback as a volume control agency is good practice. The effect is noticed only on weak signals.

Lesser Resistor Values

The set may be made to regenerate more pronouncedly by adopting the methods outlined for curing utter absence of regeneration.

The only other causes for diminished or absent regeneration would be poor condition of the tubes, improper voltages on the tubes, too high a value of plate resistor (R4) and too large a winding on the secondary (L3). There are plenty of poor screen grid tubes being sold. These tubes evidently are hard to make.

Incorrect voltages obtain where B eliminators are used without high resistance meters to measure the output voltages of these B supplies. Too high a value of plate resistor (R4) may result from a resistor being of greater resistance than that rated, so try lesser marked values. It is assumed throughout that the negative bias is correct, as constructors were requested to experiment with this (C_1-). If a smaller resistor is used for R4 you may have to increase the negative bias.

In the set working in my home the negative biases from batteries and filament resistor drops were 8.7 for the detector and 10 for the 112A.

On the detector and last audio plates the voltage was 157.

CHOICE IS EMBARRASSING

Editor Radio World:

Most of the comments that I read on radio broadcasting by various correspondents in the radio magazines are against the chain system. The principal objection is that the listener gets the same program no matter to what station he tunes his receiving set.

My pet peeve is that with three good chains on the air they sometimes each broadcast a good program at the same time and I find it difficult to choose among them. Although we have four receiving sets working, I have not yet found out how to listen to three good programs at the same time.

As we are located in the country, when well-sponsored chain programs go off the air radio will lose its interest for us.

A. B. GARDNER,
511 Green St., Dowagiac, Michigan.

Reallocation on Way; Blow to Many Stations

Washington.

Enforcement of the Davis amendment to the Radio Act which provides for equal allocation of the nation's radio facilities among the five geographical zones, "will be very detrimental to the West," Commissioner Harold A. Lafount, representing the Fifth or Pacific Zone, informed all station owners and operators in his zone in a circular letter.

Stating that conditions in the Fifth Zone are so vastly different from those in the First Zone that it is impossible to divide radio facilities in such a way as to give equalized reception and transmission, the Commissioner said that any plan is going to reduce greatly the time of operation of broadcasting unless many stations are eliminated.

Full Text of Letter

The full text of the letter follows:

"Some broadcasters have suggested that they are paying different radio information services to supply them with all radio news from Washington, which keeps them in touch with the doings of the Commission. Consequently, it seemed unnecessary for me to write a letter each month to you broadcasters."

"However, in the hope that I may give you a little closer picture of the situation as it exists today, injecting into it my own personal views, I am sending this letter to the broadcasters of the Fifth Zone, which must be considered as purely my own personal ideas.

"You are perhaps interested to know something about the reallocation which is necessary in order to conform to the recent amendment to the Radio Act.

Tried to Solve Problem

"For the past three months we have tried to evolve some plan that would not be radical and yet a set-up that would improve radio reception and in compliance with the law.

"It is easy to divide power, and a simple matter to decide on the number of stations to be licensed in each zone, and not at all hard to divide them into classes and to provide for an equal number of each class in each zone; but, when it comes to dividing wavelengths and the power to be used on each wavelength equally between the zones, making it conform also with power and licenses, it becomes a more difficult problem. Then again, when that has been accomplished, to divide these wavelengths between States on the basis of population, still further complicates the problem.

Detrimental to West

"Some of the Commissioners, including myself, have remained at the office until midnight on many occasions trying to solve the problem. We have sought counsel and advice from engineers and attorneys, and frankly my personal opinion is that while it is possible to comply with the law, its enforcement will be very detrimental to the West.

"Conditions in the Fifth Zone are so vastly different from those in the First Zone that it is impossible to divide the radio facilities in such a way as to give equalized reception and transmission.

"No member of the Commission wants to do anything that will be radical, but each one seems anxious to do everything possible to stabilize the industry, and to give the public that which Congress intended when it made the law and passed the amendment.

Likes One Plan

"A half dozen plans have been submitted to the Commission for its consideration.

"The one prepared by Commissioners Pickard and Caldwell, the Commissioners from the Fourth and First Zones, respectively, whom we appointed as an allocation committee, and who have worked almost continuously on this set-up for the past two months, seems to have much merit.

"Today they are working with experts discussing distances, the value of stations, etc., and it seems that they will within a few days have this plan completed, or in other words prepared in such a way as to comply with the law.

"Any plan is going to reduce greatly the time of operation of broadcasting unless many stations are eliminated from the air. At the present writing the most I can expect is to have 30 full-time assignments on which to place the 125 stations now operating in the Fifth Zone.

"Seems Pretty Hard"

"This seems pretty hard on you broadcasters, but think of conditions in the Fourth Zone, with almost 200 stations. However, be assured that I am doing everything possible to watch your interest. I have personally taken no vacation and have been on the job every minute trying to find some solution and relief.

"It would be difficult for me to guess accurately, but I really think that by the time you get this letter, the Commission will have agreed upon an allocation plan, and shortly thereafter it will be determined just what position in the spectrum your station will occupy and its hours of operation. As soon as that information is available, I shall certainly advise you.

"I appreciate the confidence in the Commission expressed by many broadcasters and wish to assure you that you have not misplaced it.

Solution Difficult

"We expect to make some mistakes, but as soon as they appear we shall surely correct them. I know our work seems very slow to you, and frankly it seems just that way to me, but you have no idea how many problems this Commission have to solve and how difficult it is for five men to agree on an allocation involving over 600 stations, and perhaps 50,000,000 listeners.

"This letter is already long and I have only just started to tell you something about the allocation. However, I must conclude. But feel assured that I stand ready to supply you with any information at my disposal relative to your individual problems."

Lafount Gives an Inkling of His Wave Plan

Washington.

Commissioner Harold A. Lafount has a plan of reallocation of waves, power and time on the air. Speaking of the plan he said:

"I do not contend that this plan is an ideal one. I have submitted it as a basis for discussion by the Commission and am endeavoring to show that it is possible to comply with the law requiring equal allocation."

Although no stations would be abolished immediately under the plan, Commissioner Lafount said, it is so drawn that the number of stations can be reduced at some future time, if that should be found necessary, without changing the assigned frequencies of the remaining stations.

Idea of Permanency

Declaring that the allocation would be a permanent one, Mr. Lafount said that interference that may develop as a result of its promulgation could be cured by the elimination of stations in the future without upheaval of the remainder of the setup. "This feature is particularly commended to members of the Commission," he declared.

Under the plan an intermediate class of stations, to be known as "district service stations," would be created. These would be in addition to the stations of high power, operating on cleared channels, serving large areas, and the small stations serving local communities, which would operate on a time division basis and share channels.

25 Stations of 5,000 Watts

There would be 25 stations having power of 5,000 watts and above operating on cleared or exclusive channels; 40 stations in the country having from 2,000 to 5,000 watts operating on semi-cleared channels; 45 stations of 500 to 1,000 watts operating 3 stations to a channel, and 100 stations of 250 to 500 watts, with 4 stations to a channel. In the local category there would be 125 stations with 25 station assignments per channel.

The total number of stations for the country would be 355, the total number of channels 90 and the total number of zone assignments 67.

PFALTZ APPOINTED

Albert Pfaltz has been appointed publicity director of the National Electrical Manufacturers Association, 420 Lexington Ave., New York.

Station Moves in Hope of Curing Wobbling

WCGU, after being shut down for three weeks, while their engineers moved the transmitting equipment from Sea Gate, N. Y., to the Half Moon Hotel, Coney Island, resumed broadcasting.

Engineers discovered that they could not maintain the assigned frequency at Sea Gate, as atmospheric conditions combined with the close proximity to the ocean and the location of the antenna being on a bed of sand, subjected the carrier to a varying effect when wet or dry.

With the antenna located on the highest corners of the Half Moon Hotel this condition it is hoped will be eliminated.

Hundreds of thousands of Coney Island pleasure seekers actually see the broadcasting, as the studio has been built in an exhibition room that faces the boardwalk. This is one of the best free attractions at Coney Island.

Broadcast Waves Favored for Vision

Washington.

Recommendation that "visual" radio broadcasting experiments, including television and radio photo transmission, be permitted to continue on the regular broadcasting channels, "but within strict limits," rather than force them to other wavelengths, was made to the Federal Radio Commission by Commissioner O. H. Caldwell.

In a memorandum to Commissioner Harold A. Lafount, Mr. Caldwell stated that testing these various systems of visual broadcasting on the broad channels was desirable because an audience can be obtained without excessive individual expense. The ordinary home receiver, he said, comprises 80 per cent. of the needed apparatus for television and picture reception.

"Only by such practical tests, shared in by a growing army of 'visual receiver' enthusiasts, can we determine whether visual broadcasting and television are, in public demand, to become the counterpart of our present tremendous aural broadcasting service," he stated.

The Full Text

The full text of the memorandum follows:

"In order to report to you and to the Commission on my recommendations for the control of 'visual broadcasting' in the broadcast band—that is, the transmission of moving and still pictures by broadcasters—I have during the past two weeks personally inspected or contacted with each of the important developments now going on in this interesting field.

"'Visual broadcasting' (as distinguished from aural broadcasting) now comprises two distinctly different groups of services: (1) television or moving pictures of distant moving scenes, and (2) radio photo transmission of still pictures.

"Three popular stations Zone 1 are now broadcasting short television programs daily, and producing fairly satisfactory results within the limits of the 10-kilocycle broadcasting band.

Expressions Clear

"The expressions of a face are clearly shown, and dramatists who have seen these transmissions declare that a technique can be developed which will attractively utilize this new dimension of home entertainment on the ordinary broadcast waves. Another inventor has provided 'silhouette movies' of full-length figures—black-and-white animated cartoons—which also require an ether track no wider than the ordinary 10-kilocycle broadcast channel.

"Going to wider bands of transmission, such as 40 to 80 kilocycles, two great laboratories in New York State are already transmitting full human figures in action under daylight illumination. Within the week I have seen two men box, wrestle and fence, with fair clarity—the transmission coming over a track only 40 kilocycles wide. That same week a form of 'deferred television through the medium of motion picture films was demonstrated in Zone 2. Under this plan a greater clarity and effectiveness of television appear to be made possible through the high intensities controllable by the intermediate film element.

"The broadcasting of 'still' pictures is also developing rapidly and seems to present great possibilities to the radio audience. Such pictures are received over the ordinary receiving set, coupled with a simple mechanism ingeniously utilizing one's own home phonograph.

"The adaptation of this system to the ordinary broadcast station's standard apparatus is no less ingenious.

"While in New York I watched a broadcasting director pick up an ordinary flat phonograph record, play it in front of his microphone, and a picture of Colonel Lindbergh appeared at the receiver I was watching. Weather maps, diagrams, explanatory pictures and news photographs can now be broadcast in this way, enhancing the usefulness of the ordinary home-receiving set.

Don't Use Much Time

"Of course during all such 'visual broadcasting'—both television and 'still'—a meaningless series of buzzes and whistles occupies the wave, so far as aural receiving sets are concerned.

"To permit any considerable encroachment on the aural broadcasting time of stations will not be in the public interest. But so far all the stations attempting such services have used only a few minutes per day, during off hours.

"In my opinion it is desirable to let these 'visual' experiments continue on the broadcasting channels, as at present but within strict limits, rather than to force such visual transmission to be transferred to other wavelengths.

Tests Necessary

"Because only by testing out these various systems on the broadcast channels where an audience can be secured without excessive individual expense (since the ordinary home receiver comprises 80 per cent. of the needed apparatus) can the full future usefulness of 'visual broadcasting' be investigated. Only by such practical tests, shared in by a growing army of 'visual-receiver' enthusiasts can we determine whether 'visual' broadcasting and television are, in public demand, to become the counterpart of our present tremendous aural broadcasting service."

Stations Get Testimony of Wave Expert

Washington.

Printed copies of the testimony of John V. L. Hogan, consulting radio engineer, of New York City, before the Federal Radio Commission on July 23, relating to radio facts and principles, have been sent to all broadcasting stations in the First and Fifth Zones by the Commissioners representing those zones, O. H. Caldwell and Harold A. Lafount.

The testimony was given following the hearing of more than 100 stations among the 164 cited for alleged failure to serve the public interest. It deals with limiting the total number of broadcasting stations in the country which may operate simultaneously, without undue interference.

The Commissioners stated that they had decided to send the printed testimony to broadcasters in their zones, because of the valuable engineering information it contains.

Executive Sessions at Short-Wave Parley

Washington.

The conference of representatives of Canada, Mexico, Cuba and the United States for the discussion of administrative policies relating to the licensing of applicants for short-wave channels on the North American continent convened at the Federal Radio Commission in executive session.

The sessions, it was stated by Commissioner O. H. Caldwell, Chairman, Committee for the State Department, and in charge of relations with foreign governments for the Radio Commission, probably will consume several days. The first day's session was devoted to discussion of the topics to be considered, he said.

Jolly Jester Helps Keep Children Fit

J. Wallace Mackay, "the Jolly Jester," who combines the talents of ventriloquist, musician and entertaining health educator, is being featured regularly at WGBS, the Gimbel Bros. station in New York City.

The Jester's performance is used to bring to girls' and boys' minds the important fact that they must keep the health rules if they wish to grow up into strong men and women.

A white costume, red tie, red bows on his shoes and face made up as a clown helps to attract attention. He pretends that he has come right from Healthland on Dobbin, his horse, who is very fond of oats, therefore he is strong and can make the journey with ease.

The way the Jester brings the health rules to the children is to tell how good the various vegetables, fruits, milk, water, etc., etc., are for them. He uses dolls made up into these subjects, and as he is a ventriloquist, he makes them talk to the girls and boys to tell them to use them. Thus, if Charlie Carrot tells them they should eat him they will. Minnie Spinach weeps because girls and boys neglect her but dries her tears when they promise to eat her too. Many eat spinach when before they would not touch it. One dietician writes that spinach always went begging in her school until after the Jester's visit and now when she serves it she can hardly supply the demand. And so it goes.

The cow is called upon. The girls and boys are urged to drink water as well as milk; and to use water freely for baths, thus cleaning their bodies inside and out regularly. The Coffee Pot is thrown out of Healthland as it is not good for growing boys and girls. The Jester stresses the fact that it is necessary to see your family physician or health nurse from time to time to determine how the little bodies are improving with proper care. This all goes towards helping the girls and boys to be healthier men and women of the future.

FIRST RADIO FAN

The first radio fan was Rudolph Heinrich Hertz, a German scientist. He discovered the waves and for that reason they are often called Hertzian waves. In Germany the term "hertz" is now used for cycle in his honor. Thus the Germans speak of kilohertz when we speak of kilocycle. The "hertz" is a radio term only and not the general term for the frequency of a periodic motion like our cycle.

A THOUGHT FOR THE WEEK

ENGLISH scholars and journalists—not always meaning the same thing—have formed themselves at the request of native broadcasting station owners, into a committee for the purpose of teaching the young announcers the proper pronunciation of certain commonly mispronounced words; this for the purpose of standardization. Here's one: "House-wifery; pronounced huz-wiffery." Thus compounding the English felony of making Chumley out of Cholmondeley. We suggest a Vigilance Committee, fully armed, for some of our native announcers.

P. S.—Will Oakland's Microphone Associates, please write!

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

TELEPHONES: BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45TH STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
HERMAN BERNARD, Secretary
Kansas City, Mo.: E. A. Samuelson, 300 Coca Cola Bldg.
Los Angeles: Lloyd Chappel, 611 S. Coronado St.
European Representatives: The International News Co., Breams Bldgs., Chancery Lane, London, Eng.
Paris, France: Brentano's, 8 Avenue de l'Opera.

EDITOR, Roland Burke Hennessy
MANAGING EDITOR, Herman Bernard
TECHNICAL EDITOR, J. E. Anderson
ART EDITOR, Anthony Sodaro
CONTRIBUTING EDITORS:
James H. Carroll and Capt. Peter V. O'Rourke

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage; Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5⅛"	231 lines	150.00
½ Page, 8¼" D. C.	231 lines	150.00
¼ Page, 4⅛" D. C.	115 lines	75.00
⅛ Page, 4⅛" S. C.	57 lines	37.50
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
Per Agate Line		.75

Time Discount

52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
13 times consecutively or E. O. W.	12½%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities, 10 cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Sonora Ends Fight On Sonatron Registry

The Sonora Phonograph Company and the Sonatron Tube Company have amicably settled the dispute involved in connection with the trade marking of "Sonatron," to which opposition was originally made by the Sonora Phonograph Company.

The Sonora Phonograph Company have withdrawn all opposition and have stipulated to permit registration of the Sonatron name and trade mark.

Pre-view and Review

"PROCEEDINGS" OF THE INSTITUTE OF RADIO ENGINEERS FOR AUGUST

Lynde P. Wheeler and Ward E. Bower, of Naval Research Laboratory, Bellevue, Anacostia, D. C., describe a new type of standard frequency piezo-electric oscillator in which the frequency is independent of the constants of the electrical circuit used for driving the crystal.

This independence has been brought about by making the coupling between the driver and the driven crystal extremely loose. Acoustic feedback is used in place of electrical.

Precautions are described, showing how damping and temperature variations of the piezo crystal are reduced to a negligible minimum. A quartz bar vibrating transversely is used as frequency standard and the frequency is measured by a clock driven by a synchronous motor operated by the frequency generated. Measurements indicate that the frequency is held constant to better than one part in a million.

The frequency standard points to a possible time keeper more constant than the earth.

Regeneration's Effect

Balth. Van Der Pol, of Eindhoven, Holland, discusses mathematically "The Effect of Regeneration on the Received Signal Strength." He shows that "the amplification obtained through regeneration equals the two-third power of the ratio of the 'grid space' Vgo into the amplitude obtained with zero regeneration." The "grid space" Vgo is defined as the grid voltage change necessary to bring the plate current from zero to its saturation value. Thus the amplification obtainable with regeneration is greater the weaker the incoming signal. Experimental data are adduced to verify the theory.

Output Transformers

"Characteristics of Output Transformers," by J. M. Thompson, radio engineer, Ferranti Electric, Ltd., Toronto, Canada, is a paper discussing the requirements of transformer design to get satisfactory characteristics in output transformers when working with loudspeakers of specified impedances. Both calculated and experimental curves are given to show the effects on the output of varying certain factors in the transformer.

Quartz Plates

"Notes on Quartz Plates, Air Gap Effect, and Audio-Frequency Generation," by August Hund, Bureau of Standards, Washington, D. C., discusses the effect of load and air gap on the frequency of a piezo crystal and gives an arrangement by means of which the air gap may be micrometrically adjusted to the best value. It deals primarily with the production of audio frequencies by beats between two piezo oscillators.

Antenna Compensation

Sylvan Harris, engineering laboratory of Brandes Products Corp., Newark, N. J., discusses the "Effect of the Antenna in Tuning Radio Receivers and Methods of Compensating for It." Equations are given for determining the apparent change of inductance in the secondary circuit due to the effect of the antenna, and methods of compensating for these changes.

Hum in AC Sets

W. J. Kimmell, Research Laboratory, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa., contributes a paper on "The Cause and Prevention of Hum in Receiving Tubes Employing Alternating Current Direct on the Filament." Three possible sources of hum are considered, namely:

(1) Temperature variation of the filament due to the sinusoidal power supply resulting in a variation in the plate current.

(2) Variation of the plate current due to the voltage drop along the filament.

(3) Variation of plate current due to the effect of the magnetic field of the alternating current.

The temperature variations of the filament due to (1) the sinusoidal power supply are calculated for various types of tubes and are shown to be so small that the variation in the plate current from this cause is negligible. This is particularly true of the -26 tube. The greatest source of hum is shown to be the voltage drop (2) in the filament, because the emission center wobbles about the voltage center, producing a hum component the frequency of which is twice that of the heating current.

Hum due to the magnetic field (3) of the filament current is shown to be small as it is partly neutralized by variation in the filament temperature. It is shown that a V-shaped filament produces the least hum.

Various experimental curves showing the variation of hum with grid bias and amplification factor for different tubes are given.

This is an important paper to those who design and manufacture tubes.

Oscillating Circuit

J. Warren Wright, U. S. Naval Research Laboratory, gives a mathematical analysis of "The Tuned-grid, Tuned-plate, Self-Oscillating Vacuum-tube Circuit," showing that if the circuit is to generate oscillations determined by the grid circuit the natural frequency of the plate circuit must be slightly greater than the frequency of oscillation. That is the load circuit must be inductive.

Radiation and Induction

In a paper "Radiation and Induction," R. R. Ramsay and Robert Dreisback, Department of Physics, Indiana University, develop the radiation and induction field formulas about antennas and loops by the use of simple mathematics and show by experimental data the correctness of their deductions.

Power Supply

George B. Crouse, of Conner Crouse Corporation, New York, contributes a highly interesting paper on the "Development of a System of Line Power for Radio." In this he gives a historical resume of the subject and shows many unusual circuits for the suppression of hum in A and B battery eliminators.

He also gives a number of voltage regulators which tend to keep the DC output voltage constant when the AC line voltage varies.

One of these employs a resistance bridge on the DC side of the rectifier in which the arms are heated with AC. Another controls the voltage by inductive means.

Moyer and Wostrel Third Edition Out

"Practical Radio,' by James A. Moyer and John F. Wostrel. McGraw-Hill Publishing Co., Inc., 370 Seventh Ave., New York, N. Y. Third Edition. $2.50.

This is an introductory book on practical radio in which both service men and radio students will find much useful information. It gives the facts of radio in simple terms and in a manner which takes the mystery out of the subject. The chapters on eliminators and chargers for filament, plate and grid batteries and on radio troubles are particularly useful and instructive.

Literature Wanted

THE names and addresses of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers, dealers and mail order houses are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature.

Name .....

Address .....

City or town .....

State .....

Thos. S. Herrod, 4300 Spruce St., Philadelphia, Penna.
D. J. Doherty, 260 N. Main St., Waterbury, Conn.
Roger Witty, 5450 Linwood Ave., Detroit, Mich.
Victor E. Voges, 77 Hillsdale Rd., Medford, Hillside, Mass.
Wilton E. Cobb, Chamber of Commerce, Macon, Georgia.
John Kalmar, 255 S. 10th St., Philadelphia, Pa.
Felix O'Conner, 45 Haight Ave., Poughkeepsie, N. Y.
W. G. Davis, 685 Academy St., New York City.
John H. Yeaton, 377 Richards Ave., Portsmouth, N. H.
Ottumwa Optical Co., Radio Dept., Ottumwa, Ia.
R. C. Skidmore, 1825 N. Ivor St., Hollywood, Cal.
E. D. Miner, Price County Bural Normal School, Phillips, Wisc.
Wm. F. Hemphill, Ambassador Hotel, 1728 California St., Denver, Colo.
Wm. W. Cedarholm, 16 W. Penna Ave., Towson, Md.
Yorman W. Brown, 27 Gulph Creek Rd., Coushohocken. Penna, R. F. D. No. 1.
J. L. Mechler, Hondo, Texas.
R. C. Vollmann, 3626 Bevis Ave., Cincinnati, O.
Myron Philippbar, 3303 Altoona Rd., Cleveland, O.
Robert Oliver, 1801 Weeks Ave., New York City.
Alfred Pearce, 1604 Richmond Ave., Port Richmond, N. Y.
W. J. Drew, 35 Main St., Yonkers, N. Y.
J. Gary, 1026 N. Appleton St., Baltimore, Md.
Forest Thompson, Sheldon, Missouri.
L. T. Corell, 640 Riverview Ave., Portsmouth, Virginia.
V. E. Trent, 2640 E. 9th St., Kansas City, Mo.
John H. Overesch, 207 N. 5th St., Lafayette, Ind.
Elijah Romanoff, 266 High St., Clinton, Mass.
E. H. Peery, 1025 Summit St., Kansas City, Mo.
W. J. Ross, 509 Senator St., Brooklyn, N. Y.
Leo B. Twoney, Carrier Dorchester Center, Boston, Mass.
Harry Ehman, 255 Waverly Ave., Irvington, N. J.
S. P. Brimigion, 69 Boston Ave., Lewiston, Maine.
Del E. Atcheson, 148-82 Kentucky Ave., Detroit, Mich.
Orlando Balmelt, 1263 Madison Ave., Paterson, N. J.
Jacob Weinheimer's Sons, 200 N. Salina St., Syracuse, N. Y.
Carr Bros., 65 Broadway, New York City.
C. A. Mikkelson, Rifle, Colorado.
Victor Parker, Gibson, New Mexico.
Wm. J. Kettelberger, 815 Vine St., Philadelphia, Penn.
Geo. S. Kaar, Johannesburg, California.
L. V. Perkins, 1612 S. 11th St., Lawrenceville, Illinois.
S. A. Goff, 83 Francis Ave., Pawtucket, R. I.
Wm. D. Weiler, P. O. Box 33, Eskdale, W. Va.
A. C. Clark, 5715 29th Ave., N. E., Seattle, Wash.
Victor Fhei, Harmon St., Lincoln Park, N. J.
Arno Wilkins, 241 S. 11th St., Reading, Pa.
C. L. Lufkin, 65 Savannah St., Detroit, Mich.
Harry Winwood, 2 Sherman St., Cheswick, Pa.
R. Christiansen, 1205 Willow Ave., Hoboken, N. J.
S. W. Thompson, 344 Indian Rd., Res., Toronto, Ontario, Canada.
J. Swan, Hillsdale, New Jersey.
A. E. Marlatt, 2408 N. 41st St., Seattle, Wash.
Carl G. Elfin, Reading Co., Yardley, Penna.
Dutton Radio Service, P. O. Box 661, Salisbury, N. C.
Chas. E. Eiber, Jennings, Louisiana.
Gordon Tighe, Harve, Montana.
Jess H. Spiker, 2616 Walnut St., McKeesport, Penna.
Union Special Machine Co., Utica, N. Y.
Frank Conrad, 89 Ritzman Court, Kenmore, Ohio.
A. Aker, 3901 Belden Ave., Chicago, Ill.
George Farr, c/o Hillcrest Pharmacy, 170 First Ave., Salt Lake City, Utah.
Louis E. William, Route 4, Box 346, Pine Bluff, Arkansas
T. W. Wilcos, Wabana Mines, Bell Island, Newfoundland
R. T. Lively, c/o Pullman Co. Room 3 Terminal Sta., Atlanta, Ga.
Geo. E. Jackson, 144-11th St., N.E., Washington, D. C.

Socket Antenna

Handy Accessory

A good light socket antenna plug should be kept in reserve in the home of every fan, as there is no knowing when an accident may occur to the antenna just at a time when it is impossible to repair it.

In many modern homes where an outside aerial is impossible of installation, the light socket antenna is indispensable. With this in mind, the engineers of the Clarostat Manufacturing Co., Inc., under the direction of John Mucher, president, have designed the Clarostat Light Socket Antenna Plug. This device converts any electric light socket or convenience outlet into a good antenna and may be used in conjunction with any power pack, eliminator or AC set with safety. Further information may be had from this concern by addressing them at 287 North Sixth Street, Brooklyn, N. Y. Mention RADIO WORLD.—J. H. C.

DOING WELL WITH SONATRON

Harry Spiro, the Sonatron man for Pennsylvania, West Virginia, Baltimore, Washington and Virginia, reported at the Sonatron offices at 16 Hudson Street, New York City, last week and showed a bunch of big orders in his territory. Spiro has more than doubled sales there since he took hold and surprised the sales manager, Lew Newman, with the biggest business that ever came out of that territory. —J. H. C.

Recent Issues of RADIO WORLD, 15 cents each. Any number published in 1928 available for a short while. Six issues 75 cents, 10 issues $1.00. Send stamps, coin or money order NOW, before the issues are sold. RADIO WORLD, 145 West 45th Street, New York City.

Real MUSICAL Instruments Are Made of Wood!

THE SWEET MELLOWNESS OF WOOD GIVES REAL MUSIC!

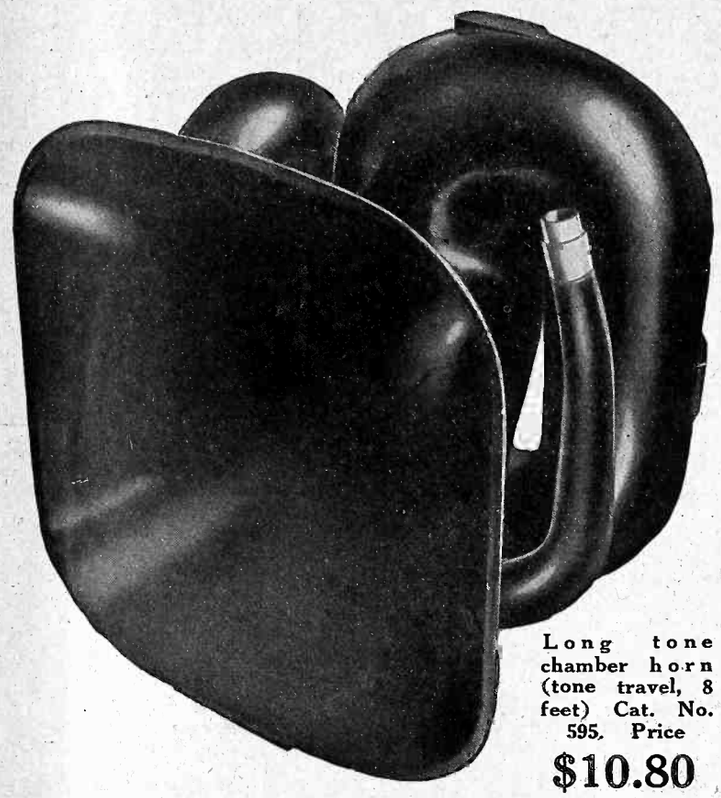
THE finest reproduction is made possible by the long tone chamber horn loudspeaker, for then you hear the *true* sounds, without over-emphasis or under-emphasis, in other words, without distortion. Violins, pianos, flutes, 'cellos and the like are not made out of paper or cloth, but out of wood. Nature chose wood as the unsurpassed vehicle of sound. Man utilized the long tone chamber to make the sound supremacy of wood available for radio reproducers.

With fine quality moulded wood formed into a long tone chamber you hear the orchestral instruments stand out individually,—sounds from the boom of the bass drum, the zoom of the 'cello, to the sweet, high notes of piccolo and clarinet. And the human voice is natural, real. The hissing sounds of speech—high audio frequencies—come through as realistically as the guttural.

Horn Motor, Cat. No. 112. Price $4.20.

Use a long tone chamber horn, like the No. 595 illustrated at right, with a specially sensitive and faithful motor, (Cat. No. 112), shown at left and enjoy the best. Cat. No. 595, horn loudspeaker, tone travel 8 feet; over-all dimensions, 21¼" high, 18" wide, 13" or 15" deep. Nozzle takes standard size unit. Price $10.80.

Felt-padded Baffle Board FREE with each order for a No. 595. The baffle is used as the inside shipping box. No need to remove the horn from the box. Use the outfit as you receive it, inside a cabinet, or in any other place you desire.



Long tone chamber horn (tone travel, 8 feet) Cat. No. 595. Price

$10.80

Smaller Model Meets Space Economy Needs

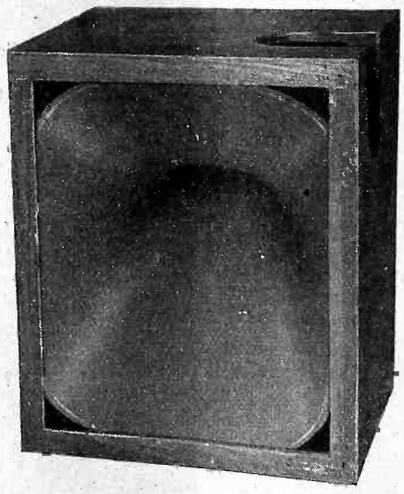
WHERE space requirements limit you to a smaller size horn, use Cat. No. 570, illustrated below. The tone quality of this medium-sized model far surpasses that of the usual cones, but does not quite come up to that of the No. 595 on the extremely low register (40 cycles and less). However, it is a very satisfactory horn, as good as can be made for the smaller space.

Your mounting problems are solved completely with this model, as with the other, due to the inclusion of a FREE baffle board with each order.

No one need hesitate ordering the smaller model if space limitations compel such choice, for the result will be charming beyond expectations.

Cat. No. 570 horn loudspeaker, tone travel 6 feet; over-all dimensions 15" high, 12" wide, 12" deep. Nozzle takes standard size unit. Price $7.80.

Felt padded baffle board FREE with each order for a No. 570.



Baffle Board FREE with each horn order!

FREE Baffle Board with Each Order

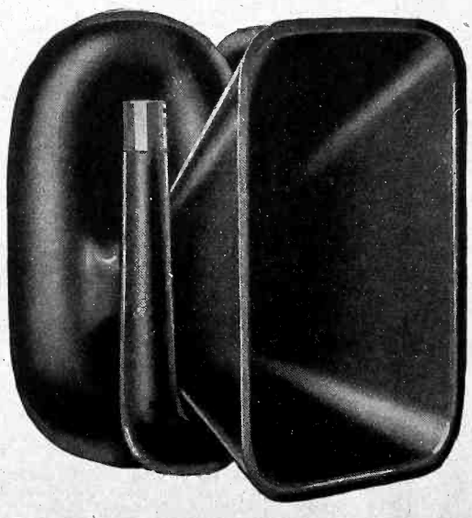
THE long tone chamber moulded wood horns are sold with an offer of a FREE baffle board that is felt-padded so that the horn is felt-suspended and doubly protected against possibility of rattles. This is the final point of protection and perfection.

What DeForest Says:

"I do not consider any of the cones now on the market come anywhere near the perfect loudspeaker. Cones invariably favor some frequencies at the expense of others and most of the cones, while over-emphasizing the bass, put a mask of paper rustle over the higher frequencies. There are certain types of non-metallic horns now on the market which, with proper loudspeaker units, give far better reproduction than any 18-inch cone. I strongly advocate a radio set built into a large console cabinet with sufficient room to take in one of the larger exponential horns."

—Dr. Lee DeForest in "Radio News" for April, 1928.

Why saddle a good set to a poor speaker? Travel 8 feet and get somewhere! Travel 6 feet and outstrip the others, anyway!



Medium sized tone chamber horn (tone travel, 6 feet) Cat. No. 570. Price $7.80.

SEND NO MONEY!

ACOUSTICAL ENGINEERING ASSOCIATES, 143 West 45th Street, N. Y. City

Please ship me at once the following (check off):

☐ **One No. 595 at $10.80** plus a little extra to defray shipping costs; also send FREE baffle board. 15" width will be sent unless 13" is specified by a cross in this square ☐

☐ One No. 570 at $7.80 plus a little extra to defray shipping costs; also send FREE baffle board.

☐ One No. 112 horn motor (universal nozzle) at $4.20 plus a little extra for shipping.

Name .....

Address .....

City ..... State .....

5-Day Guarantee of Money Right Back if Not Delighted— No Stalling—No Questions!

NEW CORPORATIONS

International Speaker Corp., radios—Attorney, L. Wolfson, 299 Broadway, New York, N. Y.

International Radio—Attorney, D. W. Peck, 67 Broad St., New York, N. Y.

Dick Wood Auto & Radio Supply Co.—Attorney, W. I. Alpert, 44 Court St., Brooklyn, N. Y.

Radio Corporation of Oklahoma, Wilmington, Del., to make radios—Attorney, Corporation Trust Co. of America, Wilmington, Del.

The Roy Craft Co., Wilmington, Del., radios—Attorney, Corporation Trust Co. of America.

Forty-second Street Radio Corp.—Attorney, L. D. Schwartz, 150 Nassau St., New York, N. Y.

Nicaraguan Radio Corp., radio construction—Attorney, J. A. Arroya, 52 Wall St., New York, N. Y.

BIG OFFER!

Radio World for Four Weeks 50c

Blueprint FREE!

of 4-Tube Screen Grid Diamond of the Air

At 15c per copy RADIO WORLD costs you 60c for four weeks. But if you send 50c NOW you get the first and only national radio weekly for four consecutive weeks and a blueprint FREE!

This blueprint is life-sized and shows in easy picture diagram form how to mount parts and wire this super-sensitive receiver. One screen grid tube is used as radio frequency amplifier. The rest of tubes are two—01A and one 112A.

This circuit gives you distance, tone quality, ease of performance. No shielding, no neutralizing required!

ACT NOW!

This offer holds good only until August 30th and coupon below MUST be used as order blank.

Radio World, 145 West 45th Street, New York City

Enclosed please find 50 cents (stamps, coin, check or money-order) for which please enter my name on your mail subscription list for the next four issues of RADIO WORLD, and send me FREE at once a blueprint of the Four-Tube Screen Grid Diamond of the Air (front panel and subpanel wiring, schematic diagram and parts list.

Name .....

Address .....

City ..... State .....

☐ Renewal.

If you are a mail subscriber for RADIO WORLD you may extend your subscription four weeks. Put a cross in the square in front of the word "renewal," to show you are a subscriber already.

HAVE YOU MISSED ANY COPIES OF RADIO WORLD WHILE ON YOUR VACATION?

If so we can furnish you with any numbers of Radio World for the entire Spring and Summer of 1928. Any one issue, 15c, any seven issues, $1.00. Find out what copies you are short of and send your order. Copies will be sent to, postpaid, immediately upon receipt of price.

Radio World, 145 W. 45th St., N. Y. C.

Bakelite Front and Aluminum Subpanel for the 4-Tube Screen Grid DIAMOND OF THE AIR - - $5.00

Five-Day Money-Back Guaranty

View of the Completed Receiver, using Drilled Front Panel and Aluminum Subpanel

Finest eye appeal results from construction of the 4-tube Screen Grid Diamond of the Air when you use the official panels. The front panel is bakelite, already drilled. The subpanel is aluminum, with sockets built-in, and is self-bracketing. Likewise it has holes drilled in it to introduce the wiring, so nearly all of it is concealed underneath set. Make your set look like a factory job.

Front panel alone, bakelite, drilled.....$2.35
Aluminum subpanel alone, drilled, with sockets built-in..... 3.00
Screws, nuts and insulating washers supplied with each subpanel.

GUARANTY RADIO GOODS CO.
145 WEST 45TH STREET NEW YORK, N. Y.
[A few doors east of Broadway]

Take Your Choice of 5 Other Publications

For NEW RADIO WORLD Subscribers Ordering NOW

Radio World has made arrangements

—To offer a year's subscription for any one of the following publications with one year's subscription for RADIO WORLD—

RADIO NEWS or SCIENCE and INVENTION or BOYS' LIFE or RADIO DEALER or RADIO (San Francisco).

This is the way to get two publications

—for the price of one:
—Send $6.00 today for RADIO WORLD
—for one year (regular price
—for 52 numbers)
—and select any one of the other
—six publications for twelve months.

—Add $1.00 a year extra for
—Canadian or Foreign Postage
—Present RADIO WORLD subscribers
—can take advantage of this offer by
—extending subscriptions one year
—if they send renewals NOW?

Radio World's Special Two-for-Price-of-One Subscription Blank

RADIO WORLD, 145 West 45th Street, New York City.

Enclosed find $6.00 for which send me RADIO WORLD for twelve months (52 numbers), beginning ..... and also without additional cost, Radio News, or Science and Invention, or Radio Dealer, or Radio (San Francisco), or Boys' Life (or $10.00 for a two-year subscription to one address), thereby getting RADIO WORLD and the other selected magazine, BOTH for two years. No other premium with this offer.

Indicate if renewal.

Offer Good Until September 15, 1928

Name .....

Street Address .....

City and State .....

NO OTHER PREMIUM OF ANY KIND WITH THIS OFFER

Quick Action Classified Ads

Radio World's Speedy Medium for Enterprise and Sales

10 cents a word — 10 words minimum — Cash with Order

THE SHOW NUMBER of Radio World, dated September 15th, will be on sale while the Fourth Annual Radio World's Fair is in progress. It will be a specially fine number.

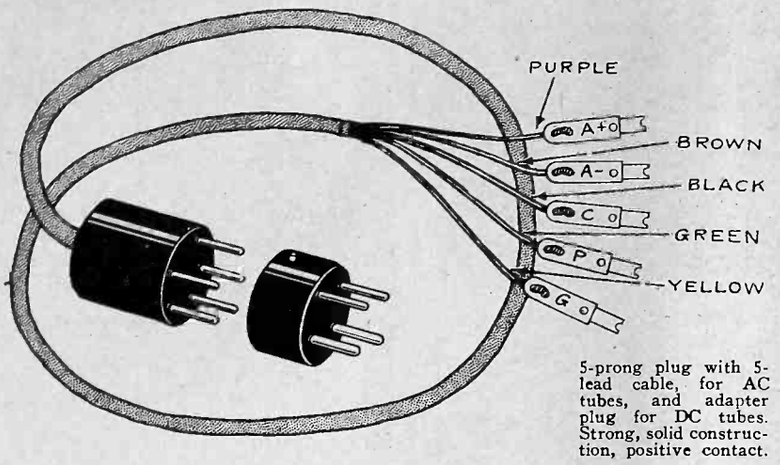
BLUEPRINTS of National Screen Grid Five, 4-tube Screen Grid Diamond and Karas 3-tube Short Wave Set—three blueprints—one dollar. Guaranty Radio Goods Co., 145 W. 45th St., N. Y. C.

SCREEN GRID COILS—Three-circuit tuner, with primary for .0005 mfd. tuning, step-up ratio of nearly 2-to-1 on secondary, and a standard tickler. Excellent for Economy Three and other screen grid circuits. Price, $2.75. Antenna coupler, with mudtapped aperiodic primary for long antenna and full primary for short antenna, and with secondary for .0005 tuning, $2.00. Antenna coupler also may be used for interstage coupling working out of screen grid plate by utilizing full aperiodic primary and tuning secondary. Five-day money-back guaranty.—Philip Cohen, 236 Varet Street, Brooklyn, N. Y.

LICENSED Radio Doctors earn $75.00-$100.00 per week Big demand; investigate at once. Free Booklet. Radio Doctors, Inc. Dept. W, Salem, Massachusetts. 9-15-28

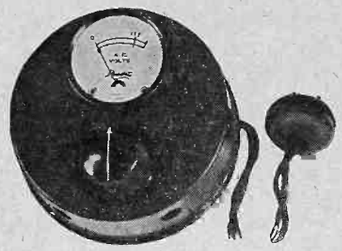
Recent Issues of RADIO WORLD, 15 cents each. Any number published in 1928 available for a short while. Six issues 75 cents, 10 issues $1.00. Send stamps, coin or money order NOW, before the issues are sold. RADIO WORLD, 145 West 45th Street, New York City.

Universal AC and DC Short-Wave Adapter Plugs! Voltage Regulator!



5-prong plug with 5-lead cable, for AC tubes, and adapter plug for DC tubes. Strong, solid construction, positive contact.

Handiest thing in the world for any short-wave adapter. Put detector tube of your present set in socket of any short-wave adapter you build, put plug in detector socket of your broadcast receiver. Cable, 34". Leads identified both by color scheme and tags. May be used as 5-lead battery cable plug with UY socket. 5-prong plug with 5-lead cable (Cat. No. 21AC) **$1.50**
4-prong extra plug only, for DC short-wave adapter (Cat. No. 21DC) **$0.50**
Cat. No. 21AC and 21DC ordered together **$1.75**
Cat. No. 21AC and 21DC with 99 adapter **$2.25**



Line voltage regulator for AC sets has an AC meter showing line voltage, and a power adjustable resistance so that the line voltage may be reduced until it reads 110 volts. Wall plug and socket for connection to AC cord from the set also built-in (Cat. No. 218) **$5.00**

Accurate Meters for Exacting Radio Uses! Speaker Switch!

Cat. No. 390, reading 0-100 milliamperes. Price ..**$1.65**

Cat. No. 326, reading 0-6 volts DC, price **$1.65**

Two of the most popular meters are Cat. No. 390, reading 0-100 milliamperes, and Cat. No. 326, reading 0-6 volts DC. Both are panel mount types (2 5/64" hole). See illustrations above. No. 390 is recommended for sets having six tubes or more, particularly if a —71, —10 or —50 tube is used as the output. May be kept permanently in circuit. For DC measurements 0-100 milliamperes. Cat. No. 390 .....**$1.65**
The 0-6 panel voltmeter may be kept permanently in circuit (Cat. No. 326) **$1.65**

PANEL AC VOLTMETER

Cat. No. 351 For reading 0-15 volts AC **$2.25**

PANEL MILLIAMMETERS

Cat. No. 311 For reading 0-10 milliamperes DC **$1.95**
Cat. No. 325 For reading 0-25 milliamperes DC **$1.85**
Cat. No. 350 For reading 0-50 milliamperes DC **$1.65**
Cat. No. 399 For reading 0-300 milliamperes DC **$1.65**

PANEL AMMETER

Cat. No. 338 For reading amperage, 0-10 amperes DC **$1.65**

6-VOLT A BATTERY CHARGE TESTER

Cat. No. 23 For showing when 6-volt A battery needs charging and when to stop charging; shows condition of battery at all times **$1.85**

VOLTAMMETER

Cat. No. 35 For testing amperage of dry cell A batteries and voltage of B batteries (not B eliminators); double reading, 0-50 volts, 0-40 amperes DC **$2.00**

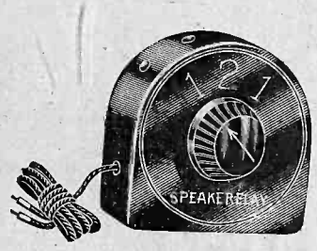
HIGH RESISTANCE VOLTMETERS

A 0-300 DC voltmeter with a very high resistance. Specially made that way so it will test the output voltages, from maximum to any intermediate voltage, of any B eliminator or grid biasing resistor. Cat. No. 346 ..... **$4.50**

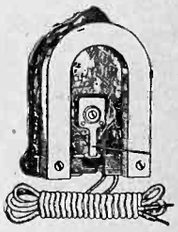
[Note: 0-500 volts, instead of 0-300 volts, is No. 347. Tests ALL power packs—Price $5.50.]

PANEL VOLTMETERS

Cat. No. 335 For reading DC voltages, 0-8 volts **$1.65**
Cat. No. 310 For reading DC voltages, 0-10 volts **$1.65**
Cat. No. 337 For reading DC voltages, 0-50 volts **1.65**
Cat. No. 339 For reading DC voltages, 0-100 volts **$1.75**
Cat. No. 40 For testing A and B batteries, dry or storage, but not for B eliminators; double reading, 0-8 volts and 0-100 volts DC scale.....**$2.25**
Cat. No. 42 For testing B batteries, dry or storage, but not for B eliminators; 0-150 volts DC scale.....**$2.00**
Cat. No. 348 For testing AC current supply line, portable, 0-150 volts.....**$4.50**



In home or store you often want to operate two speakers together, or each separately, and this speaker switch, the Speakerelay, does the trick! Connect the cord to the set and the speakers to the jacks in the switch. Turn knob at No. 1 at left to operate one speaker alone, to No. 2 to operate both speakers together, and to No. 1 at right to operate the other speaker alone. Enclosed in moulded Bakelite case. (Cat. No. 121)..... **$2.00**



Powerful unit, excellent for any cone or similar type of speaker. Stands up to 150 volts unfiltered. Very loud. Adjustable armature. Well packed. Won't get damaged in shipment. Supplied with apex, chuck and nut, Unit easily mounted. **$3.75**

If bothered by interference between stations or living near a station that comes in all over the dials and prevents you from getting other stations, use a wave trap and trap out the offender at will. Turn of the knob covers entire broadcast band. Trap is encased in moulded Bakelite (Cat. No. 22WT).... **$1.50**

Build yourself a very fine large cone speaker and get the fullest enjoyment of the quality your receiver offers. Nothing but praise has been heaped on these 36" and 24" speakers. Also, their appearance is so entrancing that they fit nicely into the surroundings of the finest living rooms and parlors. Expert radio and acoustical engineers indorse them. Nobody need be without a really fine speaker of 36" or 24" diameter, now that all have a choice of these two sizes at the same price. Remember, a five-day money-back guaranty attaches to each of these speaker kits!

Take your choice of a 24" or 36" diameter cone speaker kit, with Unit No. 1098 (see description at left). Either size at same price. Tri-foot pedestal FREE with each kit order. Front sheet of designed Phonotex, rear sheet of plain Phonotex. Radio cement furnished with each kit. Also mounting bracket, apex, chuck and nut, with instruction sheet. Fine tone quality reproduced at large volume. Ornamental and efficient cone easily built by anybody. Novices find not the slightest difficulty. As the unit is adjustable you can adjust the impedance until best results are obtained. These speakers are used as demonstrators in stores in New York City at full volume without rattling. Low notes are reproduced particularly well, because of the large radiating surface. Apex is at center for highest efficiency. (Cat. No. 36 for 36" or Cat. No. 24 for 24")..... **$6.00**

Kit is complete, including unit, apex, bracket, chuck, nut, paper, pedestal, cement and instruction sheet.

Guaranty Radio Goods Co.
141 W. 45th Street, N. Y. City

Please mail at once C.O.D. on a five-day money-back absolute guaranty, your catalogue numbers as follows, for which I will pay the advertised prices, plus a few cents extra for postage:

Cat. No. ..... Cat. No. ..... Cat. No. .....

Name .....

Address .....

City..... State.....

SEND NO MONEY!

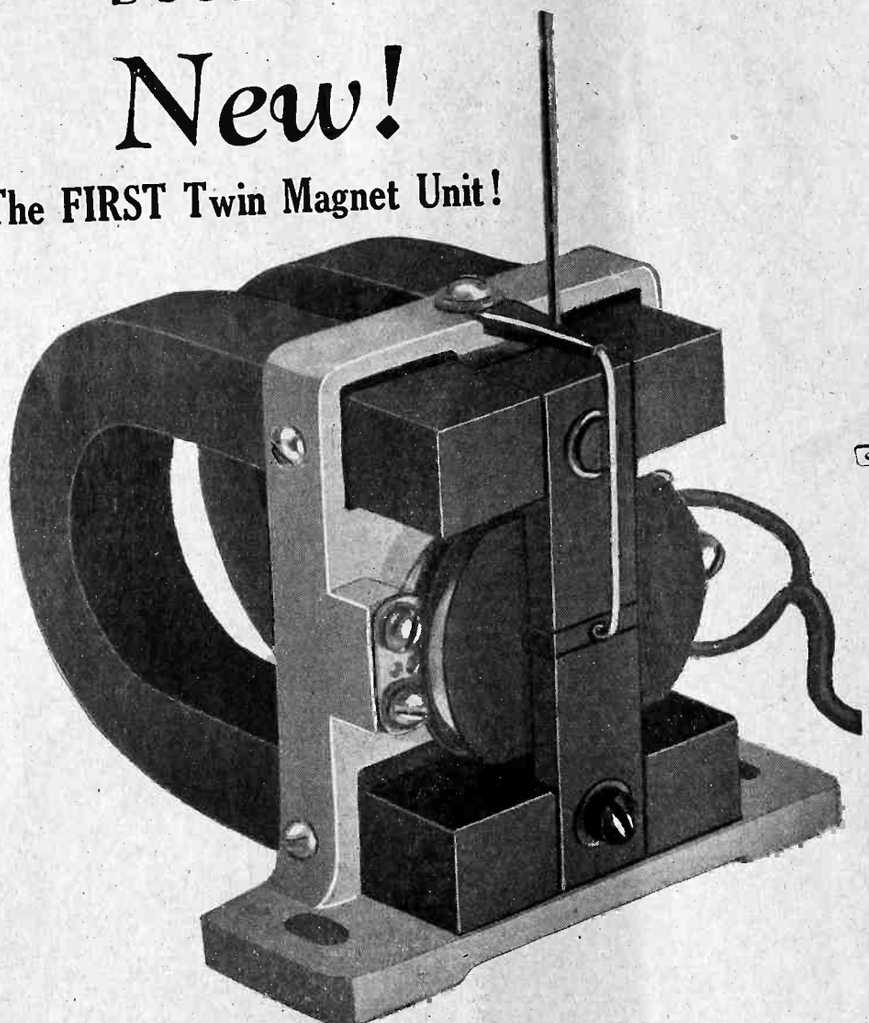
POLO

DUO-MAGNETIC UNIT

TWIN MAGNETS
DOUBLE SENSITIVITY

New!

The FIRST Twin Magnet Unit!



Polo Duo-Magnetic Unit, shown actual size. Weight three full pounds. Supplied complete with ten-foot cord, apex, chuck, nut and moulded metal mounting bracket (Senior model) **$10.00**

No Filtering at 180 Volts!

THE magnet coil of the unit consists of two separate windings, connected in parallel, so that the current divides between them. This enables you to put TWICE AS MUCH current through the coil without danger of harming it!

Use 180 volts on a —71A or —10 tube, with proper negative grid bias, and you do not need an output filter, the usual list price of which is around $10.00. The coil of the unit safely carries 25 milliamperes!

Enormous Volume, No Rattling!

THE volume obtainable from a set depends to a large extent on the efficiency of the unit. The Polo Duo-Magnetic Unit is incredibly loud—enormously loud—yet without rattling! The SENSITIVITY IS DOUBLED by the use of two magnets —the first time two have been used in a commercial unit. The magnets are genuine, efficient, costly chrome steel, and there are no holes in them. Holes weaken a magnet and shorten its life.

ASTOUNDING

Performance—And Why!

THE new and startling Polo Duo-Magnetic Unit is of the balanced armature type, needing no adjustment and no servicing. It is exceptionally efficient, long-lived and mechanically rugged. Here is a summary of its superiority:

(1) Twin magnets double sensitivity.

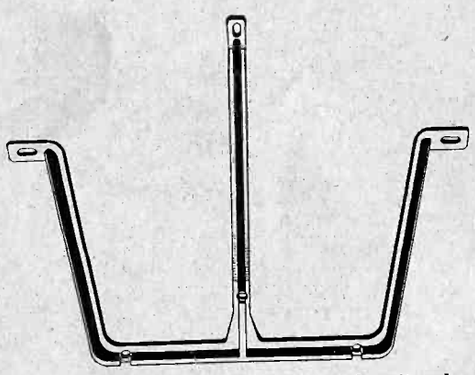
(2) Magnets are of chrome steel.

(3) Magnet coil consists of two windings in parallel, doubling the flux and the current handling capacity.

(4) Volume is extraordinary, and without rattling, due to twin-magnets, great flux density, short air gaps, balanced silicon steel armature and single-piece coupling rod and pin. The pin WON'T BREAK OFF!

(5) Die cast aluminum frame fits assembly to 1/1000 of an inch, enhancing rigidity.

(6) Large, solid machined pole pieces.



Moulded bracket FREE with each unit order; also cord, apex, chuck and nut.

Every unit undergoes seventeen careful tests and is guaranteed against all mechanical or electrical imperfections. This unit needs no after-servicing, but will last indefinitely. It works superbly any cone, cloth, Balsa or skin speaker and is one of the most remarkable units ever produced. Make Polo your choice and you'll rejoice!

POLO ENGINEERING LABORATORIES,
57 Dey St. (Suite 6), corner Greenwich St., New York, N. Y.

Enclosed please find ten dollars for which send me one Polo Duo-Magnetic Unit, with ten-foot cord, moulded metal bracket, apex, chuck and nut. YOU ARE TO PAY SHIPPING CHARGES. If after a 10-day trial I return the unit YOU WILL QUICKLY REFUND THE TEN DOLLARS.

NAME .....

ADDRESS .....

CITY .....STATE.....

Orders Filled in Sequence of Their Receipt]

POLO ENGINEERING LABORATORIES

57 Dey Street (Suite 6), Corner Greenwich Street Tel. CORtland 5112 **New York, N. Y.**