TWO TELEVISION DEMONSTRATIONS SHOW IMPROVEMENTS

SEPT. 8
1934

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Per Copy

RADIO WORLD
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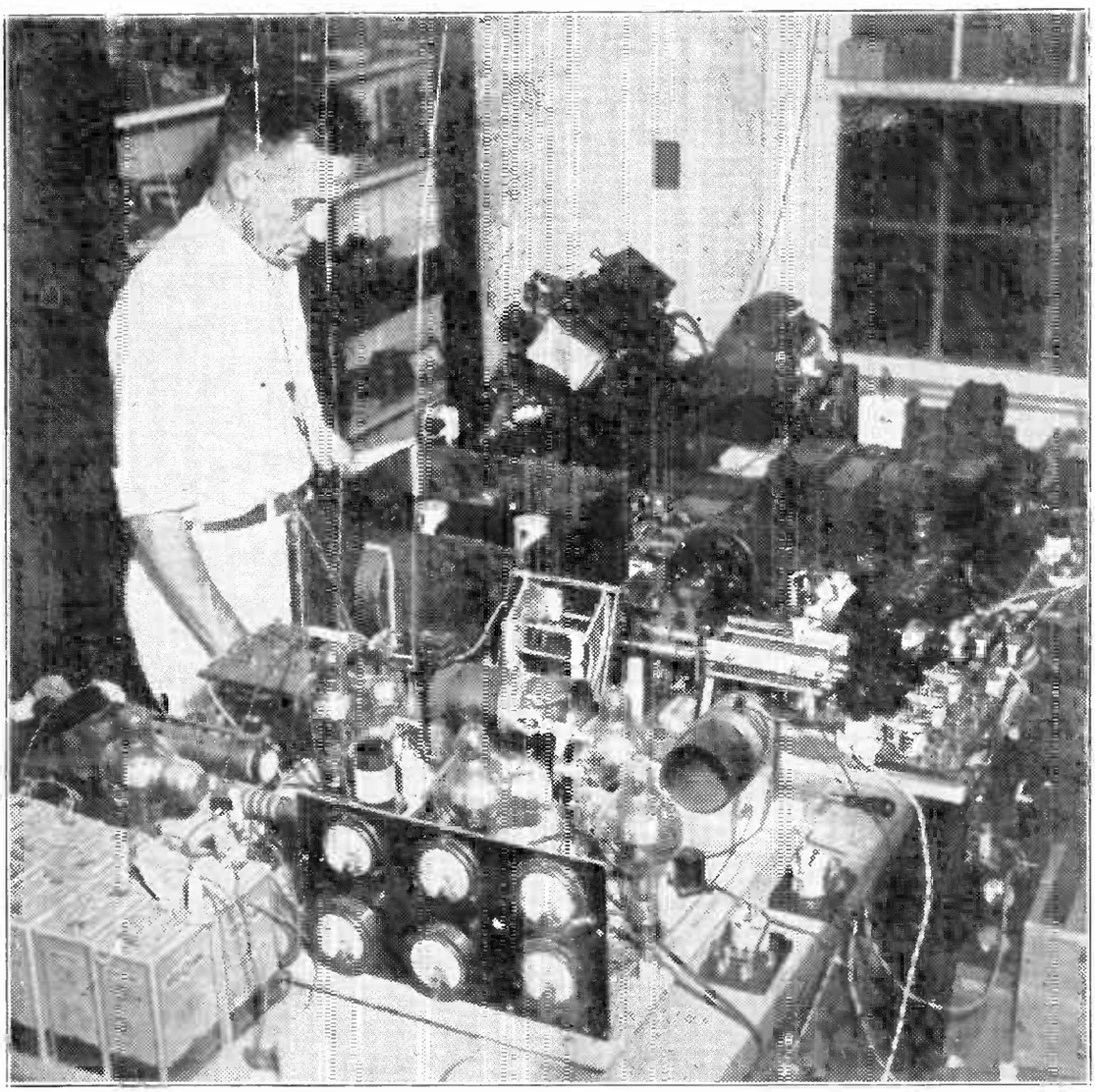
The First National Radio Weekly
650th Consecutive Issue—13th Year

HOW TO INSTALL NEW ANTENNAS

FEWER TUBES IN NEWER SETS

THREE NEW TYPES OF GENERATORS

WORLD PROBE OF ECHO MYSTERY!



The National Bureau of Standards co-operates in the world-wide measurement of mysterious echoes. The recorder is at left rear, pointing up to the cabinet. A motor-driven cam is at right angles to the central air condensers. A receiver is beneath the clock. The four transmitters used in measuring heights of the ionosphere layers are behind the rack of six meters in the foreground. The operator is looking into a power converter. See article on echoes on page 6. (Acme)

THE ONLY BOOK OF ITS KIND IN THE WORLD. "The Inductance Authority" entirely dispenses with any and all computation for the construction of solenoid coils for tuning with variable or fixed condensers of any capacity, covering from ultra frequencies to the borderline of audio frequencies. All one has to do is to read the charts. Accuracy to 1 per cent. may be attained. It is the first time that any system dispensing with computation has achieved such very high accuracy and at the same time covered such a wide band of frequencies.

"The Inductance Authority"

By EDWARD M. SHIEPE, B.S., M.E.E.

A condensed chart in the book itself gives the relationship between frequency, capacity and inductance, while a much larger chart, issued as a supplement with the book, at no extra charge, gives the same information, although covering a wider range, and the "curves" are straight lines. The condensed chart is in the book so that when one has the book with him away from home or laboratory he still has sufficient information for everyday work, while the supplement, 18 x 20 inches, is preferable for the most exacting demands of accuracy and wide frequency coverage.

From the tri-relationship chart (either one), the required inductance value is read, since frequency and capacity are known by the consultant. The size and insulation of wire, as well as the diameter of the tubing on which the coil is to be wound, are selected by the user, and by referring to turns charts for such wires the number of turns on a particular diameter for the desired inductance is ascertained.

There are thirty-eight charts, of which thirty-six cover the numbers of turns and inductive results for the various wire sizes used in commercial practice (Nos 14 to 32), as well as the different types of covering (single silk, double silk, single cotton, double cotton and enamel) and diamaters of ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½, 1⅝, 2, 2¼, 2½, 2¾ and 3 inches.

EACH turns chart for a given wire has a separate curve for each of the thirteen form diameters.

The two other charts are the tri-relationship one and a frequency-ratio chart, which gives the frequency ratio of tuning with any inductance when using any condenser the maximum and minimum capacities of which are known.

The book contains all the necessary information to give the final word on coil construction to service men engaged in replacement work, home experimenters, short-wave enthusiasts, amateurs, engineers, teachers, students, etc.

There are ten pages of textual discussion by Mr. Shiepe, graduate of the Massachusetts Institute of Technology and of the Polytechnic Institute of Brooklyn, in which the considerations for accuracy in attaining inductive values are set forth. These include original methods.

The curves are for close-wound inductances, but the text includes information on correction factors for use of spaced winding, as well as for inclusion of the coils in shields. The book therefore covers the field fully and surpasses in its accuracy any and all mechanical aids to obtaining inductance values.

The publisher considers this the most useful and practical book so far published in the radio field, in that it dispenses with the great amount of computation otherwise necessary for obtaining inductance values, and disposes of the problem with speed that sacrifices no accuracy.

The book has a flexible colored cover, the page size is 9 x 12 inches and the legibility of all curves (black lines on white field) is excellent.

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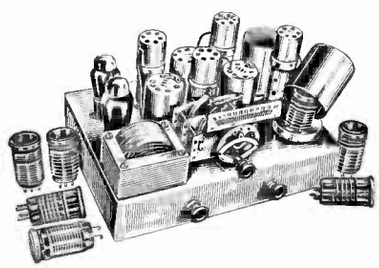

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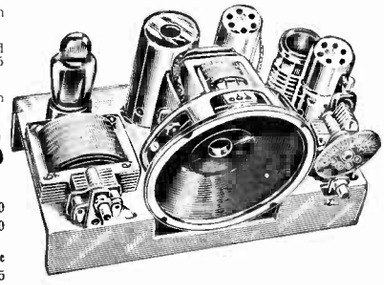

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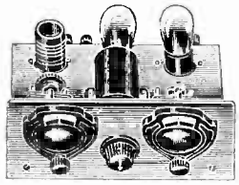
DIAMOND of the AIR



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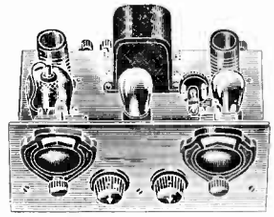
Diamond of the Air



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Television Shows Gain

Peck Startles Engineers with Clear, Projected Pictures, While Farnsworth Impresses Scientists

By Neal Fitzalan

TELEVISION progress is by no means halted, as proved by the fact that two demonstrations were given recently of well-conceived apparatus. In New York City engineers invited to a special showing were startled at the brilliancy of the pictures shown by William Hoyt Peck, who uses his patented mechanical system of scanning and a new method of pickup for transmission. In Philadelphia, Philo T. Farnsworth, who had been tied up with Philco for a while, demonstrated his electrical system, at Franklin Institute.

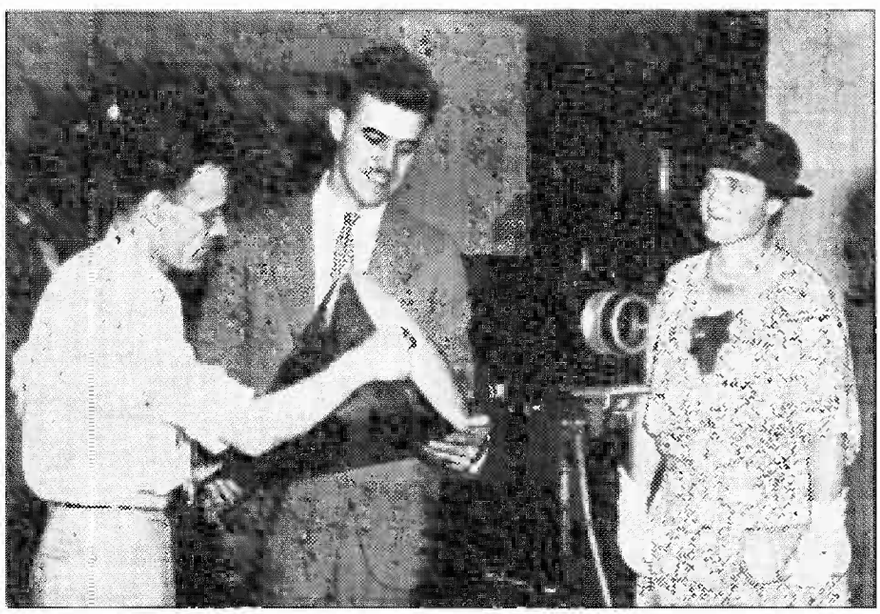
The two demonstrations show anew that scientists are working out their theories along the lines they prefer, and point to the possibility of there being room for both the electrical and the mechanical systems.

Illumination Important

The electrical system is identified with the cathode-ray oscillograph tube, against which objections of insufficient illumination have been raised, as well as against the sine-wave nature of the scanning for purposes that call for saw-tooth wave forms. However, the proof lies in the demonstrations, and the technicalities can be waived in favor of what will prove satisfactory to the public. As stated, there may be room for both methods. At least it can be said for the electrical method that it can be worked without using any moving parts.

As a prompt rejoinder, the exponent of some mechanical system may say that one does not shun an automobile though it has moving parts, nor an airplane nor an ocean liner, and that looking at a picture bears no direct relationship with the method used to attain the picture result.

One who has seen some of the more important demonstrations of both methods is free to state, without expressing a preference for either one, that a process that yields sufficient illumination and definition is vital, and that a mechanical method, such as Peck's, augmented by a treatment of the light problem that produces intense illumination, about on a par with home movie projection, leaves with the observer a profound sense of having seen something entertaining.



(Acme)
Philo T. Farnsworth, of California, gave the first public demonstration of his improved electrical system of television transmission and reception before at Franklin Institute, Philadelphia. He is shown at left, exhibiting the enormous cathode-ray oscillograph tube to Richard Snyder, as they stand beside the pick-up camera. Mrs. Nathan Hayward, wife of the president of the Institute, looks on.

Farnsworth, who hails from California, has an interesting system that possesses possibilities of course, and Dr. Vladimir Zworykin, of RCA-Victor Company, has contributed something of enormous importance in his combined electrical system of transmission and reception of moving pictures, where the pickup apparatus, using photo-cells, is endowed with "memory." Called on to create something almost fantastic, he turned out a practical instrument that won the admiration of engineers.

Naturally, the inventors working in specified fields favor their own endeavors, and see the most in what they are doing. Privately, at least, they have little in the nature of an encouraging or hopeful word to say about the work or practices of their competitors. An exposition of a particular method often is accompanied by a strong statement of its superiority over all other methods, the acknowledged drawbacks of those other methods being emphasized, but the drawbacks of the "revolutionary" method not even being mentioned.

(*Continued on next page*)

(*Continued from preceding page*)

All methods have their drawbacks, and the day is not here yet when one can say that television has arrived as a commercial entity, unfailingly good enough for home entertainment purposes, with pictures large enough for ready discernment when projected on a screen. Peep-hole television is for the hobbyists. Projected television is what the public wants and will get and much of the progress toward that attainment is a reality today.

Peck System Applauded

Mr. Peck, who came to New York from Atlanta, Ga., drew a round of applause from hard-boiled engineers and editors for the clearness and largeness of his pictures.

The transmission was accomplished by scanning a movie film, using the Peck system of titled reflecting lenses disposed circularly on the periphery of a wheel. The transmission was wired to the receiver, which passed frequencies up to 150 kc. The design of the receiver was in itself a feat. The whole combination process has been absorbing Mr. Peck's close attention for several years. He is a noted optical expert, and naturally he drew away from all systems deficient in illumination. He controls the light from an automobile headlight to throw intense illumination on the screen.

The fact that the transmission is wired, instead of being sent out on radio waves, is immaterial, especially as perhaps better results are attainable by "ether propagation."

Tennis Players Act at Television Showing

Philadelphia.

Word that television was to be demonstrated brought many requests for permission to be in the auditorium of Franklin Institute when Philo T. Farnsworth, 28-year-old head of Television Laboratories, Ltd., was to show his improved electrical system of scanning and reproducing.

As a fitting spice to the occasion, tennis stars who had come on for tournament play at Manheim showed their favorite racket grips and strokes before the electric eye of Farnsworth's device, the output of the pickup being wired from the "studio" to the auditorium, where 200 persons were anxiously awaiting the expected opportunity to be thrilled.

Shields and Stoeffen Perform

Sure enough, there on the screen they saw the grips and strokes, and moreover, with the aid of a sound system, heard the simultaneous remarks of the tennis players, including Frank X. Shields, of New York, and Lester Stoeffen, of Los Angeles.

Spectators interviewed after the performance stated that they were greatly interested in the result, and praised Farnsworth for his intense application to a difficult problem, as well as for the tangible results he was able to show. Numerous spectators were physicists and other scientists familiar with the problems.

Mayor Moore was present and seemed surprised at the acceptability of the pictures. Nathan Hayward, president of Franklin Institute, was host on the occasion, and he and his wife plied Mr. Farnsworth with questions. They, too, seemed to get a big kick out of the demonstration.

Outdoor Attempt Given Up

It had been hoped that the sun would be bright, so that outdoor scenes, including close-ups, could be televised, and delivered to the screen in the auditorium, but the day was dark and discouraging from this viewpoint, and no effort was made to get picture results from artificial illumination, a type admittedly inadequate to the purpose.

The demonstration proved that Mr. Farnsworth is working toward the goal generally sought, that of being able to bring into the homes of the world pictures of the events and personalities of the day, at the time of their occurrence, both on a scenic scale, and in close, intimate views. Thus baseball games, tennis games, horse races, and even studio appearances of artists in solo and ensemble, could be brought right into the home, on large screens, to give the world the thrill of its jaded life. The demonstration did not fully prove that the day for that has come, but it did prove progress toward that realization.

The Moon Televised

On clear evenings the moon is being televised, and scientists are studying the moon with the aid of the television apparatus. For usual mortals, except those in love, looking at the moon may not rank as thrilling entertainment, but if one can see an event some hundreds of thousands—or is it millions?—of miles off, at least there is a likelihood that events closer at home will be observed as a matter of routine information and entertainment in years to come.

Mr. Farnsworth has gotten away from the flying-spot method of pickup, of course, in line with all advanced television work, and uses a camera for pickup. The ground-glass is scanned electrically and the light impulses are delivered to a small photo-sensitive surface, which rectifies the light, yielding direct current values, in effect modulated in amplifiers comparable to the variations of the original illumination arising from the pick-up scanning process. The camera is something like an enlarged graflex in appearance.

Small Cell

The photo-sensitive area is at the input to the cathode-ray tube. Thus the variations in current sweep the cathode emission of the tube to modulate the electron stream.

The moment that the image on the ground-glass is picked up by the photo-electric cell, the process has nothing to do with a picture as such, as the picture values of light and shade are changed in the photo-sensitive area into corresponding values of current modulated at amplitudes corresponding to the variations in original illumination due to scanning. Since both light and the rectified current consist of electrons, it can not be said that light values cease and electron values take their place, but that the light has been rectified.

A nickel sleeve at the end of the cathode-day oscillograph tube picks up the rectified current, and is caused to be illuminated by this current (or inverse rectification), duplicating the original light values, and affording the secondary source that is to be scanned anew for restoration of the picture that had been broken up by scanning. This end cell has an outside diameter of only 0.012 inch.

Centano Cites His Patents on Scanner

Says Method Priess Described Dates Back to 1929 and is Excellent

By Melchor Centano, V

With great interest and surprise I read the article by William H. Priess entitled "A New Scanning System," in the September 1st issue of Radio World.

It so happens that the device described by Mr. Priess, as well as many modifications, are fully illustrated and described in the following U. S. Patents issued to me:

No. 1,702,195 (issued February 12, 1929).
No. 1,800,601 (issued April 14, 1931).
No. 18,761 (reissued March 7, 1933 on patents issued August 23, 1932 with No. 1,873,929).
No. 1,873,696 (issued August 23, 1932).

Besides the above patents, I have a Patent Application (Ser. No. 627,519, filed August 4, 1932) pending before the U. S. Patent Office. These patents and patent application cover the same field of television scanning systems.

In a paper I presented while at the Massachusetts Institute of Technology several years ago I described the scanning device belong to the same class, namely, devices consisting of a mirror elastically mounted so that in can vibrate freely about two rectangular axes at the same time, at different frequencies (one for each axis of vibration) and in mechanical resonance with said frequencies. My patents cover this field.

The efficiency and economy of said devices are not equalled by any other type of scanning device developed up to this time, as Mr. Priess very well states in his article. Unfortunately, it is not in the scanner that television is in want, if ultimately television is to depend on scanning devices at all.

Undoubtedly, Mr. Priess does not know about the patents mentioned, since the device he describes in his article is illustrated, described and fully protected by my patents (particularly by No. 1,873,696, Fig. 15).

CLOCKS SET FOR PROGRAMS

Clock-tuning will be offered by some manufacturers this season. The apparatus may be presented to tune in seven different stations at various times throughout the day.

Peck Provides a Thrill

Moves Television Performance Up to Plane of Home Movies

By Adam L. Holmes

WILLIAM HOYT PECK, president of Peck Television Corporation, demonstrated recently further development of his mechanical scanning system in the company's laboratory at 33 West Sixtieth Street, New York City.

The laboratory set-up included a radically new type of film pick-up, using standard size 35-millimeter film, and a receiver utilizing Peck's mirror lens principle, with an ordinary automobile headlight bulb as the light source. The film shown at the demonstration included shots of a rodeo, horse races, baseball and hockey games, boxing and wrestling bouts, and close-ups of Samuel Insull, Mussolini and Eddie Cantor.

Economy of Power

The pick-up is unique in that it is entirely gearless, and uses as its light sources 21-candle power, six volt automobile headlight bulbs instead of the customary 150-ampere arc lights. This economy of power and equipment is made possible by the great light-collecting qualities of the Peck lens, in which a single glass casting, silvered on the back, has the efficiency of a highly-corrected photographic lens. Mr. Peck is one of the world's leading optical scientists, as well as an electrical engineer.

Twenty such lenses, each slightly wedge-shaped, are mounted on the face of a whirling disc, their plane or rear faces at an angle of 45 degrees to the shaft. The disc revolves in a horizontal plane above the film, which is drawn over a tubular housing containing a photo-cell. Vertical scanning is accomplished by the continuous motion of the film; horizontal scanning, by means of the twenty lenses at the disc, powered by a 3,600-R.P.M. synchronous motor. The light source is at the top of the device, the spot being focused on the disc through an optical system, and thence reflected through the film. The design of the lenses, to be described subsequently, makes it possible to use approximately 83.33 per cent of the light available from the source instead of 1/4320, as with the pin-hole system on 60 lines.

Sound Sent Also

The sound channel of the film is acted upon by a separate headlight bulb and photo cell, similarly housed. The bulbs have been placed in a high position both for easy accessibility and to insure that no measurable heat reaches the film. In fact, as a test, inflammable film was left with the full light shining on one shot for 72 hours. There was no deterioration.

The reels of film, which hold the standard 1,000 feet, are turned by a 360 R.P.M. synchronous motor, the shaft of which is extended to take the driving sprocket. The total absence of gearing, which always adds noise and vibration, greatly simplifies the problem of mounting the photo cells and associated primary amplifiers. In fact, vibration is so totally lacking that a coin, balanced on edge atop the machine before the motors were started, remained thus throughout the entire demonstration.

Separation of Channels

The signals generated in the light-sensitive cells were amplified and transmitted to the receiver over two separate channels, one for the sight part of the program, the other for sound. While wire transmission was used in the demonstration, it was explained that it would be no more difficult to put the program on the air in its entirely when television broadcasting channels shall be made available.

The receiver was set up in a dimly-lighted room, partitioned off from the rest of the laboratory. There was sufficient light in the room at all times so that the body type of a newspaper column could be read without difficulty. This was done to impose a stiff requirement on the demonstration.

The picture was as bright as the average home motion picture, and measured approximately 11 by 14 inches. It was viewed from a distance of about fifteen feet.

Although the discs which Peck is demonstrating at present afford only sixty lines horizontally, the detail resulting was sufficiently fine to enable observers to see the movements of rapidly-swung hockey sticks in long shots, where as many as a half-dozen players were shown at once. When scenes from a baseball game appeared, witnesses were able to see the swing of the bat and the action of runners sliding to base. Every blow was clearly visible in the shots of a boxing bout, and the two contenders could be told apart. Likewise, one was able to see all holds in the scenes from a match between Jim Londos and Jim Browning, and to differentiate between the two wrestlers.

"Old Friends" Recognized

The grim visage of Mussolini, the weary face of Samuel Insull, and the staring popeyes of Eddie Cantor were all readily recognized by those who attended the demonstration.

The lens disc used at the receiver employs the same basic principle as that on the transmitter, save that sixty lenses are utilized. The lenses are fully protected by Peck's patents, being used in a basically new principle which takes advantage of the merits of the Coddington lens, while avoiding its drawbacks.

The disc to which they are fastened is revolved by means of a 1,440 R.P.M. synchronous motor, which Peck brought out about a year ago. Prior to his invention of this motor, engineers had believed it impossible to produce a synchronous motor to work at this speed, necessary for scanning 24 frames per second (as in standard talking motion picture film).

The Strong Receiver Light

Between the disc and the screen upon which the image is projected is the light source, in this case a 21-candlepower, 6-volt headlight bulb identical with the lamps used in the transmitter. Light from this bulb is brought through a simple condensing lens system to a new type of electrolytic light valve. Unlike the Kerr cell, this device has a capacity of only 0.000006 mfd., and measures less than one square inch overall. It contains but fifteen drops of liquid, and the two plates have a total combined area of about ⅛ square inch. This cell is modulated by a screen-grid tube.

The entire available light passes through it and thence to the reflecting lenses on the disc before projection to the screen. This makes the apparatus about five times as effcient as the best lens discs in which the light passes completely through the lenses.

Advantages Listed

Advantages claimed for the Peck receiver, in comparison with other television systems, follow:

Exclusive of the plate voltages used in the standard amplifiers which all systems must have, the Peck television devices use only a safe six volts, as contrasted with the 1,000 or more volts required to operate a cathode ray tube.

When compared with a neon crater tube, using a Weston Photometer as checking device, the Peck system is found to afford more than 3,000 times as brilliant an image.

The light source—a headlight bulb—costs 10c at any garage, as contrasted with the high cost and limited distribution of crater and cathode ray tubes.

The lenses in the Peck disc are made of moulded glass through a process which the corporation controls. Their cost of manufacture in quantity is about 6c each, including silvering.

There will be no costly wastage in the manufacturing process, as when a complete cathode ray tube must be "junked." The body of the disc is a simple casting. The lenses may be inserted and adjusted by an unskilled operator in less than an hour.

Simple Focusing

The Peck disc passes four times as much light as any other form of lens disc, because the light from the source is concentrated to a tiny spot, all of which is projected onto every lens. In other systems, the spiral arrangement of lenses, necessitating the use of a spot large enough to cover both Lens No. 1 and Lens No. 60, wastes three-quarters of the available light.

If it is desired to make the picture on the screen larger or smaller, no focussing is required. The infinity point of Peck's lenses lies within the lens itself. It is therefore necessary only to mave the screen near to or farther from the disc in order to make the image smaller or larger.

Great cabinet depth is unnecessary, for an economy of space is achieved by placing the light source on the same side of the disc as is the screen. Nor is the inordinate length of the cathode-ray tube needful in order to get a picture of satisfactory dimensions.

Future Plans

In further explanation of the system, Mr. Peck points out that his lenses are arranged in a circle instead of the usual spiral. Horizontal scanning is accomplished by means of the lateral travel of each lens as the disc is rotated. Vertical scanning is achieved through the angular displacement of the lenses, each being tilted at an agle of six minutes more than the noe preceding it, giving a total angle of 6 degrees over the entire sixty-line picture.

Asked as to his plans for the future, Mr. Peck said:

(*Continued on next page*)

World Test of Echoes

British Effort Aided By U. S. Bureau of Standards—All Short-Wave Listeners Invited

SPECIAL signals are being transmitted from two European radio stations for the study of long-delay echoes. The signals and the whole undertaking are adapted to the participation of persons all over the world who have high-frequency reeciving sets, no technical training being required. Long-delay echoes are a most surprising and baffling prenomenon.

J. Hals was listening in Norway, one day in 1927, to telegraphic signals from station PCJJ in Holland on a frequency of about 9,600 kc. Some of the signals were followed, after about 3 seconds, by a faint echo or reproduction. Echo signals occurring one-seventh of a second after an emitted signal had been well known, being due to the reception of waves that had traveled all the way around the earth. But the discovery of echoes after a materially greater interval than a seventh of a second immediately raised the puzzling question of where such an echo could come from.

More Light Sought

The phenomenon has been verified in a few scattered observations by Dutch, British, and French engineers. Echoes have been heard from 1 to 30 seconds after the emitted signal. Not enough is known, however, to determine what causes the echo signals nor how they are propagated, says the National Bureau of Standards.

Two theories have been proposed. One, by Dr. C. Stormer, of Norway, is based on the assumption that theer are streams of electrons in space some hundreds of thousands of miles out from the earth's equator, converging in a vast toroid upon the magnetic poles of the earth, and accounting for the aurora borealis or northern lights. Dr. Stormer supposes that the signals are reflected from these electron streams in space. According to the other theory, advanced by Dr. B. Van der Pol and Prof. E. V. Appleton, these echoes are due to a slowing up and reflection of the waves by a peculiar distribution of ionization in the very high levels of the ionosphere (that portion of the atmosphere 65 miles and more above the surface of the earth which is responsible for all long-distance radio transmission).

World Wide Test

The British Broadcasting Corporation through its magazine, World-Radio, and with the aid of Professor Appleton, has just inaugurated a worldwide endeavor to learn more about these long-delay echoes. Special emissions are provided from two high-power, high-frequency stations to facilitate observations by anyone who cares to listen with a high-frequency receiving set.

Listeners in all parts of the world have been enrolled in the endeavor, over 10,000 of them in Great Britain. It seems likely that information of unique value to science will result, and an orderly explanation of the curious phenomenon developed, when definite data are secured on the frequencies and the times of day and season at which these echoes occur, their intensities, the area over which a given echo is heard, their relation to magnetic storms, sunspots, etc.

The stations transmitting the special signals are GBS, Daventry, England, and HBL, Geneva, Switzerland (the League of Nations station). The GSB signals are transmitted on 9,510 ks, with a tone or modulation of 1,000 cycles per second, each Sunday, Tuesday and Thursday, from 3:25 to 3:55 a. m., Eastern Standard Time. The HBL signals are transmitted on 6,675 kc, unmodulated continuous waves, each Sunday, Wednesday and Friday, from 6 to 6:30 a. m., Eastern Standard Time.

Details of Sending

Each transmission consists of a 5-minute adjusting period (GSB using phonographic music, and HBL using its call letters in Morse code repeated) followed by the letters of the alphabet in Morse code, spaced a minute apart. Thus, for instance, GSB transmits the letter A in Morse code at 3:30, and after a minute of silence the letter B at 3:31, then the letter C at 3:32, etc., finishing with the letter Z at 3:55.

During the 1-minute intervals between signals the observers listen for echoes and observe the elapsed time in seconds wtih a watch having a seconds hand. It should be noted that the CSB signals are receivable with a receiving set as used for broadcast programs, but the HBL signals are unmodulated CW and therefore require an oscillating receiving set.

Dr. J. H. Dellinger, chief of the radio section of the National Bureau of Standards, would be very glad to have any successful reception of long-delay echoes in the United States reported to him, and will relay the information to the British authorities who are coordinating the investigation for the world as a whole.

Observers should give the identifying letter of the signal observed, the time to the nearest second at which the direct signal was heard, the time to the nearest second at which the echo was heard, an estimate of the relative intensities of direct signal and echo, a description of the sharpness or apparent shape of the echo, and any pertinent information on interference, fading of signals, or other conditions of the observations.

Dr. Dellinger would be interested also in receiving reports on reception of long-delay echoes on any other stations, especially high-frequency stations in the United States.

Persons desiring to keep in touch with all details of the project may address Broadcasting House, London, W. 1, England.

[Illustration on Front Cover.]

Peck's Television

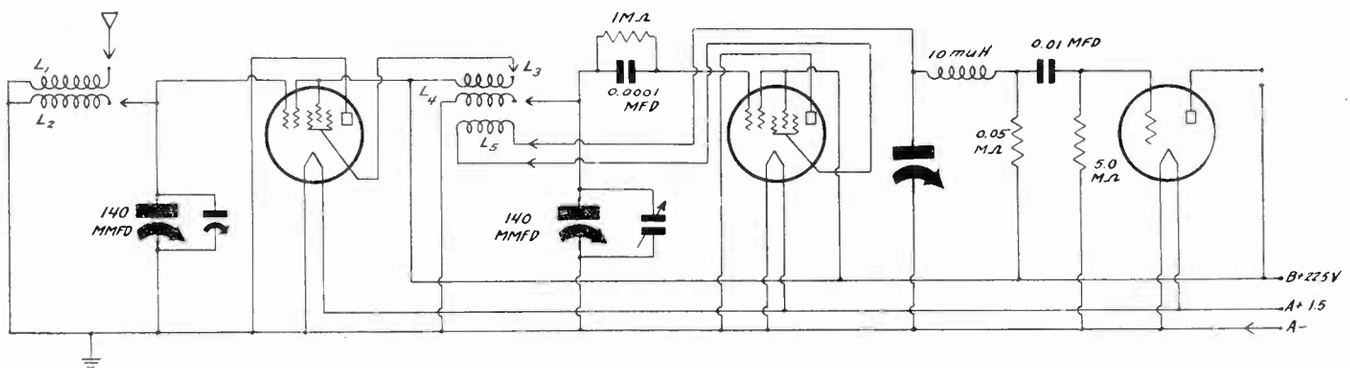
(Continued from preceding page)

"I hope to show a 120- or 180-line picture within the next few months. I shall not have to increase the number of lenses in the transmitting disc to do so; I shall merely turn it at double or treble its present speed. The number of lenses will be greater in the receiving disc, but as I shall use smaller lenses, the disc will not need to be more than a foot in diameter—if that.

"I shall also build a direct pick-up, for televising programs originating in broadcasting studios, on ball-fields and at other points of interest. This disc has already been engineered, and I can state definitely that it will afford instantaneous change from long shots to medium shots to close-ups, just as do the lens turrets on motion picture cameras.

"Mechanical scanning will, in my opinion, continue important in the television industry no matter what developments are likely to be made in cathode-ray tubes. People will demand sets which are efficient, inexpensive and safe. Mechanical scanners using my methods meet those requirements, and I know of no other apparatus which does."

The commercialization of the Peck television devices will take place with licensing agreement between the corporation and radio manufacturers and broadcasters. Peck does not plan to manufacture complete television receivers or transmitters, though he will probably make the lenses upon which his entire system is based.



Even a simple short-wave set like this may be used for tuning in echoes of GBS and HBL.

Fewer Tubes in Receivers

Six or Under Per Set Is Becoming Rule—Trends Discussed

By William M. Perkins
National Union Radio Corporation

A PAPER recently presented before a group of radio engineers stated that past experience has shown that one may safely predict what technical developments will be of commercial importance for one season or even two seasons in advance. In support of his statement the speaker directed attention to the developments, such as a.v.c., twin speakers, etc.

All of the features now popular were known to the industry for a year or more before commercial introduction, and even after introduction at least one and in some cases two years elapsed before really widespread acceptance was achieved.

In the light of facts brought out in the speech, one need only have in mind the developments that are already on the horizon, and which have undergone a so-called "aging period" to predict with reasonable certainty the technical features which will hold the center of the stage for the 1934-35 radio season.

Short-Wave Growth

Short-wave reception will most certainly be the featured item of the coming season's radio receivers. This feature has followed the normal and natural growth which past experience has shown must be attained before really universal popularity can be achieved.

The engineering branch of the radio industry has been acquainted with the technical aspects of short-wave reception for three or four years, and since its commercial introduction two years ago it has been sufficiently well exploited to the point that now the public desires a radio receiver capable of short-wave reception.

In April 35% of current radio designs included one or more short-wave tuning bands. Later in the year this percentage will have grown to where the majority of the designs will provide for short-wave reception.

Many of the receivers will be marketed with all-wave antenna kits. These aerial kits will make for better broadcast reception as well as for more noise-free high frequency reception.

Automatic Program Selection

Too long has it been since the public has had its attention brought to the importance of a good aerial. To provide an urge for the set owner to see that the aerial is really installed at least one large manufacturer will require a signed statement that the installation instructions were followed in the erection of the aerial before issuing to the owner a guarantee certificate. This manufacturer will feature "guaranteed foreign reception" in his advertising.

Automatic program selection will begin to make a bid for popularity in the 1934-1935 season. Adequate technical means have been at hand for some time now, and one concern placed a receiver having automatic program selection on the market several seasons ago. In this coming season this feature will play a minor part, but it will be introduced to the public, and there are reasons to believe that a year or so from now when short-wave reception has become to be taken for granted, that automatic program selection will do much to make the public buy new sets.

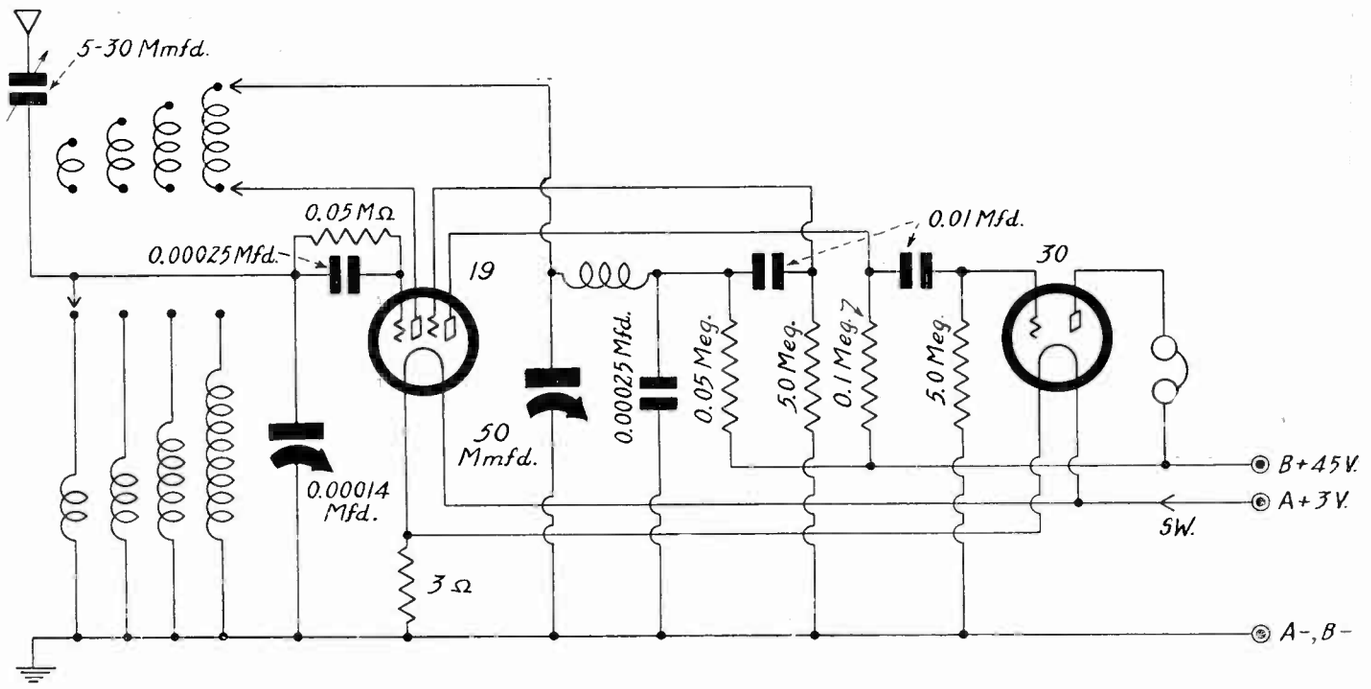
Fewer Tubes for Receivers

Much has appeared in the trade press during the past year regarding "high fidelity" receivers. "High fidelity" cannot be regarded as a strictly new feature. It falls more nearly into the classification of an expected improvement. Much remains to be done by the broadcasters in providing high signal levels to the country as a whole before really high fidelity radio receivers can be widely desirable.

Specifically, as the coming season's radio sets are translated into radio tube trends, only two items worthy of note suggest themselves. First, it apparently can be made a matter of record that six-volt tubes have won for themselves a greater popularity than the two and one-half volt tubes have been able to retain for themselves. All indications point to the continuance of the six-volt line as the standard. Portable sets (AC-DC) and automotive receivers are the explanation of the adoption of the six-volt line.

Six Tubes or Fewer

The second trend which is likely to continue through the coming year in relation to tubes is the use of six or fewer tubes per set as contrasted with the practice of a couple of years ago of using an average of eight or nine tubes per set. When "high fidelity" receivers come into their own, the average number of tubes per receiver again climb.



The number of tubes in sets is being reduced due to combination tubes like the 19 in the illustrated circuit.

New Antenna

Matching Requirements, Broadcast-Band Accommod

THE Atwater Kent Manufacturing Company has placed on the market a new doublet antenna kit which is said to reduce background noise and increase volume on distant stations.

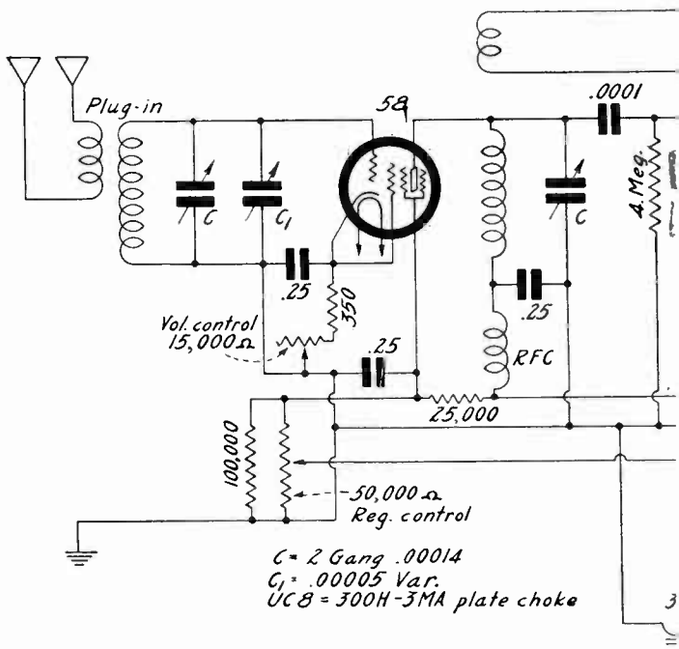
In developing the Type D doublet antenna kit, for a simple doublet with a parallel transmission line, many comparative tests were made with practically every known type of receiving antenna in order to determine its superior advanatges. The company reports:

All results showed a greater signal pick-up over the short-wave range and the suppression of local electrical interference. The kit may be used with any radio set provided with double antenna connections.

"To permit the use of the doublet antenna with all-wave and short-wave receivers equipped with a regular single antenna connection the company has developed a special transformer. Carefully designed for maximum performance over the short-wave range, the transformer is provided with a change-over switch allowing the doublet antenna to be used as a regular single antenna when the regular broadcast band of the receiver is being tuned."

The main value of the doublet antenna, according to Atwater Kent engineers, is that the signals picked up by the two halves of the doublet do not balance but reinforce each other, thereby reducing interference.

What is meant by the double-antenna connection being provided in the receiver, so that a doublet antenna may be used without necessity of a matching transformer between the leadin and the set. The primary is brought out to two separate insulated terminals



Untuned Type Favored

A large proportion of the interference on any radio set is picked up by the lead-in on the antenna. In the doublet arrangements the noise picked up by one of the two lead-ins is balanced out by bucking it against the identical noise in the other lead-in. This balancing action takes place in the doublet transformer if it is correctly designed.

Tuned doublets have definite specific lengths for the antenna section and sometimes also for the transmission line. But as the short-wave frequency range is extremely wide, and the international short-wave broadcast bands do not bear a strict harmonic relation, Atwater Kent has found that best results are secured with an untuned doublet. The untuned type has the great practical advantage that there are no definite lengths for the antenna or transmission line. You can make the doublet fit in the space that is available.

Actual comparison showed that while a twisted pair forms a very convenient type of transmission line, it cannot compare in performance with a transposed or parallel type transmission line.

The parallel type transmission line is used because it affords maximum signal strength over the entire range, and it makes a simple and practical installation.

Transformer Important

A separate doublet transformer is not required with any set that is provided with doublet-antenna terminals. But for all other short-wave receivers it is necessary to use an external doublet transformer.

Actual comparative tests on different makes and types of doublet transformers proved definitely that successful performance of a doublet-antenna depends almost entirely on correct design of the coupling transformer.

Many of the available doublet transformers showed a marked drop in signal strength and increase of noise, thus defeating the purpose of the doublet.

Transformers that seemed satisfactory, on paper, proved unsatisfactory in actual reception.

Electrical interference is more evident on short waves than on standard broadcast, so it is necessary to use an antenna system that will reduce this interference as much as possible.

A large proportion of the interference is picked up by the lead-in. On standard broadcast, this pick-up can be eliminated by using a shielded lead-in. But on short waves a shielded lead-in causes a tremendous drop in signal strength owing to the by-passing effect of the shield.

Select Favorable Location

The signals picked up by the two halves of the doublet do not balance out, but reinforce each other.

The doublet antenna provides greater reduction of interference and stronger signals than a plain antenna.

No method has yet been found to eliminate interference that may be picked up by the antenna section of the doublet. For this reason it is desirable to erect the doublet antenna in a location as free as possible from electrical interference.

The doublet should be erected as far as conviently possible from sources of electrical interference.

The direction is important, best reception being at right angles to the length of the doublet. In the United States, European short-wave stations will be received best with the doublet running in a North-West and South-East direction. This angle is not critical, but remember that reception is poor in a line directly along the length of the doublet.

Two 30-foot rolls of bare stranded antenna wire are satisfactory. It is desirable to use this entire length, making the doublet approximately 60 feet long. However, if sufficient space is not available, the length may be decreased, but naturally ths signal pick-up will not be as great.

In any case, each section of the doublet must be the same length. If one section is 20 feet long, the other section must be 20 feet.

Height and Length

The doublet should be erected as high as conveniently possible (about 10 feet above the roof) to obtain the best signal pick-up and to keep the antenna removed from the usual sources of electrical interference.

Two 60-foot rolls of heavy rubber-covered wire are used for the transmission line. The line may be any desired length; if 60 feet is not required, cut off the surplus. If more than 60 feet is necessary, splice on additional rubber-covered wire of the same type.

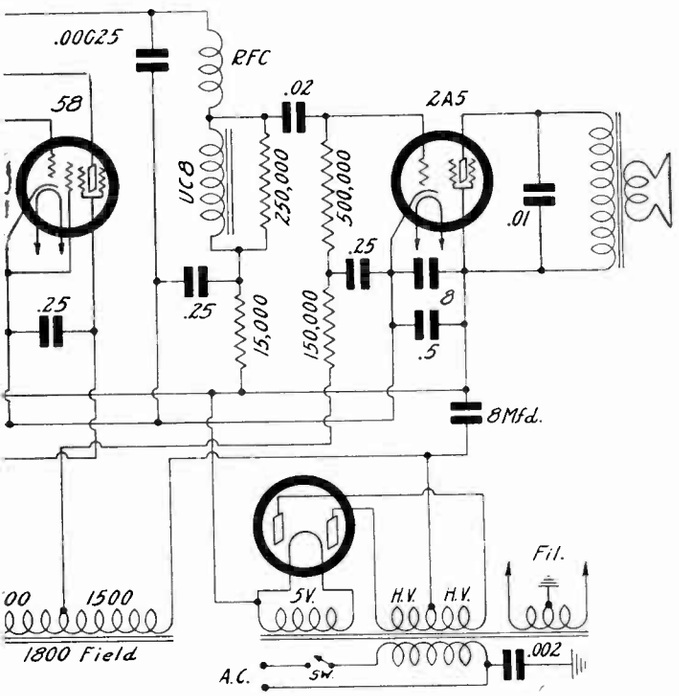
The transmission line should be pulled taut and anchored. It must be placed sev- inches from the walls and pipes. It should not be run closely parallel to electric lines. If the transmission line must run parallel to electric wires, it should be spaced as far as possible from them. The two leads comprising the transmission line must be spaced 2 inches apart for the entire length of the line by means of the spreaders and stand-off insulators provided in the kit.

Erect suitable antenna supports. If the antenna is on top of a house with a metal roof, the roof is regarded as ground, and the doublet antenna should be about 10 feet above the roof.

If the distance between poles is less

ı Installations

ation, and Other Aspects of Noise-Reducing Systems



The grid returns usually are grounded in sets, and brought out to a separate ground post. Though a regenerative receiver of the plug-in-coil type is shown, the antenna connection is illustrative of receivers in general

By ARTHUR H. LYNCH

UP to the present time every all-wave noise-reducing antenna system has been deficient in signal strength on the broadcast band. In some systems a compromise has been made with noise by including a switching arrangement which converted the antena from a doublet with noise-reducing properties to an ordinary T antenna with no noise-reducing properties. It had been thought impossible to provide an antenna system which would be efficient over the very broad band of frequencies which lie between five meters and six hundred meters, which is equivalent to fifty-six thousand to five hundred and fifty kilocycles.

The ordinary broadcast receiver has a frequency ratio of approximately three to one. New antenna systems have a frequency ratio of more than forty to one.

Location Determines Better Type

For the person who is located in the city or who lives on a modest sized plot in the suburbs, the doublet antenna system is recommended because the total length of the horizontal portion of the antenna need not be more than forty-one feet. Naturally an antenna of such small dimensions will not have the pickup of one made with a very much longer flat-top. But this deficiency is overcome in a most practical manner by the use of an impedance-matching device at the antenna which eliminates the losses usually sustained in the ordinary type of noise-reducing lead-in.

Where suitable space is available an entirely different type of antenna is suggested, having a total overall length of 114 feet, approximately half a wavelength at 70 meters or 4.3 kilocycles. With this type of horizontal antenna the lead-in is taken from the end rather than in the center. This has been done as a matter of mechanical convenience rather than electrical efficiency. This system of commercial prototypes were known as inverted L type antenna systems.

The latter system does not require the elaborate and rather expensive antenna transformer and where space is available it is recommended as being superior to the doublet type. The flat top need not be in a straight line. It may zigzag, but it should not double back on itself.

How the Systems Work

Most of the important short-wave broadcast stations operate on approximately 13, 16, 19, 24, 31, 49 and 70 meters. A long horizontal antenna cut to receive on 70 meters is fairly efficient on all of the other wavelengths and it is extremely good in the broadcast band. Such an antenna should be at least thirty feet above the ground. By reason of the size of the collector (antenna) the signal strength it picks up is rather large and compensates for small deficiencies between the antenna and the receiver which could not be tolerated with a collector of the smaller size. Therefore, the impedance-matching transformer at the antenna is eliminated for both mechanical and financial reasons. A low-impedance transmission line is used on both systems between the antenna and the newly-developed receiver impedance matching transformer which is connected directly between the lower end of the transmission line and the antenna and ground posts of the receiver itself.

The impedance of the transmission line is approximately 70 ohms and the input impedance of the transformer is also approximately 70 ohms. The output impedance of this transformer may be selected by means of simple telephone tip-jacks to match receivers with either high or low input impedance. A third connection is provided on this transformer which enables the entire antenna, plus the lead-in, to be utilized as a regular T type antenna, in areas where noise occurs on one band and not on the others. This new transformer affords a means of coupling a transmission line to the ordinary type of receiver without requiring any changes in the receiver itself and without noticeable loss in either the broadcast or the short-wave bands.

Improving Doublets

The new type of all-wave antenna system employing a doublet for the horizontal portion of the antenna may be made to operate satisfactorily over all of the existing wave-bands as a result of some matching transformers combined with accurate fixed condensers.

important developments in impedance-

It is common radio engineering knowledge that fixed condensers have a lower impedance at high frequencies than they

(*Continued on next page*)

than 60 feet, cut each section of antenna wire to the required length (the two wires must be equal in length) and fasten the ends securetly to the glass insulators.

Soldering Necessary

Insert the leads of the transmission line through the holes in the spreaders. The number of spreaders to be used, as well as the distance between spreaders, depends on the length of the transmission line between the antenna and the first pair of stand-off insulators. There should be one spreader at least every 10 feet.

Securely fasten and solder the leads of the transmission line to the two halves of the doublets, about 2 feet apart, as shown in illustration.

Suspend the doublet between the antenna poles, pulling it as tight as possible.

The transmission line should, where possible, be brought down to the window nearest the receiver.

Run the transmission leads through the first pair of stand-off insulators on the wall of house. Use additional spreaders if necessary along the transmission line between the pairs of stand off insulators. Pull the transmission line through the last pair of stand-off insulators and anchor the leads.

Use An Arrester

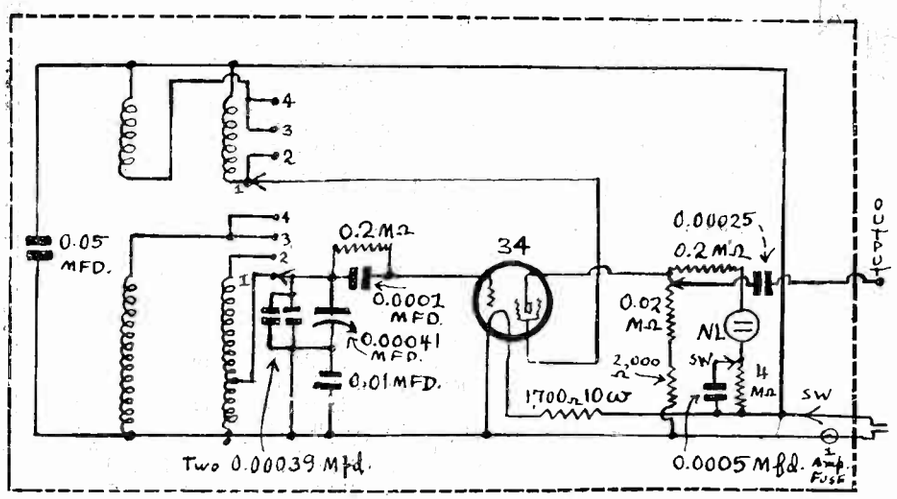
Connect the transmission line to the lightning arrestor and to the flexible dual window lead-in strip as shown in illustration. In cases where the window lead-in strip can not be used, drill a hole for a porcelain tube insulator in the window casing (on an upward slant to prevent entry of water) and bring the transmission line through the insulator. The transmission line may be twisted for a short distance (2 or 3 feet) without loss of signal strength.

In some cases, depending on local conditions, a better ratio of signal-to-noise may be obtained without a ground connection to the receiver. Try it both ways, and if there is less electrical interference without the ground, leave the ground connection off. (Of course, this does not apply to the ground on the lighting arrestor, which must be connected always.)

Two New Signal Generators

One Uses Switching, Other Fundamental and Harmonics by New Method That Avoids Usual Confusion

By Herman Bernard



A switch-type signal generator, fundamentals used to 4,500 kc, harmonics for the rest. Top of 0.01 mfd. should go to box, not to filament.

TWO signal generators shown herewith attack the performance problem in two different ways. One uses four different bands for fundamentals, and harmonics of the highest for higher frequencies. The other uses a single fundamental band, and relies on harmonics for all the other frequencies, but in a manner that eradicates possibility of confusion as to what is the unknown frequency.

The four-band fundamental signal generator covers the following ranges:

83 to 99.9 kc.
140 to 500 kc.
540 to 1,600 kc.
1,620 to 4,500 kc.
3,010 to 3,600 meters.

Only two different coils are used. When the tuning condenser has a large fixed condenser in parallel with it the tuning ratio is very low, a trifle more than 1.2 to 1, for the 83 to 99.9 kc range, using the larger coil. While seldom any fundamentals are to be measured in this range, nevertheless with such abundant spread-out harmonics of this fundamental can be used for most accurate and stable measurements even of frequencies included in subsequent fundamental ranges.

When the large fixed condenser is removed from the tuning condenser of course the frequencies are higher and the normal ratio is attained, 140 to 500 kc, so that all the intermediate frequencies to be measured are encompassed at one switch point. The third switch point is for 540 to 1,600 kc, the broadcast band, using the second separate coil. The fourth is for the intermediate short waves, whereby the frequencies are three times as high as they are when the switch is set for the broadcast band.

The wavelength range is represented by the first switch stop, hence represents the metrical wavelength equivalent to the frequencies of this band, 83 to 99.9 meters. Therefore while it would seem that there are five bands, and only four switch stops, the one stop represents frequencies and wavelengths of a single band, but these appear separately on the dial scale.

As there are four tiers on the dial, two on each side, each pair read from a separate escutcheon, and as there are five scales evidently to be accommodated, the seemingly "missing" one is simply represented by the broadcast band scale multiplied by three. Since the capacity in circuit is just the same, the same scale will hold, at three times the frequency value, if the inductance of the coil for the intermediate-short-wave band is one-ninth that of the other coil. And if a secondary intended for the broadcast band is tapped just at the right place, this conformity to the broadcast scale will hold nicely.

There is no representation for 100 to 140 kc.

By using fundamentals and harmonics, frequencies may be measured from 83 to 99.9 kc and from 140 kc to 99.1 mgc., as well as wavelengths measured from 3,010 meters to 3,600 meters on the fundamental, and to 10 meters on harmonics, with confusion that might otherwise arise from harmonic use being eliminated.

A Station-Finder, Too

The frequencies and wavelengths of fundamentals are directly read from the dial scale, higher frequencies or wavelengths measured by infallible interpolation. This arises from the use of the new system of harmonic calibration.

The signal generator also may be used as a station-finder, and works on 90-125 volts a.c. (any frequency), d.c. or batteries. Use across 90 volts of B battery, the idea in mind as an emergency practice only, is wasteful on the B block, because of the drain of some 65 milliamperes. But for the short period of testing, in a place where no other power is available, particularly to service a battery-operated set, the practice has to be resorted to in a pinch.

Always there is modulation present. On a-c use the line frequency (hum) is the modulation, or sound heard, which comes through only at resonance. The resonance point may be established by listening to speaker or phones in the measured circuit (normally a broadcast or all-wave set), or by attaching an output meter to the receiver's power tube output circuit. Either way works well.

Neon Tube Modulator

The modulation for d-c use is provided by a neon glow tube. As is well known, this tube will oscillate at audio frequencies, and even to low radio frequencies, say, 100 kc, if a series limiting resistor is used, a condenser across the lamp or across the resistor (never across both), the suitable voltage is applied. For a tone of about 1,000 cycles a resistor of 4.0 meg., across it a condenser of 0.0005 mfd. is required. While the choice of resistance and condenser values may be changed almost at will, the resistance should not be below that required for protecting the lamp, normally 200,000 ohms. Higher resistance than that often has to be used for assurance of oscillation, even if a high capacity is put across either lamp or resistor.

If the 0.0005 mfd. capacity does not yield a tone, still using 4.0 meg., put more capacity across the resistor.

The modulation is too strong when the condenser is across the resistor, perhaps too weak when the condenser is across the lamp.

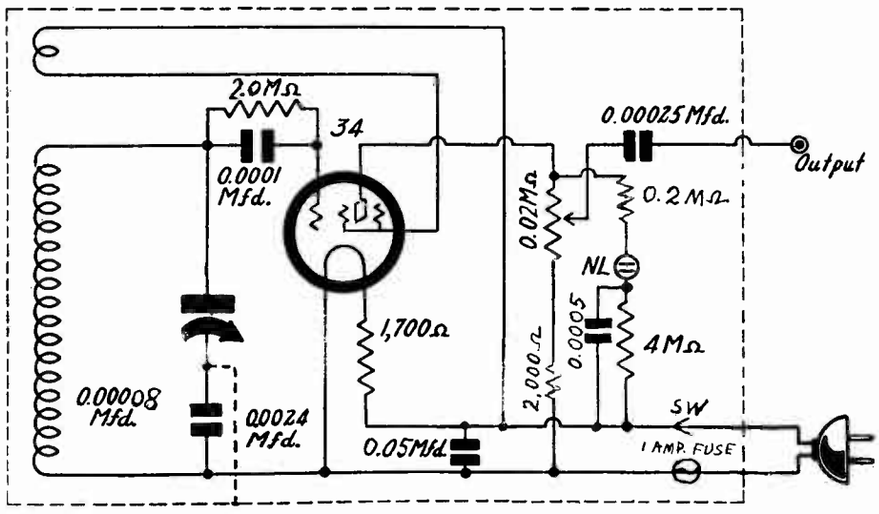
In the lamp-shunted instance the per-

New Antennas

(*Continued from preceding page*)

do at low frequencies. Therefore, when the receiver is tuned to the high frequencies, that is, any of the short-wave bands, the impedance of the two small condensers offers the path of least resistance to the incoming radio waves which pass directly through the condensers to the low-impedance transmission-line. From this line it goes into the receiver-impedance matching transformer and then, by one of three distinct methods, directly to the receiver.

It is also well understood that a doublet antenna cut to a size which is most efficient on the short-wave band will not function satisfactorily when used in the broadcast band. For this reason transformers are utilized to carry the broadcast signal into the transmission line at a considerable gain over the signal which would be possible without these transformers. In this case the impedance of the transformer is very much lower than the impedance of the fixed condenser and the incoming broadcast signal passes through the transformer in preference to the condenser.



The harmonic-calibrated generator, Model 334.

centage modulation runs around 15. In the resistor-shunted method the percentage exceeds 100.

Avoidance of Distortion

A modulation percentage in excess of 100 spells distortion. This distortion shows up in the form of double-hump tuning. Instead of getting a sharp response at one point on the dial for a particular frequency you get a broad response at two adjacent points, with practical silence between, and you can't tell which one represents the calibrated frequency. This is caused by overloading. To avoid this condition a series resistor is used, unbypassed, leading to the r-f oscillator tube, to reduce the modulation until its amplitude is such as to yield only one response point, the point on which the dial-scale calibration is based.

Depending on how much modulation one desires, this limiting resistor may be selected. A value of 200,000 ohms is abundant. For still stronger modulation (but not strong enough to overload the r-f oscillator) as low as 75,000 ohms may be used, but the intensity resulting from the use of 200,000 ohms has been found adequate.

Why Neon Tube Oscillates

The neon tube oscillates by virtue of its negative resistance characteristic. That is, as the voltage is increased across the tube the current decreases, or, as the voltage is decreased the current increases, just as in the dyantron. Except for the confinement to audio regions, there is hardly any reason why the neon-tube oscillator can not be classed as a dynatron, though that word is applied ordinarily to screen-grid tubes of the type having no suppressor grid, worked with plate at a critically lower positive voltage than the screen, the plate circuit tuned.

The generator is a familiar type of circuit to readers of Radio World, as similar designs have been shown before, but the switching arrangement and the distribution of bands and the harmonic identification process are new. The advantages of the circuit include electron coupling between modulator and r-f oscillator; electron coupling between r-f oscillator and measured circuit, so that no detuning of the measured circuit results from the output coupling, and the confinement of the circuit to the simplest essentials. Signal generators are like short-wave sets—the fewer parts in them, the better they work, as a rule. Of course there are exceptions.

There is an attenuator, consisting of a 20,000-ohm potentiometer, and from the moving arm of this device is connected a fixed condenser that leads to the output post. A value of condenser suitable for general requirements is 0.00025 mfd. However, any who desire a stronger output need have no hesitancy in using a larger capacity, since the electron-coupled output safeguards against detuning effects.

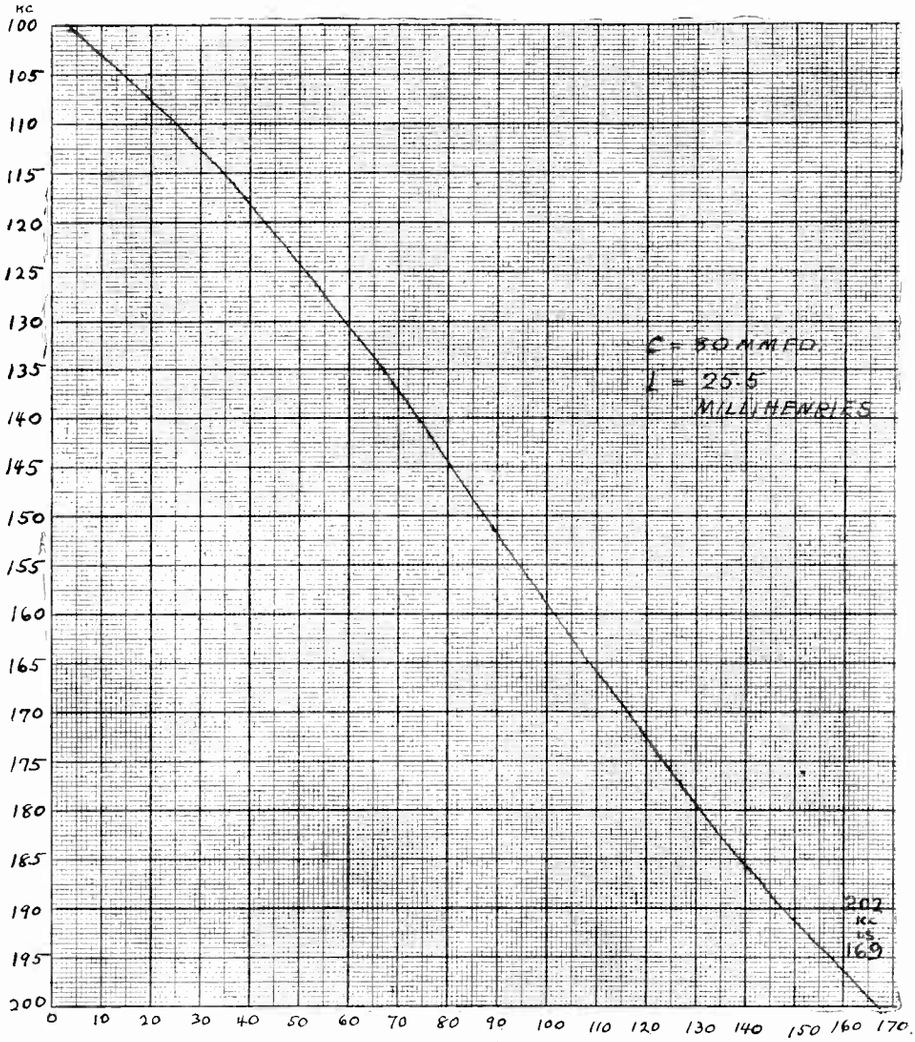
There is one nuisance sometimes encountered when using signal generators that have large output. It is desired to reduce this because the signal from the generator is too loud for comfort of the ear and also for most accurate measurements. One should realize that the close measurements are made with attenuated input—low volume level. The trouble is that the volume control (attenuator) on the generator when turned to relatively low-resistance position between arm and return, partly short-circuits the input to the measured circuit. In the case of a receiver the sensitivity of the receiver is thus controlled by the generator.

Safeguard Introduced

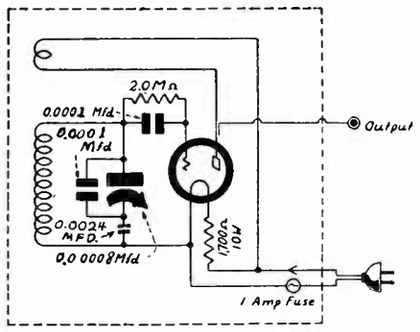
The reason would be use of too low a value of potentiometer, so that when the resistance between arm and return is a few hundred ohms or so, the circuit, in parallel with the receiver input, acts as a short to that input. However, raising the value of the potentiometer too much prevents the use of the method of coupling the neon oscillation in the unique plate-circuit hookup. Hence as a safeguard against shorting the receiver input, a limiting resistor is put in series with the potentiometer, 2,000 ohms being sufficient if the potentiometer is 20,000 ohms.

While the model is described as being for 90-125 volts, the 180-250-volt range can be covered for the foreign needs by using 3,500 ohms as the limiting resistor (20 watts), instead of 1,750 ohms (10 watts). Or a switch could be used, to turn from one voltage range to the other, for even in this country, in certain factory installations, the lighting company supplies 220 volts. The only precaution necessary is to see that, if the higher

(*Continued on next page*)



Curve for the fundamental of the harmonic-calibrated generator. Hammarlund's or Bud's condenser will follow this curve closely.



The smaller model signal generator uses a 30 tube, covers a fundamental range of 116 to 332 kc, and by the automatic electric counter method enables measurements up to 20 mgc, and down to 15 meters, in either kc, mgc or m. Harmonic confusion is eliminated.

(Continued from preceding page)

voltage is to be applied, the switch is set for it. The other mistake, of setting for a high voltage when using a low one, does no further harm than to prevent the circuit from oscillating, thus reminding the absent-minded.

Harmonics Capitalized

The model that uses only one fundamental frequency range, 100 to 200 kc, also calibrated in wavelengths, 3,000 to 1,500 meters for the fundamental, ought to be an answer to those who cry, "No more harmonics for me!"

It is a fact that harmonics have been very confusing. Moreover, there have been doubts even in the minds of learned scientists, upon occasion, as to just what was the unknown frequency, when high-order harmonics were used. Was the unknown 10,050 kc or 10,100 kc, or, indeed, 9,000 or 10,000 kc, using harmonics of a 50-kc fundamental? The answer often was important to ascertain, but had to be foregone.

The harmonic model uses an airplane dial with four scales on the upper semi-circle and four on the lower.

The topmost scale is the fundamental, 100 to 200 kc, with 1 kc separation. The second tier from top represents 200 to 400 kc, with gradations 5 kc apart; the third 400 to 800 kc, still with bars spaced for 5 kc; and the fourth on the upper semi-circle 800 to 1,600 kc, at 10 kc separation.

When the Fun Begins

Thus we have covered all the intermediate frequencies and the full broadcast band, using fundamental and second, third and fourth harmonics.

Second and third harmonics have not been troublesome. They do not represent such a large assortment of response frequencies as to make one doubt what the unknown really is, when a fundamental is used for its harmonic. The fourth harmonic begins to become troublesome, even when the frequency ratio of the fundamental is as low as 2 to 1.

However, lest there be any mistake as to the identity of a frequency covered by the fundamental, one need only recall that if one turns the dial and gets only one response in the receiver, then the receiver is tuned to the fundamental. This fact has been well known in regard to harmonics in general for some hundreds of years. In physics somewhat the same idea has held forth some thousand years: contents can not exceed container.

An exception in the generator to the one-response rule for fundamental identification is when the receiver or measured circuit is tuned to 200 kc, with generator set at 100 kc. However, the isolated case of this second harmonic, disclosing the unknown as the higher of the two frequencies read, is merely noted. It is of no consequence.

Now, if there are more than one response, there is a certain relationship between those responses, and this model signal generator establishes that relationship as part of the calibrations on the lower half of the dial. The lowest or bottom calibration is indeed that of the harmonic calibrator. And the calibration is in terms of the unknown, that is, the frequency desired to be determined. If it is of any interest to the user, the actual harmonic order may be ascertained by a simple calculation.

As intimated, the bands from 100 kc to 1,600 kc are covered by fundamentals or harmonics by a method applied in conjunction with a special calibration that enables determination of frequencies, even when using harmonics, without any calculation whatever. For higher frequencies, 1.6 to 20 mgc., with most of the calibration area in 200 kc jumps, again the determinations are made without any calculation—right from the scale. Simply see what the frequency reads, and that's what it is.

For extension of the method, so that unknowns are determined in wavelengths or frequencies, and particularly for better definition in the high-frequency region, 8 mgc up, where close readings are not practical automatically, a single computation is required. In no instance does this computation consist of more than one simple subtraction alone, or one simple multiplication alone.

So finally there has come upon the radio horizon a method, long needed, that removes the guesswork formerly attendant on use of harmonics, precludes error, makes things easy and accurate, and substitutes science for floundering. Practically every manufacturer of signal generators has gone over to switching, and confinement to fundamentals, with either veiled or open denunciation of the use of harmonics (which all their own previous instruments actually employed), the departure being due largely to lack of knowledge of this method of automatic harmonic calibration.

Accuracy is 1%

The same circuit is used for this model as for the one that uses a combination of switching and harmonic interpolation. The stability of the non-switching type is no doubt better, due to the low frequencies generated as fundamentals, these being easier to handle by far, also better from the viewpoint of accuracy. There is no trouble in holding the accuracy of the instrument to 1% (coincidence of generated frequency to the frequency actually read). Of course almost any dial can be read to ½ of one per cent., and if large perhaps to ¼ of 1 per cent., but accepting ½ per cent., there would be no particular wisdom in having greater accuracy of coincidence than the percentage closeness to which the dial can be read. And if great stress is laid on the use of a dial that can be read extremely close, say, to 1 part in 1,000, with no mention of the accuracy of frequency stability of the oscillator, the blurb is all right for the dial, but does not apply to the signal generator at all. The oscillator may shift, drift and wobble some 3 to 5 per cent., so what good would be the close reading of a frequency that is itself so far off calibration?

Moreover, a dial is most important in a signal generator when the dial is frequency-calibrated, because while it is nothing to read a dial to ½ per cent., curve sheets, as supplied with uncalibrated oscillators, scarcely can be read as accurately, unless these sheets are larger than usual. The dimensions would be in feet.

Unusual Stability

Both of the models discussed are frequency stable to an unusual degree. This test can be made readily by beating fundamental or harmonic with a crystal-controlled station, and letting the beat continue for, say, half an hour, noting whether the pitch changes. If it does not change, the oscillator is as stable as the station's wave, and some 50-kw stations have a wave steady to 5 parts in several hundred thousand. If the shift is within 1,000 cycles then the station's shift may be added to the oscillator's for the total change. If an harmonic is being used, divide the shift by the harmonic order before applying it to the generator fundamental for determination of the drift. It will be found that the two circuits are stable at the low-frequencies to within 0.1 per cent., which is much more than one would expect. However, one might not suspect that hidden in the circuit (and find the clue if you will) there is a stabilization method. And moreover, the method has been discussed in these very columns recently—say within three months.

The same scale used for Model 334 may be applied to battery use, as shown in another diagram. As only 22.5 volts are used for B feed, a neon lamp can not be used as the audio oscillator or modulator, because it will not strike until around 60-odd volts are attained. Therefore a 30 tube has a small audio transformer connected to it to produce the audio note, and the 30 is coupled electronically to the r-f oscillator. The limiting resistor is 0.2 meg., to prevent overmodulation.

The filaments of the 334-B are connected in series, since both the 34 and the 30 draw the same current. The A voltage is 4.5 volts, obtained from a small dry battery of the C-biasing type. Thus each tube gets 2.25 volts. This shortens the tube life just a little, not enough to demand attention, and besides the A battery resistance increases with age and use, and the actual voltage soon becomes very close to 2 volts. The slight excess over 2 volts of course increases the emission, hence the intensity of the output is larger.

Alternative Method

If the two tubes were radio-frequency oscillators it would not be practical to use the series-filament method, because then there would be no control of the coupling. The impedance of the filaments is sufficient to afford coupling between the tubes at radio frequencies of oscillation, but not at audio frequencies, for then the impedance is practically the same as the d-c resistance, some 60 ohms, at least for the relatively low audio frequency used. Hence the tubes are left lighted even if modulation is removed by switching.

Since B current still flows, it would be acceptable to switch off the B voltage from the 30 tube, when modulation is not desired, instead of removing the modulation connection, for only the filament would remain excited. Running a tube with only filament lighted, and no B voltage, does not appreciably affect the life of the tube, as what constitutes a drain on the emission of course is the attraction of the electrons from the cathode to the plate.

The battery model can be equipped with plates for percentage modulation and decibel output attenuation. If the r-f oscillator is stable, then the current through the "plate" circuit, really a pick-up circuit, is constant, hence the output attenuation is proportionate to the amount of resistance between "plate" and ground. Hence a straight resistance vari-

ation type of potentiometer may be used, and the decibel attenuation derived from the power formula, as set forth in last week's issue (page 6, September 1st).

The percentage modulation would also be proportionate, but without requiring anything save simple proportion, provided that the maximum modulation is 100 per cent., the desirable maximum. The formula is:

$$M \frac{100\ E_d}{E_c}$$

where M is the modulation percentage, E_d is the difference in the voltage readings between the unmodulated r-f wave and the r-f wave when modulated, and E_c is the voltage of the unmodulated wave. By applying the formula the whole run of percentages may be ascertained, or sufficient points to establish a curve from which even steps of percentage may be derived.

A smaller model "universal" type signal generator is the Model 335, particularly suitable for those who desire to use it principally as a station-finder, for ascertaining both the wavelength and the frequency of a station being received, although it will read intermediate frequencies, too.

Identifying the Stations

A great deal of confusion regarding the identities of stations being received on short-wave and all-wave sets arises from the long lapses between station announcements and also, no doubt, from the fact that when an announcement is made it may not seem to be as clear as desired. This may be due in truth to the announcement being in a foreign language. But the language of frequency, or wavelength, is universal, and determination of the frequency of wavelength by an accurate method enables identification of the station.

This model has a fundamental range of from 110 to 332 kc, with 1 kc separation between bars on the scale; 230 to 460 kc with 5 kc separation between bars on the scale; 2,590 meters to 1,250 meters; 1.8 to 20 mgc. The intermediate frequencies may be read without possibility of confusion even though harmonics are used. Also, the broadcast band can be checked the same way, using harmonics. The principle of harmonic confusion elimination is applied, and besides an harmonic counter system for the 1.8 to 20 mgc span.

For 1.8 to 4 mgc the steps of the counter are 200 kc apart, from 4 to 10 mgc they are 1 mgc apart. The reason for this difference in separation is that the tuning characteristic, for any adequate frequency or wavelength ratio, has to make the high-frequency points registered for the counter come rather close together. Therefore for the higher frequencies, say, 5 to 20 mgc, the system is not completely satisfactory, as it lacks adequate separation or definition, but for these high frequencies the counter system need not be used, but instead the harmonic-confusion eliminator method, for either wavelength or frequency determination. No other mental operation is necessary than alone to subtract one simple number from another, or alone to multiply two simple numbers, the numbers in each instance being read from the dial scale.

There is no attenuator on the Model 335, for since this instrument is likely to be most often used as a station-finder, no attenuation is necessary. Also there is no modulation on d.c. or battery use, although it is necessarily present on a-c use, consisting of the hum of the line.

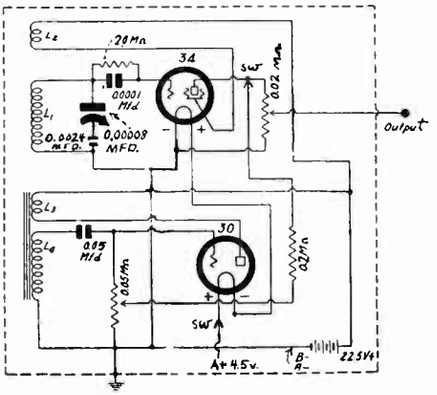
For station-finding the method used in all instances, for all models, is that of almost zero-beating with the incoming signal. This consists of setting the station-finder or signal generator going, coupling it to the aerial by twisting a few turns of the output wire from the generator around the leadin anywhere in the house, producing a squeal with the incoming signal that way, and carefully tuning the generator until the sound heard is of the lowest possible frequency. When the sound is of zero frequency the zero beat exists, but since there is a 60-cycle note present as modulation on a-c use, about as close as one can come is 60 cycles from zero beat, or carrier frequency, which is negligible, especially as it constitutes 60 cyles out of 1,800,000 to 20,000,000 cycles.

In fact, the dial scarcely could be set closer than 60 cycles off resonance, except by rarest of accidents, and the calibration of no commercial signal generator can be accurate to 60 parts out of 20,000,000 or even 1,800,000. Even crystal control with temperature over would not yield such results. Monitoring would be necessary in addition to these precautions.

Model 335 should not be grounded externally, neither should Model 333 or 334, for the automatic grounding is sufficient, and besides the scales were calibrated without external connection to ground. A slight frequency difference is introduced due to ground capacity if a ground is used externally, so it is well not to ground externally. Also do not touch the metal cabinet when working the three "universal" type generators, as that would change the frequency just a wee bit, also. Simply hold the dial knob and let the box rest on a table.

The battery model may be grounded, if desired, but since the same scale is used, calibrated, it will be remembered, without external ground, the ground potential of the batteries may be relied on with assurance of satisfaction.

The laboratory model with attenuators applied for battery use. Here both output and percentage modulation attenuation are practical, and these values may be calibrated for direct-reading, just as the dial scales of all these generators, universal or battery types, are direct-reading.



12 New Set Models Are Announced by G.E.

Twelve new receivers, featuring standard and short-wave reception in every set plus "all-wave" and additional tuning-bands in eight of the models, are included in the new line of G-E radios. In addition 19 models previously announced will be continued.

The new models include four table models, six consoles, and two automatic radio-phonograph combinations. All sets receive both broadcast and short-wave signals. Two are standard and short-wave models, the rest of the line being all-wave receivers covering at least 540-18,000 kc. Of these, three models have one additional band and three others have two additional bands over and above those required by the RMA all-wave definition.

Among the new features incorporated in the new multi-band models are three improvements designed to lend added ease and simplicity to the tuning of the shorter wave-length bands. These are: (1) dual-ratio tuning, by means of which the tuning knob, when pulled out slightly, provides a change in ratio from 10:1 to 50:1 and thus affords convenient vernier tuning; (2) band indicators, by means of which a letter, such as "A," "B," or "C," appears in an aperture at the bottom of the new square-shaped airplane-type dials in order to indicate which band is being tuned; and (3) "stop-watch" band-spread dials, by means of which an auxiliary pointer—very much like the sweep-second hand of an electric clock—spreads the short-wave bands through a much larger arc than that covered by the customary pointer and thus makes possible the accurate recording of dial settings for many short-wave stations, the logging of which would otherwise be practically an impossibility.

Weil Demonstrates New Faithful Reproducer

Auditory perspective, which is engaging the attention of noted acoustical experts, has been achieved in a new way by Maximilian Weil, consulting engineer, who demonstrated his system at his office in New York City recently. He calls his device the "audio projector." The object is to create realistic reproduction, with reproduced sound waves widely distributed in their emanation from the reproducer, instead of being localized, as they are in systems at present in vogue.

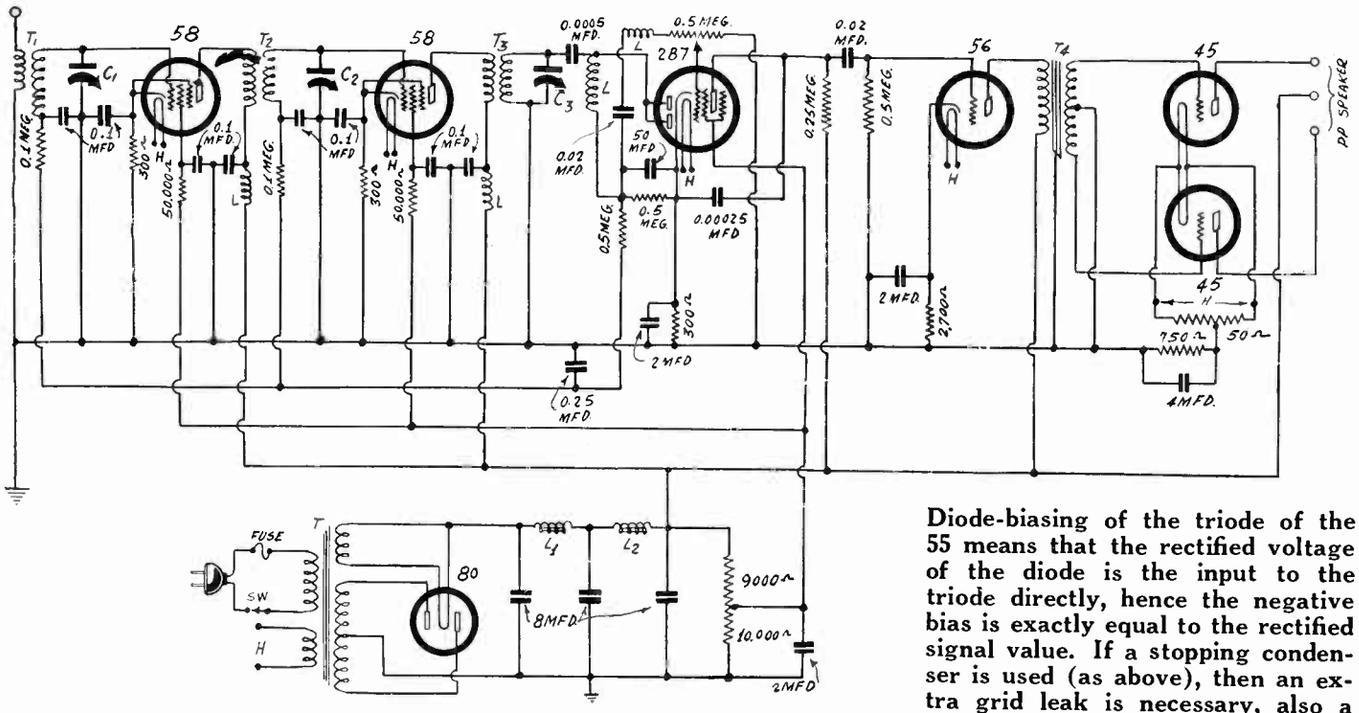
When sound comes from distinctly one direction, as it does from the single opening in most radio sets, much of the realism is lost, because the natural condition of rendition is that of tone distributed over a wide angle. The difference is strikingly obvious if one listens to a symphony orchestra playing on a stage, and then to a reproduction of the same rendition from a speaker.

For three years Mr. Weil has been working on his invention. He uses the normal method of reception and amplification and centers his contribution on the reproducer. He applies his system to music picked up from a broadcasting station as well as to phonograph reproduction. The same focal emission of course is present in modern phonographs, but Mr. Weil introduces his method of distributive radiation for recreation of the music with earnest fidelity and realism.

The cabinet he uses is rectangular, and has slits around the edges, from which the sound is principally emitted, simultaneously in all directions.

Mr. Weil says that the standard "beam" method of reproduction makes the tones seem cramped.

He has put in a patent application and has made provisions for commercialization of his device.



Diode-biasing of the triode of the 55 means that the rectified voltage of the diode is the input to the triode directly, hence the negative bias is exactly equal to the rectified signal value. If a stopping condenser is used (as above), then an extra grid leak is necessary, also a biasing resistor. The leak here is the potentiometer volume control

RADIO UNIVERSITY

Bias for 55, Two Uses

WHY IS IT POSSIBLE to omit a biasing resistor and conect 55 cathode direct to ground? It seems to me that the tube is then worked without bias and terrible distortion would result on loud signals. It should be necessary to put in a resistor. Of what value should it be?—L. E. D.

The 55 has a bias, all right, and it is negative, too. The signal is rectified in the diode. The rectified voltage appears across the load resistor (usually 500,000 ohms). If the grid is returned to the negative side of this resistor, then the input to the triode is always equal to the value of the rectification voltage. So the bias on the triode is negative by the amount of the signal's rectified voltage, for remember grid went to negative of the load resistor. Then cathode may be grounded, as the triode is rectified-signal-biased, so to speak. The case requiring a biasing resistor (illustrated herewith) is that of inclusion of a stopping condenser, when a separate grid leak is required, for return of the grid, and of course the biasing resistor. Minimum value is 300 ohms, but up to 20,000 ohms have been recommended. What really determines the value is what is put into the triode. If only 2 volts go in at maximum, 300 ohms would suffice, and sensitivity in the triode would be higher than under conditions when high sensitivity is needed. Yet the bias may be as high as 8 or even 10 volts, but then the tube is less sensitive. The only danger of distortion would arise in this tube from overload. In diode-biased circuits the overload would consist of reduction of the plate current by a strong signal to so low a value that the tube performance practically stops. For the self-biased method, overload would come approximately when the signal voltage was almost as high as the negative bias voltage, as the signal works against the bias.

* * *

Holding B Voltage Close

AS I AM DESIROUS of obtaining a particular voltage (d.c.) at the output of a B supply system, and can not well tamper with the transformer or the amount of current drawn, please enlighten me as to some method. The device with which the B supply will be used has good regulation and the hum is kept below 3% at present.—L. L.

The exact voltage condition may be attained for any particular a-c voltage input by proper selection of the filter capacity next to the rectifier, or by bleeder resistance selection, or by a combination of both methods. The condenser method is very simple. If the voltage is higher than what you want, use less capacity next to the rectifier, until you get just the right voltage. If the voltage is less than desired, increase the capacity at this position. If any fine gradations are desired, and small capacity variation is not so readily made for this purpose, increasing the bleeder resistance increases the voltage and decreasing the bleeder resistance decreases the voltage. However, the power in the bleeder must be recognized as waste, except for this adjustment advantage, and whatever contribution is made to improved regulation.

* * *

Which Is Best?

WHICH IS THE BEST all-wave antenna system, and are matching transformers necessary?—T. D. H.

The different systems differ in performance. The ideas of the engineers who designed the systems are to some extent in conflict. Therefore each engineer acted on his own judgment and ascribed relative values or importance to various factors. For these reasons it is not possible to say that any system is "best," but rather that different weights have been attached to different subjects, and the antenna systems built accordingly. The general practice is running to the use of matching transformers, particularly for wide-frequency coverage. The input impedance to a set adjusted for broadcast reception may be quite high, while when the set is switched for intermediate short waves the value of impedance may be medium, and for quite short waves low indeed. Therefore some adjustable factor ought to be introduced, for maximum performance, although a happy compromise of course can be attained, as is done in such systems where the engineers thought very seriously of serving the public's convenience, even at perhaps some sacrifice in performance. We believe that in time to come switching or tuning by some other method will become quite general in the transformation end of the all-wave antenna systems.

* * *

Shields for Short Waves

IS IT PRACTICAL to shield coils for short waves? How far may one go in this direction?—L. H.

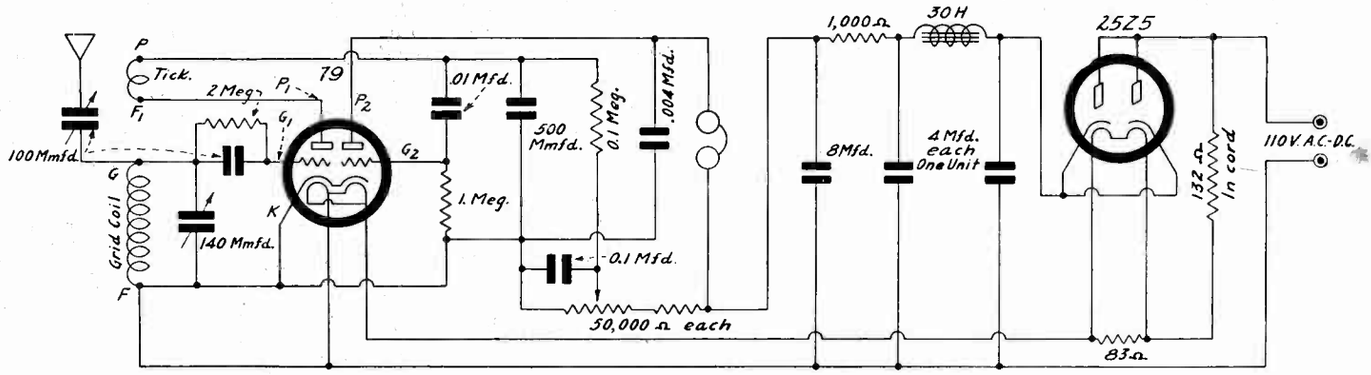
Yes, it is practical. If a simple regenerative receiver is used, shielding is hardly ever applied, because there is some loss. However, in multi-stage sets shielding becomes imperative, although working to some extent at cross-purposes. If the capacity and equivalent resistance effect of the shield become large, as they may at pretty high frequencies, then another stage may have to be added, and this is commonly done in closely-shielded sets for high-frequency work. Another method employed is to have the shielding incomplete, or use of open-end containers. Of course, tin, iron or the like should not be used, but preferably copper or aluminum, and the shield should be at least twice the diameter on which the coil is wound, and the distance at ends, between coil and shield, at least as great as at sides.

* * *

Mismatched L and C

IN A SHORT-WAVE SUPER I built I put some of my own ideas, but used plug-in coils as obtained commercially, also used the divergent capacity tuning condensers, 0.00028 mfd. for the modulator and 0.00014 for the oscillator. Then I got the broadcast coils, but the results in this band are poor. In fact, WMCA comes in at the low capacity end, and WINS comes in at the high-capacity end. (WMCA, 570 kc; WINS, 1,180 kc). How do you account for this.—R. D. S.

You did not state whether reception in general in the broadcast band is pretty good, and that the reversal of expected results in the case of WINS and WMCA is merely an exception. If general results are poor in the broadcast band, then the tracking is enormously off, assuming the condensers are ganged. A front-panel-controlled trimmer across the oscillator would be a good move, if the modulator capacity is too high. The reception of low-frequency stations at positions at which higher frequencies are to be ex-



Adding a resistor to the filter chain improves filtration somewhat, although, of course, reducing the d-c voltage. In a short-wave set of this type the inclusion is advantageous

pected may be due to too large oscillator capacity and inductance, plus insufficient selection ahead of the modulator. For instance, suppose the intermediate frequency is 465 kc. The oscillator for bringing in 570 kc, should generate 1,035 kc. If it does so generate, then WMCA will come in, no matter to what frequency the modulator is tuned, especially in view of the obviously poor pre-selection. For 1,180 kc reception the local oscillator should generate 1,645 kc. If it is set to generate 822.5 kc, the second harmonic thereof will provide 1,180 kc reception. It therefore appears that there is too much inductance on the oscillator secondary, the second harmonic result being the clue. Also you might try a series condenser from stator of oscillator condenser to broadcast oscillator secondary, as the lower the frequencies the greater must be the difference between the two capacities, oscillator and modulator.

* * *

Who Is Right?

IN THE August issue of "Service" is an editorial in which the statement is made, in reference to servicing all-wave receivers, "proper adjustments can not be made unless the test oscillator covers almost the whole band of fundamental frequencies, the harmonics of fundamentals being unsuitable in most cases for precise circuit adjustments." This disagrees sharply with what you have been printing, and I would be interested in seeing your reply.—J. T. C.

The usual practice, when a difference of opinion is being reviewed, is that the party who expressed opinion A retains opinion A, and the one who expressed opinion B retains opinion B, the review consisting simply of restatements of what was said before. The technical radio press is replete with such examples of difference of opinion. Certainly it isn't right for one of the disputants to act as the judge in the case. A century ago editors (though of newspapers) used to invade one another's offices and shoot one another down, all over some editoral or political dispute. To-day editors are calm individuals, as a rule, and when ruffled, resort to the typewrter or pen as weapon, instead of pistol. It is certainly true that the use of harmonics has been and is unsatisfactory "in most instances," i.e., where those harmonics can not be identified, hence the unknown frequency can not be surely determined. In that sense harmonics are unsuitable for precise circuit adjustments. But in the sense that an harmonic is not a precise multiple of a fundamental, that would be quite ridiculous, as the difference would be far slighter than could be read on any commercial dial or chart (say, 1 part in 100,000,000). But suppose there were a system that eliminated confusion about the unknown frequency when harmonics were used, and even enabled determination of the harmonic order, if one were interested in that too? Ah, that would be different! Well, there is such a system, in fact a combination one: (a), it eliminates confusion due to harmonics by making one absolutely certain of the frequency of the unknown; (b) it enables determination of the harmonic order of the fundamental; (c) it provides (with limitations) for automatic electric harmonic counting. As the system originated at this end and is only beginning to be given publicity, one can not expect every one to know about it. But pistols are out. That goes.

* * *

Short-Wave Hum Reduction

HAVE YOU SOME simple remedy for reduction of the hum in a plug-in type short-wave set I built (regenerative)? I use a 25Z5 as rectifier. A twin-tube is detector and audio amplifier.—R. E.

A resistor in series with the B feed will help. It should go at the end, toward the receiver. A value of around 1,000 to 5,000 ohms will prove sufficient, if the condenser put between receiver end of the resistor and ground is 8 mfd. or so. Sometimes a paper condenser of 1 or 2 mfd. next to the rectifier, in addition to an electrolytic that may be there, also helps. See the diagram for the series B resistor methods applied to a circuit such as you have.

Station Sparks

By Alice Remsen

ONE of the nicest things I've heard this week is that Willard Robison and his Deep River Orchestra have been chosen to provide the musical portion of Mrs. Roosevelt's programs over WJZ. The First Lady will give a series of talks under the sponsorship of the Simmons Company, each Tuesday at 9:30 p.m. . . . Although Irene Rich is playing in a new show, it does not prevent her from fulfilling her radio contract with the Welch Grape Juice Company, over WJZ each Wednesday night at 7:30; in fact, Miss Rich has just signed a contract to continue broadcasting over NBC for the same sponsor until January, 1935. . . . Charles Basil Dean, who is responsible for Danny Malone's rise to fame, wrote the theme song used by the young Irish singer—"My Old Irish Mother." Mr. Dean also wrote two others, "The Same Stupid Gossoon Am I" and "One Kind Word," typifying episodes in Danny's life. . . . Pat Barnes, master of ceremonies for Lombardo Land, also arranges the program, picking out the tunes used by Guy Lombardo and his Royal Canadians, and weaving them into a harmonious whole. . . .

Walter Preston, NBC baritone, has just celebrated his tenth anniversary in radio with his 2,500th performance. . . . A new basso has been brought East from the Coast by NBC; his name is Armond Girard; he is a French-Canadian, born in Kansas, if that's possible! . . . Young Walter Tetley is back from a trip to the old country, where he made a triumphant seven-week tour of England and Scotland. The fifteen-year-old NBC artist brought back several new Scotch songs, which he will add to his repertoire. . . . Tony Wons is now an actor. As John Witcomb, in "The House by the Side of the Road," Wons returns to his former love, the legitimate drama. Program is heard each Sunday at 5:30 p.m. over an NBC-WEAF network, sponsored by the makers of Johnson's Wax. . . . Ozzie Nelson is working on a new composition which he calls "Aeroplane Suite"; it is in three parts—Solo Flight, Transatlantic Flight, and Forced Landing. It will be presented on NBC when he resumes his broadcasts with Joe Penner on October 7th. . . . Four young men from Hollywood have raided the NBC studios and are now heard five times a week over the NBC networks—they are the King's Guard, a quartet of harmonists. . . . There is a new RCA Radiotron program on WJZ these Saturdays at 9:00 p.m., featuring John B. Kennedy and Frank Black's Orchestra. Radio stars are being interviewed by Mr. Kennedy. . . . Floyd Gibbons is now pinch-hitting for Phil Baker on the Armour program. . . . Irene Beasley will continue on the same program. . . .

Over at Columbia, Abram Chasins, one of America's most outstanding young pianist-composers, has started his second season of weekly lecture-recitals. Each Sunday at 2:15 p.m. . . . Lucrezia Bori, soprano of the Metropolitan Opera Company, will be heard in a special song recital over the Columbia-WABC network on September 12th, at 7:45 p.m. . . . The Roxy Revue, featuring Roxy (S. L. Rothafel), starts on Saturday, September 15th, over the Columbia network, at 8:00 p.m. Roxy has a new idea which he calls "Ear-Pictures," which will be presented in this series. . . . "Buck Rogers" is back —and are the kids pleased! Monday, Tuesday, Wednesday and Thursday at 6:00 p.m. Tune in and hear these fantastic adventures. Title of the new series is "Trouble on Saturn" . . . .

Both the King and Queen of England will be heard during the christening and launching of the world's greatest liner, the Victoria, which will be described in an international broadcast over the WABC-Columbia network on Wednesday, September 26th, at 9:50 a.m. . .

Kate Smith says: "There are two schools of breathing among singers. One believes in swelling out the chest with air, and letting it down for volume, but I believe that this method of breathing is apt to cause the voice to waver when the supply of oxygen is almost depleted. The second method is the one natural to me. That is—breathing so that the stomach holds the air. When I exhale, it pushes the air from the stomach, bellows-like, causing the chest to expand, instead of caving in". . . . "The Main Stem" is the title of a new show on the WMCA-ABC System, each Tuesday at 9:30 p.m. . . . The "Three Little Sachs"—Bill Hansen, Vincent Howard and Jim Brennan—are holders of the championship for long-term continuous broadcasting. Ten years for the same sponsor without a break. That's goin' some! Over the same station, WMCA! . . . Three more orchestras have been added to the dance programs of WMCA—Alex Botkin's from the St. Moritz, Art Landry's and Louis Russell and his "Ol' Man River" orchestra.

I wonder when some of the stations are going to do something about the new advances in television?

A THOUGHT FOR THIS WEEK

WHEN YOU GET JOHN F. ROYAL to agree with you, make up your mind you are doing or saying something worth while. Mr. Royal, who is vice-president of the National Broadcasting Company in charge of programs, agrees with Rudy Vallee, Paul Whiteman, Guy Lombardo and Abe Lyman in their endeavor to clean up the air by getting orchestras, publishers and song writers to cut out any attempt at suggestiveness in word or meaning. In this way a home-made censorship will be exercised among the very folk who don't want censorship of the official type. They feel, and sensibly so, that the clean-up, like charity, should begin at home, and apparently they have gone at it in the right spirit.

Mr. Royal, in commenting on this move, announces that the NBC has been maintaining a censorship, with the result that, many songs have been either rewritten or changed, with the warning to band leaders that they must keep eye and ear open for double-meaning titles and lyrics. Mr. Royal has had a long and valuable experience in the amusement world and what he doesn't know about censorship isn't worth finding out. He has always gone on the principle that the way to do away with legislative censorship is to offer nothing that calls for censoring. As a consequence, during his long and honorable career in the managerial field he has helped to keep things smooth and happy by advising that his associates do the right thing at the right time.

Reich Seeks to Double 5,400,000 Sets in Use

Berlin.

The German people do not own as many radio sets as the Government would like. Since much propaganda is sent out over the air, and officials encourage listening as practically a civic duty, the Hitler regime is doing a great deal to promulgate the use of radio. One of the recent incentives was the exemption of the unemployed from payment of the monthly license fee of two marks for the privilege of possessing a set. This helped increase the number of sets in use.

Although the total number of receivers is below what are desired by the Government, which seeks a 10,000,000 figure, there are actually nearly 5,400,000 sets in use, due partly to an increase during the last two years of about 1,250,000. Dr. Paul J. Goebbels, Propaganda Minister, said in opening the German Radio Exposition here:

"Some day radio will be the spiritual daily bread of the whole people, their soulful sustenance and chief mentor," he said.

Western NBC to Give Better Outlying Service

Effective Sunday, September 30th, KPO, NBC's 50,000-watt station in San Francisco, becomes the key station of the Western network. That is the date program time is changed, due to the conclusion of the daylight-saving period in eastern cities. Starting on this date seventy-five sponsored programs now heard over KGO and the network will be heard over KPO and the network, and a large number of sustaining programs likewise will be shifted to KPO.

"We have made this change to improve the service of the network," Don F. Gilman said. "Important programs which are not now available to listeners in many outlying places where radio service is not satisfactory will be brought to these sections by means of KPO's greater carrying power."

WSM Soon Will Use Large, New Studio

Nashville, Tenn.

WSM will open the most modern auditorium studio in the South, with the completion of the new wing of the Home Office building of the National Life and Accident Insurance Company, owners and operators of the station. With the latest acoustical treatment, the new auditorium will be 18 feet in height, with floor dimensions of 43 by 70 feet. Most of the larger productions will be presented in this studio before audiences of several hundred persons.