Construction Continued

wire may be calculated. Moving the decimal point one place to the left gives the resistance of 100 feet, and two places to the left, the resistance of 10 feet. The resistance per pound in ohms is found by dividing the ohm per 1000 feet by the weight in pounds of 1000 feet.

From the foregoing it will be seen that it will be far safer in most cases to deviate when a change must be made from specifications, in the direction of using a size larger wire rather than any smaller size.

The foregoing refers to wire to be used as conductors for battery or similar current, which occupies the whole area of the wire, whereas high-frequency currents travel chiefly along the outside surface only, so that a thin metal tube will offer scarcely any more resistance to a high-frequency current than would a solid conductor of the same diameter.

Insulation.

With regard to insulation, enamel occupies the least space of any, and is useful for carrying comparatively small currents in apparatus where many turns of wire are necessary whilst bulk must be kept down as much as possible. So long as there is no great difference of potential between adjacent turns, enamelled wire is quite serviceable, and adds much to the efficiency of small transformers, choke coils, electro-magnets, etc., by reason of its compactness. But care should be taken that where the potential difference is greater than a few volts, as at the return ends of layers, extra insulation should be interposed so that a breakdown of the enamel is impossible.

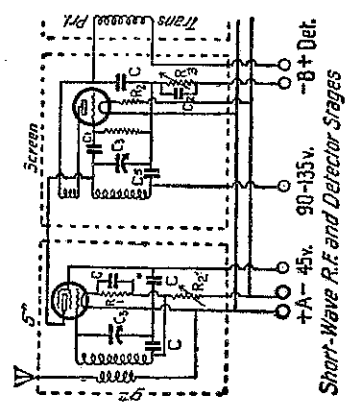
Double silk-covered wire is used in some apparatus, and has a smart appearance. It occupies rather more space than enamelled wire, but as it is from two to three times the price of the latter, finds little favour with constructors, especially as the difference in efficiency, for many purposes, is nil.

Double cotton-covered wire is useful where good insulation is required, as in filament windings of elimination transformers and the like, but too much faith should not be put into its insulating properties, and for the class of work mentioned it is not safe unless well shellaced after each layer has been wound, the shellac to be allowed to dry before being covered with between-layer insulating fabric.

Double cotton-covering has the property of automatically providing spacing between the turns when closely wound on a tube of insulating material, but this form of tuning coil is giving way to tinned uninsulated wire space-wound and supported only by three or four strips of celluloid, to which the turns are cemented.

UX222 AS SHORT-WAVE R.F. AMPLIFIER

The following diagram of a short-wave receiver, employing the UX222 as R.F. amplifier, is taken from the December number of "Q.S.T." The set is built in three separate aluminium or copper boxes, each 5 by 6 by 9 inches. One box holds the R.F. stage, another the detector, and the third the 2-stage amplifier, which is not shown in the diagram. Another method is to build one large box with partitions. As plug-in coils are used, the top of the boxes must be easily removed. Many experimenters will be satisfied to try an R.F. unit alone, which may be made up in a small copper box.



C—.006 mfd.
C1—.0001 mfd.
C2—.1 mfd.
C3—Variable, .000075 (?).
R1—10-ohm fixed resistor.
R2—12 ohm rheostat.
R3—50,000 ohm variable resistance.

It must be distinctly understood that this circuit has not been personally tested, but from its origin may be considered quite reliable, and is given here for the benefit of any reader who wishes to do his own experimenting.

When the R.F. unit alone is constructed it must be particularly noted that some slight alterations will be necessary in the wiring of the present detector circuit, but these will not interfere with its normal operation.

It will be necessary to connect the grid leak from the grid to the filament of the valve, instead of across the grid condenser. A .002 mfd. fixed condenser must be connected between the tuning-coil and condenser at the earthed end, the condenser being left connected to earth. A lead from the earth side of the coil goes to the B battery to supply voltage to the plate of the R.F. tube, and another from the grid end of the coil goes to the plate of the amplifier. When the R.F. valve is not being used the lead to the B battery will cause no trouble, and the lead from the grid end of the coil may go to the antenna through a small capacity, or may be left disconnected, and an aerial coupling coil used if this is desirable. As a volume control, a 500,000-ohm variable resistance is recommended to be shunted across the secondary of the last amplifying transformer.

Because the tube is to be operated as an amplifier, it is necessary to apply a biasing voltage of from 1 to 1.5 volts to the control grid when using from 90 to 135 volts on the plate. The outer or shield grid is connected to the plate battery at about 45 volts, although this is not at all critical. A by-pass condenser (*) ensures a low impedance radio-frequency path from the shield grid to the filament and earth. The extremely high impedance of the valve is most easily matched by use of a tuned trap circuit, and the voltage across it is applied to the guide of the succeeding valve. In order to do away with dry cells for obtaining C voltage, this is obtained as a drop off the filament resister.

"FREE" GRID-BIAS.

If a 10-ohm fixed resister is connected in series with a 12-ohm rheostat, the voltage drop across the fixed unit, when the proper filament current is flowing, will be 1.32 volts, a value that is satisfactory for bias purposes. As the bias on the grid must be negative, the resister must be connected in the negative filament lead, and in order to impress only 1.32 volts on the grid, the unit should be connected directly to the filament. The positive A battery is connected to earth, and to the copper shield, as are the rotor plates of the tuning condenser. It is, therefore, necessary to apply the bias voltage between the rotor of the tuning condenser and the low potential, or earthed end, of the tuning inductance. The use of a pair of by-pass condensers takes care of the radio-frequency currents that flow in the grid circuit.

SEPARATE DETECTOR B BATTERY.

A separate B battery is used for the detector, but when it is considered that this also prevents feedback between the detector and R.F. circuits, which might easily be caused by the internal resistance of the B battery, it is well worth having. A small-sized dry B battery will be quite suitable.

A fixed condenser of 1 mfd. should be placed across the main B battery, and in the plate lead from this battery to the audio amplifiers, a radio choke should be inserted to prevent the by-passing of R.F. energy from the radio stage through the audio circuit.

The inductances are wound on bakelite tubes or other form, and may plug into a strip mounted directly on the tuning condenser.

The tickler and aerial coils are bunch-wound affairs supported by their own leads. They are slightly over an inch in diameter, which tends to reduce the amount of reaction caused by the regeneration control on the tuning. Regeneration and oscillation are controlled by a variable resistance, which is usually not by any means as satisfactory as condenser control.

If a sufficient number of readers are interested in the circuit, further details and diagrams will be given.

Electrolytic Rectifiers.

A contributor to an American radio journal states that he has considerably improved the working of electrolytic rectifiers of small size in series by connecting a 1 meg grid leak across the terminals of each cell. Borax is the solution used. This must not be taken as a recommendation. The same writer lays great stress upon proper "forming" of the plates at the outset, if good service is expected. This probably is a process that many amateurs shirk, and make more difficult by neglecting to properly clean the lead and aluminium plates before forming.

TIPS AND JOTTINGS

B ELIMINATOR REGULATION.

THE object of the "glow tube" regulator for B eliminators is to maintain the correct nominal voltage output at each terminal. This is accompanied by the tube taking a certain amount of current, and when more output is demanded, the tube automatically takes less surplus, thus compensating for the increased demand.

YANKEE FILAMENTS REVISED.

THE following valves, CX312A CX371A, UX112A, UX171A, are now produced with filaments requiring only one-quarter ampere, half the original filament current. There is also a whisper of 201A type tubes to be produced with a filament requiring but one-eighth amp., half the present consumption.

THE MONITOR'S LOUDSPEAKER.

THE fidelity of reproduction of a broadcast depends very much on the loudspeaker used for monitoring. If the loudspeaker at the station is "drummy" or "down" in high frequencies, the operators may tend to over-emphasise this portion of the band in microphone placing, equalisation of lines, etc. If, on the contrary, the station loudspeaker is "tinny," or relatively lacking in low notes, there may be a preponderance of bass in the station's output without the operators being aware of the fact. While such effects may benefit some listeners whose receiving apparatus requires acoustic correction, it will result in distorted reproduction in both the good receivers and those which have the opposite fault relative to the monitoring circuits at the transmitter. Thus the characteristics of the station loudspeakers are often an important element in the fidelity of reproduction attained.

SHIELDED-GRID VALVES.

THE first shipment of the new American screen-grid tubes to arrive in Wellington sold "like hot cakes" at £2 each. These tubes appeal to the "hams" as short-wave R.F. amplifiers, and will in many cases also be adapted to the R.F. stages of broadcast receivers. Tubes available in the United States differ considerably from those used in England, not on account of their electrical characteristics, but rather due to the mechanical arrangement which, in English tubes, seems to have been worked out with more thought toward ease of use. Captain H. J. Round has published a helpful book, "The Shielded Four-electrode Valve," published in London at 2s. 6d.

THE BEST LOUDSPEAKER?

DISCUSSING loudspeakers, the current number of "Radio News" says, "The best combination, however, comprises a horn and a cone connected to the set, either in parallel or series, and placed is different parts of the room. This gives the greatest fidelity in reproduction available to-day. There are of course, such exceptions as the large exponential horn, which gives very excellent reproduction on both the low and high notes. This speaker, however, takes up a great deal of room."

BATTERY SETS WILL LIVE.

THE advent of the a.c. operated set will not mean the death of the battery set, which is bound to continue in use for many years, at least in places where no power supply is available, or where it is unsuitable. At the present moment battery operation is quieter than a.c. valve operation, although the noises emanating from power lines are practically of no consequence to the average user. It is quite possible that the development of new valves might even cause a return to battery-operated sets, owing to much reduced current consumption.

A DEFINITION OF TERMS.

AN "electric radio" receiver is an a.c. receiver containing no batteries or liquids, and works entirely from light-socket power. An "electrified" set is an ordinary battery-operated set wherein the A and B batteries are replaced by eliminators necessitating no alterations to the set itself. Automatic trickle-charging also comes under the "electrified" heading.

GRAMOPHONE PROGRESS.

RECENT advances in the technique of recording and reproduction have reduced the loss in musical fidelity of the gramophone as against direct presentation to an almost negligible quantity. The chief obstacle to a greater use of the gramophone as a source of broadcast entertainment at the present time seems to be the prejudice of listeners, carried over from the days when the shortcomings of the gramophone were manifold, and broadcasting emphasised rather than minimised them.

A COMBINED LOUDSPEAKER.

AN American has patented a combination of horn and cone loudspeaker for ceiling fixing, two lamp-holders also being incorporated. Sound radiates equally in all directions.

A ELIMINATOR EFFICIENCY.

THE high efficiency of a new A eliminator filter that has appeared on the American market is due mainly to the tremendous capacity of the electrolytic condensers employed. These have a capacity of several hundred thousand microfarads, obtained by virtue of the usual arrangement of nickel and steel plates immersed in a non-acid caustic solution which constitutes the condenser. The plates form one side of the condenser, and the solution the other. When an electric current is passed through the unit, infinitesimally thin films of hydrogen and oxygen form over the entire surface of the plates, and it is the thinness of this film dielectric that accounts for the tremendous capacity obtained..

(End of Constructional Section.)

British Music and Broadcasting

(CONTINUED FROM COVER.)

IN looking through "The Radio Times," the official organ of the B.B.C., one is amazed at the variety and wealth of music that is crowded into one week. Just a glance through from station to station and one notices names of important British musicians —Harold Samuel playing Bach from the London studio—Irene Scharrer, Chopin from Manchester—Jell d'Aranyi giving a violin recital from the Birmingham studio—John Coates sing-English songs from Glasgow—and so on. Also countless names of new people and young musicians that one has never heard of before. Broadcasting in England has brought to the ear of the public many young and worthy executants, eager and keen composers—truly this wonderful invention of broadcasting has it in its power to do an endless amount of noble and lasting work, and one must admit that this has been already accomplished in England.

THE WORK OF THE STUDIOS.

ANOTHER and important branch of the music broadcast is the performance of opera given from the studios at regular intervals. The librettos of these operas are published by the B.B.C. and distributed among the listening public at the absurd price of twopence per copy. With a copy before him, the ordinary listener is able to follow the opera with more than ordinary ease; and so the success of such broadcasting is ensured. The performance of these operas entails much hard work and ingenious organisation, the necessity of numerous rehearsals to become accustomed to the confined space of the studio. It needs but a moment's reflection to realise that there are hundreds of musicians and artists working for the B.B.C. If broadcasting had not come about one wonders what would have become of these numbers that are thus busily employed.

IN the brief time at my disposal I have been unable to do more than touch on the more important branches of the musical activities of the B.B.C.

We have here in Wellington the finest station in the Southern Hemisphere —a great triumph and a great responsibility. It is in our power to send the heartening influence of good music, not only all over the Dominion, but all over Australia.

I LOOK forward to the day when 2YA will have a fine station orchestra of professional players, and the great symphonies of Beethoven, Mozart, Mendelssohn and others, and the works of our own modern composers, will bring that wonderful spur to endeavour and stirring to the spirit which is the gift of pure music to the remotest listeners of the Empire.

G.P.O. CHIMES

BROADCAST BY 2YA.

The regular broadcast of the Wellington G.P.O. chimes by 2YA has created some interest in the words that go to the chimes. Uncle Sandy has on several occasions given these words, and this was gracefully acknowledged in the Wellington Press by a correspondent as follows:—

Uncle Sandy, of 2YA, has twice, in the last few months, recited this verse to the children "over the air":

"All through this hour,
Lord, be my guide;
And by Thy power
No foot shall slide."

Uncle Sandy is full of unusual bits of quaint information, that are very interesting both to the children and their parents, and he is much appreciated.

THE "EARS" OF RADIO

PLACING THE MICRO-PHONES

LATEST STUDIO PRACTICE.

WHEN man seeks to improve on any mechanical arrangement he looks to Nature. That is why the radio experts, wishing to improve on the "hearing" capabilities of microphones, have studied the position of the human ears. Two ears are better than one, no matter how acute that one may be. Two ears give a sense of direction in regard to the origin of the sound that is heard.

Since birth, we have trained ourselves unconsciously to locate the direction of sounds by means of our binaural sense. To determine the direction, we, instinctively face it. This unconscious action, common to all animals and birds, seems merely to bring both ears equidistant from the source under which conditions the binaural sense is most accurate and the audition image is binaurally centred in the head. If a sound is to the right of us, the right ear, being more exposed to the sound, receives a stronger impression than the left ear, which is somewhat in the shadow of the head, so to speak, and the sound waves take slightly longer to reach it. The two ears unconsciously take cognisance of this binaural time difference and give us a resultant audible impression which we have trained ourselves from childhood to regard as a sense of direction. It is this interpretation of a time interval in terms of direction which is known as the binaural sense. It is this principle that radio engineers are now applying to the placing of the microphones. In listening to a band, orchestra, or choir, for instance, the two human ears, because of their position can hear and detect the position of the various instruments or singers, whereas one ear could not. Similarly, two or more microphones are more efficient than one on such occasions.

For some time now at 3YA two microphones placed in an angular position similar to that of the human ears have been used even for soloists, and the result has been a decided improvement on that obtained by one microphone.

RUGBY BROADCASTS

AUCKLAND UNION'S EXPERIENCE.

The annual report of the Auckland Rugby Football Union for the year 1927 discloses that the season's operations ended in a profit of £2757 8s. 11d.

The report states: "It is very gratifying to be able to state that the past season was one of the most successful in the annals of this union, and but for the wretched weather conditions which obtained during almost all the latter part of the season, would in every way have easily eclipsed all records."

The above would seem to be an answer to those who contend that broadcasting keeps people away from the event being broadcast. Last season was the first in which regular broadcasting on relay had been carried out on every occasion, including representative fixtures.

The chairman of the union, Mr. Harry Frost, concludes his report with the remark that the outlook has never been so bright in the history of the union.