

Mainly about Construction

BY "MEGOHM"

THE "RECORD" CRYSTAL SET

SOME ADDITIONAL NOTES—ALTERNATIVE TUNING

Several correspondents residing within a mile of 2YA are desirous of receiving that station at loudspeaker volume, using a crystal without amplifier. In our last issue the "Record" crystal set described is a good one with which to make the attempt. It can be done, but of course the error should not be made of expecting boisterous volume such as is given by a valve set. The writer has heard several sessions through at a distance of two miles, and the speaker volume was such that not a word of a lecture on Hollywood was missed, sitting three or four yards from the speaker, and on Sunday, the 6th instant, the band concert music could be heard fairly well in an adjoining room. This way of listening is more comfortable than wearing headphones, but quietness is necessary during reception. A carborundum crystal without battery was also tested and gave splendid results. For 'phone reception round the city and suburbs the aerial need not be of very great dimensions, but of course the larger it is the more volume there will be. The earth connection is of very great importance in every case, and if this is made to a water-pipe (the cold water supply), care must be taken that the connection is a clean and tight metallic contact between the wire or earth clip and the pipe, which must be well cleaned at the point of contact. In damp weather a water-pipe is usually a very efficient earth connection, but in dry weather it may in some cases prove otherwise. Dry sand is a bad conductor and in sandy districts, if signals are noticeably weaker after a

spell of dry weather, it is wise to replace the water-pipe earth with something more reliable. This consists of some kind of metal plate sunk in the ground near the aerial to a depth of several feet, where the ground is always moist and damp. A copper plate about two feet square is the ideal earth plate, but a petrol tin with a 14's wire soldered to it as an earth lead will serve quite well. An end of the tin should be cut out and earth, coke, or cinders put in. With one of such plates sunk near each aerial pole and connected by a buried wire, the same wire continuing to the earth terminal of set, best results are assured so far as the earth portion of the circuit is concerned.

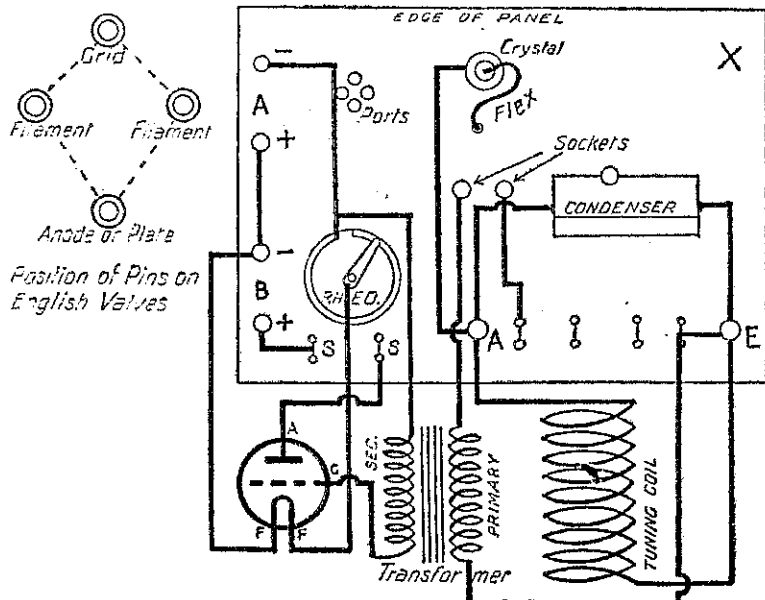
The coupling of the condenser in the "Record" set is that known as "parallel," but listeners can try the "series" coupling in an easy way as follows:—Disconnect the B terminal connection from the condenser, and in its place, on the condenser, connect the aerial direct, leaving the A terminal unconnected. The condenser will now give a much higher reading to tune in, and whether the result is better than parallel tuning can soon be judged. The series tuning is an equivalent to reducing the number of turns on the coil for the lower broadcast wave-lengths. If it is desired to keep the set permanently in series, then the present connections to A terminal should all be taken off, but still keeping condenser, crystal, and coil connected. The A terminal is then connected to the condenser terminal that was previously connected to B. The aerial is then connected to the A terminal as before.

AMPLIFYING THE CRYSTAL OUTPUT

DETAILS FOR ADDING ONE VALVE

However wonderful reception may at first seem with the aid of a simple crystal, there soon comes a desire for something that will put a little more "ginger" into the concerts, and from 'phones to a loudspeaker is the natural step. This necessitates, if a crystal is still to be used, the addition of one or perhaps two amplifying valves, according to the distance from the station. The addition of one amplifier will now be described to work in conjunction with the "Record" crystal set. Those who wish to build the set complete may increase the width of panel to 9 or 10 inches, keeping the height the same, 7 inches. A depth of six inches from back to front will be ample. If the crystal set has already been made, the size of the panel may be increased by adding a strip at the right-hand side

are required to an existing detector. When it is desired to use the amplifier, the pin on the end of flex is plugged into the right-hand socket, and for the detector only 'phones, the pin is put in the left-hand socket, looking at the front of panel. The positive or marked tag of the speaker or 'phones must always be placed in the clip connected with the positive of B battery, that is, the right-hand clip or terminal. The baseboard and panel having been completed, the transformer and valve-holder may be fixed in position as shown, and the rheostat and terminals fixed in place on the panel. Four holes may be drilled in the panel as shown so that the filament of the valve may be seen, unless it is a dull filament valve such as the P.M.3, in which case the "ports" would hardly be necessary.



of the present panel, extending the baseboard and cover to suit.

The extra components required will be a valve, and holder for same, rheostat, 2-valve sockets, 1 pin for do., large L.F. transformer, A battery, B battery, 4 terminals, ebonite panel, connecting wire, etc.

Provision is to be made for using 'phones on the detector only if desired, cutting out the amplifier. This is arranged for by drilling three holes as shown below the crystal. The two lower holes must be about 1/2-inch apart and drilled to take the sockets, which should, if procurable, be a type that will sink flush with the panel. A short piece of flex. is to be put through the top hole, and to its outside end is connected the pin that fits the two sockets. The wire that connects the back of the crystal to the right hand 'phone clip is disconnected from the crystal and the inner end of the flex connected in its place. The free end of the wire from the 'phone clip is now connected to the back of the left-hand socket. These alterations are all that

At the lower part of the panel two clips or terminals are provided to connect the loudspeaker.

In wiring-up, one primary terminal of the transformer is connected to the left-hand 'phone clip of the earth terminal, which amounts to the same thing, as both are connected. The other primary terminal of the transformer is connected to the right-hand socket on the panel. One secondary terminal of the transformer is connected to the grid connection of the valve holder. On an American holder the terminals will probably be marked, but a diagram is given of an English holder so that no difficulty is presented. It will be noticed that the four sockets are arranged in the shape of a kite. The plate connection is where the tail would be attached, the grid the top, and the two filament connections are at the "ears." The other secondary is connected to the end of the rheostat winding and then continues to the top terminal of the four on the panel front. The plate connection of valve holder is wired to one of the speaker connec-

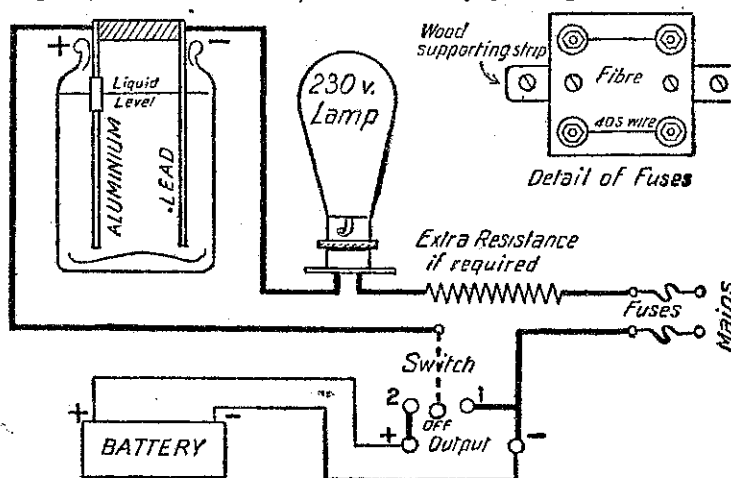
A SIMPLE A.C. RECTIFIER.

Correspondents are making inquiries regarding chemical rectifiers for 230 volts alternating current, so the following brief description will be given.

A glass jar about 2 1/2 by 4 1/2 inches makes a suitable container, and all that is required in addition is a wooden cover of some kind to keep out dust and to hold the plates, which must be kept as far apart as possible in order to ensure proper rectification. The two plates are of lead and aluminium respectively, and the dimensions of these should be about 4 1/2 in. by 3 in. A hole is drilled in one end of each and a screw through this will affix each to the sides of the cover, the connecting wires being either clipped round the screw under the plate or soldered to each (special solder for the aluminium). The lead must be well cleaned to present a bright surface.

The aluminium is the vital part of the rectifier, and unless this is pure metal, cannot perform its duty satisfactorily. Thin sheet aluminium of perfect purity can be obtained, and

not permanent. When the forming is being carried out the battery is not connected up, but the aluminium side of the rectifier and the main not connected with the lamp resistance are connected together with or without a suitable resistance in place of the battery. In order to cut down the voltage where such is an advantage, it is a good plan to have two rectifier cells in series, the lead of one being connected to the aluminium of the other. This is also a safeguard, as if one cell happens not to be rectifying, the other may continue to do so and save any trouble. When charging the accumulator B battery recently described in this column, a 60-watt lamp should be included in series with the rectifier, and for smaller accumulators a lamp of less power may be used, whilst for voltages of 46 or 56 it may be found an improvement to include in the circuit next of No. 36 mchrome resistance wire space wound upon a piece of red fibre or other non-inflammable material. Such a resistance only gets slightly warmed up, but



will last quite a long time if the precaution is taken of cutting a strip about an inch wide and folding it round the aluminium plate so that the level of the liquid comes at about the centre of this reinforcement. This is done because most of the corrosion of the plate takes place at the surface of the liquid. Put into the jar sufficient tap-water to reach about 1 1/2 in. from the top. Ammonium phosphate is then put in and allowed time to dissolve, or stirred to quicken the process. A saturated solution is required, so that a small quantity of the chemical should remain undissolved at the bottom of the container. Occasionally, as the water has evaporated, more water should be added to keep it at the proper level. If the aluminium is pure it will only show a luminous glow in the dark when rectifying properly; if violent sparks are dancing all over the surface, rectification is not as perfect as it should be. No trouble will be experienced with the lead plate, but before the rectifier will work properly it must be run for an hour or two so that the plates will "form," and this should be done as a precaution for a minute or so before each charging operation, if more than a day or two has elapsed since the last time of using, because the formed oxide is

it should be put upon the material mentioned. Should this be found necessary the fibre can be cut slightly narrower than the baseboard and fastened underneath out of the way, a strip of wood being screwed under each end of the base to raise it up sufficiently high. The diagram shows a two-way switch that can be put on contact for a minute to start rectification and then put over to 2 to charge the battery. The aluminium is always the positive electrode, and when charging is connected to the positive side of the battery.

When using any apparatus such as this connected to the electric mains it is a good plan to go to a small amount of extra trouble to include a fuse on both mains. A piece of fibre about two inches square is drilled with six 1/8th inch holes as shown. The two centre holes are for screwing down to a strip of wood. The other holes are fitted with 1/8-inch brass bolts with a washer and nut on top, to which connections are made. A short piece of 40's copper wire (thinner if handy) is carefully cleaned and a piece clipped under each pair of washers. All wires in the circuit should be insulated where possible. If the switch is provided it can also be fitted with an "off" position for convenience.

Amplifying the Crystal (Continued).

tors on panel, and the other connector to the lowest terminal, B positive. Now connect the two centre terminals on the panel, A positive and B negative together, and the same wire is to continue to one of the filament connections on valve holder. The other filament is connected to the arm of the rheostat. If there is 20's enamelled wire left from making the tuning coil, it may be used for connections, but the enamel must be very carefully scraped away wherever contact is to be made with the wire. No thinner wire than this should be used.

The Batteries.

A very suitable accumulator for the filament of one valve is a couple of small Exide cells in series to give up to four volts. A small carrier could be made to contain these for convenience in taking to a charging station or garage. These small accumulator cells can be obtained for 7s. 6d. each, and if a two-volt valve is to be used, only one of these cells would be required. A P.M.1 L.F. Mullard valve would be suitable as a two-volt amplifier valve, or a P.M.3 as a four-volt, requiring two Exide cells.

A dry B battery of 45 or 60 volts will be most suitable.

Anybody not used to handling batteries must be very careful not to allow the positive and negative ends to become connected, even for an instant, except in the specified way provided for in the set. In the case of the A accumulator an accidental connection of the two terminals results in an instant discharge of all the stored-up energy, and only many hours of recharging can restore its former condition. In the case of "grid plate" accumulators, such accidental "shorting" may cause permanent ruin of the plates. Short-circuiting of the B battery must also be carefully avoided, and great care must also be taken in connecting the B battery to the set, as if connected across the top two termin-

always be recharged when not more than about three-quarters of its full capacity has been used.

Grid-bias is not usually provided on a single L.F. amplifier, but is an assistance towards greater volume and clarity. It can be added by breaking the wire running from rheostat to transformer secondary and inserting one or two small dry cells to give 1 1/2 or 3 volts. The negative side connects to the transformer.

If dry batteries are preferred to the small A accumulator, then a valve suitable for dry battery operation must be selected. If the charging of an accumulator can be conveniently managed by taking it to a garage, it will be found more satisfactory to use one rather than dry cells, which use up much more quickly on the filaments than is the case with dry B batteries. Charging at home is, of course, the ideal, but hardly worth the expense of installing for one valve. The chemical charger described elsewhere is for charging B batteries only, and is not suitable to charge an A accumulator.

WINDING COILS ON FORMERS

The method of making thin cardboard formers described two weeks ago will be found to answer well if instructions are properly followed. Zig-zag strips of card on edge can be used to separate the circles in core if nothing else is handy. The safest way of winding is to keep this core inside while the wire is wound on. If this is done, 18's wire can be tightly wound and the coil will keep a good shape. Stand the former upright on the table with the core inside, make holes in end for wire, starting winding at the top. With the left hand turn the former clockwise, steering the wire on with the right thumb, the wire running through the right hand. The right forefinger must hold the top of the former while the left hand gets a fresh grip. By this method it will be found that quite a good pull can be made on the wire without spoiling the shape of the former, so long as there are sufficient circles of card inside to support it.

The supply of wire should be on the table at the right, and if a loose coil can be laid flat and if turned round frequently to release enough wire for a number of turns will come away without any tangling or kinking.

ANSWERS TO CORRESPONDENTS

"Puzzled" asks for an explanation of why he can receive 4YA in two positions of the dials on his five-valve neutrodyne. It was what is known as a "harmonic" that was being received in the unusual position towards zero. Wireless vibrations behave much in the same way as the vibrations of sound in the matter of harmonics. The second harmonic is the strongest; and received at exactly half the wave-length in metres of the transmitting station. Thus the second harmonic of 4YA would be at 281 1/2 metres, and that is why a New Zealand station was found among the American stations. Quite a strong harmonic of 2YA can be received on a short-wave set at 70-60-53 metres. Most of the interference by morse on the wave-length of 3YA is owing to its nearness to the harmonic (300) of VLW's 600-metre transmission. The harmonics are simply sub-multiples of the fundamental wave-length, so that dividing the fundamental by two gives the second harmonic, by six gives the sixth, and so on.

From the district north of Gisborne comes an inquiry regarding push-pull amplification. Upon making inquiry in Auckland regarding such equipment, the firm in question informed our correspondent that they were sold out of Pye push-pull transformers, and had not replaced them on account of a considerable change being expected in this method of amplification. Probably this statement refers to the fact that push-pull transformers are now being constructed upon lines following the more modern type of ordinary low-frequency transformer, whereby the output of power valves may be handled without distortion. Without such improvement the push-pull method would probably not have much advantage over the latest power valves with straight transformer coupling.

The Italian Government, now planning a very elaborate broadcast system, proposes to lay a small radio tax on householders, whether or not they now have sets.

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