Mainly about Construction

BY "MEGOHM"

THE "RECORD" CRYSTAL SET

SIMPLE DETAILS AND EFFECTIVE RESULTS

This is a very efficient crystal set if carefully constructed and used on an aerial of ample proportions. It will even give loudspeaker volume sufficient for an ordinary room up to about two miles airline from 2YA, provided that the aerial is about 30 feet high and 80 or 90 feet long, including the lead-in. There is no guarantee given that every set constructed according to these directions will give speaker volume, but where reasonable care is used in construction, and the aerial is not unduly screened by hills, it is possible, and in any case excellent 'phone strength may be relied on, sufficient to work three pairs of headphones. The original model constructed actually gives weak loudspeaker strength at two miles from 2YA. When made up, the set has a much neater appearance than is conveyed by the line drawing, the black ebonite panel showing up in pleasing contrast to the woodwork, which may be finished with shellac or other medium.

THE PANEL.

Six inches wide and seven inches high is a convenient size for the ebonite panel, which should be a quarter or three-sixteenths of an inch in thickness. The sizes of holes to be drilled will depend upon the style of components purchased. Condenser spindles are usually quarter-inch, and the permanent crystal shown may require a three-eighths hole. However, if a carborundum crystal is used, no hole will be required in the panel to accommodate it, as three crystals are permanently fixed. Quite a different pattern of knob to that shown may be chosen for the condenser control, and a vernier dial may be used, though it is not of much advantage on a crystal set. The two screws shown at the left above the earth terminal (E) are to fasten the panel to a diagonal strip of wood running down to and screwed to the baseboard to ensure the panel remaining in an upright position. A metal stay could be used if more convenient. The panel is secured to the front edge of the baseboard by three brass screws near the bottom edge, for which one-eighth inch holes should be drilled. It is a good plan to purchase the panel before making the case, so that the latter may be made to fit snugly round the ebonite, even if it is not cut to the exact size required, but in any case it should be tested for squareness and corrected if not true. Small differences may be put right by laying a sheet of coarse glass paper on the bench and rubbing the edge of the ebonite upon it as required. An ordinary plane finely set can be used, but some kinds of ebonite chip easily, and may not safely be planed: in any case the planing should be done from end to the centre, and not right along one side, as the finishing end would be liable to chip. When finding the position for the condenser spindle turn the vanes to zero position, and see that there is room for them to clear the cover when in place.

THE CONDENSER.

The capacity of the variable condenser depends upon the number of turns of wire put on the coil, and there is a good deal of elasticity about both quantities, especially when only the local station is to be received. A variable condenser of .0005 microfarad capacity will suit very well, but a smaller one of .00025 may be used with equal results provided that extra turns are put on the coil to compensate for the smaller condenser. A dial or knob with scale must also be provided with which to operate the condenser.

THE BASE AND COVER.

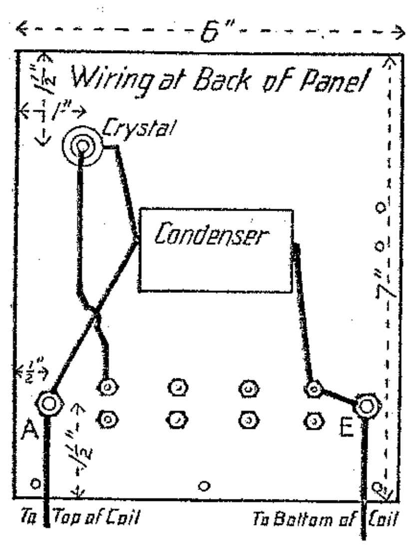
Three-eighths of an inch will be a suitable thickness for the baseboard, which should be cut the exact width of the panel. Six inches from back to front should be ample, as the condenser will probably not project more than 2½ inches from the back of the panel, leaving a space of 3½ inches for the coil of 3 inches diameter, which may be placed towards one side to clear a projection on the condenser. A batten is screwed under the baseboard at both back and front. The front one projects forward the thickness of the panel, as shown on inside view of the set. The back batten is sufficiently short at each end to allow room for the guide strips inside the cover.

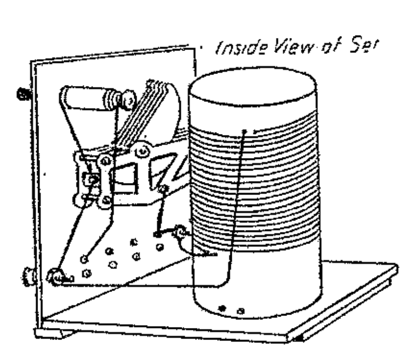
The cover consists of three sides and a top. On the inside at the bottom of each side two strips ⅜in. square are screwed, so that the baseboard may slide in between them. The two sides might be made of ⅜in. rimu, and the top and back of three-ply or ¼in. wood, and finished with shellac and methylated spirits applied and polished with a rag, but individual tastes may please themselves in the exact construction of the cover.

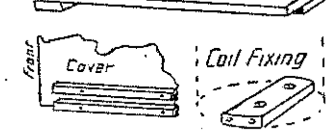
THE COIL.

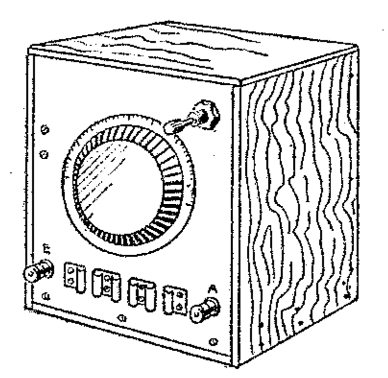
The solenoid soil should be three inches in diameter, and may be wound on a cardboard former of suitable length, either purchased or made by the constructor. There are two methods of winding the wire on this former. One is to wind on 50 turns close together, as described in the simple crystal set recently published. A better method is to wind on the wire with a space between each turn, as in this type of coil certain losses are eliminated that occur where the turns are close together. The space between each turn may be from about a half to the full thickness of the wire. One way is to guess the spacing between, and another method is to wind another wire or twine alongside the wire to be used permanently, afterwards unwinding the extra wire or twine. Whatever method is used, it is as well to securely fasten the turns as soon as possible, and this can be done with cement made by dissolving chips of celluloid in acetone. This should not be applied all over the wire, but in about three or four strips half inch wide running from end to end of the former. The wire recommended is 20's enamelled; this winds about 22 to the inch close together, and 50 turns occupy 2¼in. Spaced with its own thickness, therefore, 50 turns will occupy about 4½in., so that a five or six inch former would suit. The ends of the wire are passed in and out again through two holes made in the former with a bradawl. Referring to the inside view, it will be seen that a good length of wire must be left at what is to be the top of the coil. If left long enough this wire could go under the aerial terminal, to one end of the condenser, and on to the cat's-whisker end of the crystal without any joining, but the enamel must be well scraped off where the wire is connected to any component or terminal. A small drawing shows how a strip of wood is fitted inside the lower end of former and screwed to the baseboard to hold the coil secure.

For long-distance reception a low-loss coil is specially worth while, and those who do not mind a little extra work can make a real skeleton low-loss coil as will be described. If, instead of winding the spaced wires direct on the former, as just described, we wind them over four strips of celluloid placed at intervals along the former, we can then fasten the wires to the strips with celluloid cement, and when this is set the former is pushed out, leaving only the wire securely attached to the celluloid strips. The celluloid used is









that used for motor hood lights, the thicker the better. If scratched with a sharp point it breaks clean where the scratch is made. Now cover the former with a sheet of good paper, fastening by sticking the overlapping edge, but do not let it stick to the former anywhere. This is to prevent the coil sticking fast to the former. Cut four strips of celluloid, 3-8 inch wide, and length of the former. Lay the strips along the former at equal intervals, and fasten in place with twine by tying round the end of the former and the ends of the strips, this being done at both ends. Fasten the beginning of the wire to the twine at one end, and proceed to wind, guessing the spacing, but wind tight, and temporarily secure the finish of the wire by tying down with twine around the former. Now, if we wish to be particular about even spacing of the wires, take a strip of celluloid an inch long, and on its edge file a notch every tenth of an inch. This gauge can now be used to coax the wires into exact position, by pressing it down and working the wires into place in the notches. When this has been done the cement can be applied fairly liberally to the wires and celluloid strips where they cross. Leave the whole to set until next day, when the former can be withdrawn and the coil is finished. It may be fastened to the base by drilling the ends of the opposite strips and screwing to the ends of a slip of wood, as previously mentioned for a former. The direction of the winding of the wire on the coil does not affect the working of the set.

If it is found that the condenser has to be set at zero to tune in, this indicates that there is too much wire on the coil, so that, say, six or eight or more turns can be taken off, until the best tuning is at a position away from zero. If the condenser has to be full in to give best tunning, then a few more turns must be added to the coil. This latter might be the case where the aerial was very short. The same construction of low-loss coil can be used for valve sets, and adds to their selectivity. The coil is to be placed not to touch or be too near to either the case or the condenser.

THE CRYSTAL.

To make a crystal set highly efficient it must be good right through, and too much care cannot be given to obtaining a stable and reliable crystal. The cat's-whisker needing constant adjustment is not worth while, at least for listeners within easy distance of the local station. A good semi-permanent crystal will see a whole evening's reception through without once being adjusted, and may go for a week or two, and in any case the readjustment is quick and easy. These crystals can be purchased for about 3s. 6d., and will give about as much volume as can be got from any crystal. The carborundum crystal, whilst more expensive, is most reliable, and does not require adjustment, so that instead of being inserted in a hole in the panel it could remain behind the panel supported by the wires connected to it. These crystals work well without a battery, and give splendid tone and volume. The price is usually 7s. 6d. A poor crystal will not give anything more than 'phone strength.

FINAL NOTES.

There will be no soldered jointus, but if the ends of the coil wire are left long they can continue from one connection to another as shown and will be quite efficient if all nuts are screwed on tight. The 'phone clips were described last week. They are made from 30's hard brass ½in. wide by 1 5-8 for the centre ones and 1in. for the two end ones, curled found a 1-8in. drill and adjusted to fit the thick part of 'phone tags. They are drilled and bolted to the panel as shown, with 1-8in. brass bolts, which can be obtained at the ironmongers'. When using one pair of 'phones, a tag goes in each of the two outer clips; two pairs, one tag in left-hand clip, one in next clip, tag of second pair in second clip from left, and other tag in right-hand end clip; three pairs, each pair of tags in two adjacent clips, but tags of the same pair of 'phones not to be put into the same piece of brass. Terminals can be used in place of the clips if desired. A loudspeaker would be connected in the same way as one pair of 'phones.

A small or medium-sized speaker would give better results than a large one, but the constructor is advised to borrow one in order to test the capabilities of the set. Long leads from the set to the speaker, perhaps in a different room, will tend to increase volume, as the extension wires act as an additional pick-up in the aerial circuit.

It must not be forgotten that the earth connection is of great importance, especially if it is desired to use a loudspeaker, which would be practically impossible without a good earth, which is permanent connection of some kind to a depth in the ground where it is always damp. The fact that a wire is connected in some way to a water service pipe is no guarantee that there is an efficient connection to earth at all seasons. It usually takes quite a long time for a person to realise how careful and certain he must be about every part of a radio installation, and that is why beginners do not always get the results they should from the apparatus they construct. Every link must be perfect in the radio chain, from aerial to earth. Undue haste is a common fault with beginners, but it is far better to take a day or two extra to turn out a satisfactory and lasting article than try to rush a set together in one evening. Anyone who is handy with tools should be able to construct this set and get good results, but any beginner who finds a difficulty has only to send in a query, which will be fully answered in this column.

MANSBRIDGE CONDENSERS

SELF-HEALING PROPERTIES EXPLAINED

At some time or other in reading about wireless apparatus the amateur is bound to have come across the term Mansbridge condenser, and has probably wondered in what way a Mansbridge condenser differs from any other fixed condenser.

If he asks one of his more experienced friends he is probably told it is made of strips of tinfoil and waxed paper, but this is incorrect. A Mansbridge condenser is not so simple as that. First of all the name refers to the type, and is named after its inventor, a post office engineer, and it is not a trade name owned by one particular firm, although there is one firm, which has become associated with the name by its specialising in this form of instrument.

The peculiar feature about the Mansbridge condenser is that the insulating medium, or dielectric, and the conducting metal is amalgamated into one strip. We have, therefore, a composite strip, one side an insulator and the other a conductor.

The strange thing is that they cannot be separated as might be thought. This is because of the methods used to put the metal on the paper surface. It is done by depositing pure tin in a process somewhat resembling electro-plating upon the paper. In fact, we can be said to have plated one side of the paper with tin. The paper used is a specially prepared one called cellulose paper, and rather resembles good quality cigarette paper.

When the tin has been properly deposited the strip is passed between two rollers which are charged at a high potential of about 2000 volts. This is because during the plating process some of the tin is bound to penetrate the pores of the paper and would result in short circuiting any condenser made with that strip. The high voltage, however, burns away any such faults.

A short circuit occurs wherever the tin penetrates the paper, with the result that the film of metal is burned away, leaving small punctures which can be clearly seen if the strip is held up to the light.

When the short circuiting metal has been burned away the insulating properties of the paper are restored, and the composite strip is ready for the next step.

Every Mansbridge condenser consists of two of these strips and two strips of pure cellulose paper. The four strips are laid down so that we have a strip of paper, a prepared strip, a paper strip, and another prepared strip. The required length of interleaving strip for any given capacity of condenser is then rolled up, and later pressed flat. It is then impregnated with molten wax at a high pressure and fitted into its case. Contact to the metallic faces of the paper is made by slipping either brass strips between the metallic face and the adjacent paper, or by rolling in short lengths of bare flexible wire during the rolling process.

Self-Healing.

One of the great advantages of the Mansbridge condensers is that they seldom break down in use and are in some respects "self-healing."

That means that if a short circuit does occur in them the tin is burnt away at the point of contact and the paper is punctured. This enables the condenser to retain its insulation and so it can be kept indefinitely in service.

The small fixed condensers used in other parts of sets differ in that they do consist of definite layers of metal and insulator. In the better qualities the insulator is mica, but some cheap makes use paper instead. These are not Mansbridge condensers, however, because the metal is not an integral part of the insulator as it is in the genuine Mansbridge condenser.

A Conclusion.

Many experimenters must have wondered if it would not be worth their while to make their own condensers by assembling tinfoil and waxed sheets. The Mansbridge condenser factory made as described above is a wonderfully efficient and compact article, and no home-made arrangement can compete with it. The cost of tinfoil and waxed paper would amount to several times the cost of a factory-made condenser, the bulk would be very great in comparison, and then there is all the trouble.

· · " has its radio experts. Although only 24 years old, Hiroshi Ando claims to be the inventor of radio television, a process by which moving images can be transmitted by electric waves through the air. He also claims to have invented the neutrodyne circuit in 1922, which was before Professor Hazeltine ought forth his neutrodyne ideas in America. Whether Ando's claims are just or not, he is recognised by Japanese scientists as a pioneer radio expert

Hers's a new method for painless dentistry. An ingenious dentist in Butte, Mont., U.S.A., wrote to KOA requesting the station to broadcast "slow and soothing music" in the afternoons as an aid to his profession. According to the letter, he has a radio in his office and headphones for the patient. "It takes their minds off their teeth, and makes them forget the pain," he declared.