Frame Aerials and their Uses

SIMPLE CONSTRUCTION FOR EXPERIMENTERS

MANY inquiries have been received regarding the use and efficiency of loop or frame aerials, and it is in response to these that this article is written.

It should be stated as a preliminary that the sensitivity of an average frame aerial compared to that of an outdoor aerial of ordinary proportions is from one-sixth to one-tenth, so that where heavy volume is sought, a frame is out of the question with an ordinary set, except at very short distances from the transmitter. In the ordinary way, a frame aerial is more frequently used with a super-heterodyne type of receiver, which is both sensitive and selective, the latter quality being further augmented by the use of the frame or loop.

Yet even with an ordinary set of three or more valves, good results may be obtained over long distances, using headphones, by anyone of an experimental turn of mind. A few years ago the writer and others have on one or two favourable occasions been able to pick up KGO (California) on one and two valves, using a small loop, but such reception appears to be impossible at the present time owing to the congestion of the ether or some other reason.

IN spite of its limitations, however, the frame has some compensations, and the lack of sensitivity is made up for to some extent by the great reduction of interference and the clearnes of reception owing to the silent background. Tuning is very fine, and will seem particularly so to those who have not had experience on short-wave.

FRAME aerials are made according to several different patterns, but the most selective is that in which the wires all lie in the same plane. The winding is connected across the aerial and terminals of the set, the aerial tuning condenser then being in parallel with it. The reason for its selectivity is because waves from a transmitting station reach one side of the frame before the other, if the plane of the wires lies in the path of the waves. When the waves strike the first wire of a turn they induce voltage in a certain direction; when they strike the further side they induce voltage in the opposite direction. These two voltages would exactly balance each other, except for the fact that the waves strike one side before the other, and on this account the voltages on the two sides are unequal, and the small difference only traverses the windings. The fact of there being several wires supplies a difference of voltage for each turn and these differences add together, giving the total effect. The waves strike the top and bottom wires equally, so no difference of potential is available from them. In like manner, when the plane of the frame is turned across the direction of the waves the latter strike more and more equally until the position is at right angles, when there is equal effect upon all wires, and consequently no voltage difference to traverse the windings.

THIS property is made use of in finding the direction from which waves are coming, and it is quite easy to distinguish the difference on strong signals between maximum and minimum settings, the frame being parallel with or at right-angles to the incoming waves. Failing any known data as a guide, this test will give a line of direction along which the waves may be travelling in either one direction or the other. To determine the direction of origin upon this line, two bearings are usually taken by moving the frame and receiver after the first one, to some distance either side of the line that has been found. Such new bearing will converge upon the original line, thus indicating very clearly the direction from which the waves emanate. This is the method adopted by the British Post Office for tracking-up offending oscillators, all the apparatus being installed in a specially-built motor-van. Two vans are often employed, each one taking a different bearing simultaneously.

THIS method also constitutes the radio compass, by which means bearings may be found by a ship or its bearings communicated to it from shore. The directional effect of frame aerials is much more marked on short than upon long wavelengths, so for compass work short waves are used. Some years ago there was established a radio beacon of limited range working upon a wavelength of seven metres.

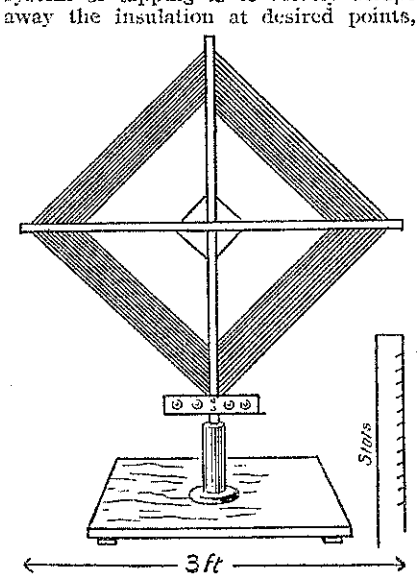
ESSENTIAL POINTS.

ONE point in using a frame aerial is that any circuit whatever may be employed, including any that would be illegal on an outside aerial. In the construction of a frame aerial attention must be paid to making it as "low-loss" as possible, especially if for use at high frequencies (short-wave) where its efficiency will be the greatest if design and insulation are good. Essential points for successful operation are good audio amplification, a good B battery, silent background, and full control of reaction. All oscillation backlash must be eliminated so that the detector glides imperceptibly into and out of oscillation.

CONCTRUCTION.

FROM the foregoing remarks it will be seen that the amount of energy dealt with by the frame is very small, and it is clear that the greater the distance between the two upright portions of the winding, the greater will be the difference in voltage induced. It is therefore an advantage to keep the size of the frame large rather than small, yet within reasonable limits, to suit the rooms of a house. A convenient and fairly effective size is one having two-foot sides, which has a diagonal of nearly three feet.

ON a frame of these dimensions 500 metres would tune in on 12 turns, which would require about 36 feet of wire; 300 metres on 9 turns, or about 74 feet; 180 metres on 6 turns or 50 feet. Lower wavelength would require fewer turns. Many taps are not actually required, because the parallel tuning condenser in the aerial circuit of the receiver gives a wide range. Twelve turns will be ample for any broadcast reception, and it is a good idea to take a tap at the centre or sixth turn, and one at the ninth. One system of tapping is to merely scrape away the insulation at desired points,



and make connection by means of a clip attached to the lead. Dead ends are not desirable in frame aerials, so if short-wave is to be worked it would be a good plan to bring out the ends of both halves separately at the sixth turn, and connect together to put the whole in series, or use only one winding of six turns, further reducing it by clip connections as mentioned. No doubt a number of enthusiasts will be pleased to add to their experiences by experimenting with the frame, and in order to bring the opportunity within the reach of the greatest number, the simplest possible way of constructing the frame will be described.

In some frame aerial circuits reaction is obtained by including some of the turns in the plate circuit.

TWO laths one inch by half an inch will be required, 3 feet and 3 feet 6 inches in length respectively. The shorter one is fixed by its centre at right angles to the longer at a distance of 18 inches from one end of the latter by "halving." Further security is obtained by fastening on a 4-inch square of 3-ply or ¾ wood, as shown in the diagram. Twenties or 22's enamelled copper wire is the best to use. Before putting the cross-pieces together they must be slotted to take the wire. The slots are made with a saw, the slots, sloping diagonally, can be sawn in two strips at one operation, and if held in a vice with a waste strip outside each side, there will be no fear of breaking out the small pieces of wood between the slots, which are ¼in. apart. Just the same effect will be obtained by drilling holes ¼in. apart, and threading the wire through, which is rather a tedious operation. Brass (not iron) tacks sould be used on one edge of the strips as a makeshift idea. It is important that the wood used be of a good solid kind and thoroughly dry, and after cutting the slots, should be well shellaced, getting the shellac well into the cuts. To obtain stability of the cross-piece, two short pieces of wood may be screwed to the upright as shown at AA. Ends of wires may be secured by passing through a hole drilled in the strips, or may be connected to terminals on a small square of ebonite as shown.

The lower extremity of the upright is rounded to fit the centre of an old wire spool, from which one flange may be removed. This is screwed to a baseboard and allows of the frame being rotated with ease. If a calibration scale is required for direction-finding, the top flange of the spool should be left intact, and upon it a cardboard scale marked in degrees can be fixed. A pointer of wire or a large needle is then attached to the upright.

No useful work can be done with loop aerials in connection with crystal sets, and an inside aerial will give better volume than a loop, but loses the advantages of the frame aerial's selectivity.

Our Mail Bag

Taranaki Reception.

Ed. J. L. Payne (New Plymouth): I regret to notice that you are still maintaining that we must seek locally for the cause of 2YA's distortion, the plain insinuation being that our receivers are to blame. Your past slurs on North Taranaki's receivers are still rankling, as you are doubtless aware. There is one fact which I would like to point out to you. It is this: the same "distortion producers," at the touch of a knob or dial, bring in clear, sparkling reception of foreign stations operated on various wave-lengths. Can your technical experts explain this away? Do you claim, Mr. Editor, that the Broadcasting Company's own engineer supports you in your opinion that our reecivers are to blame for our distorted receptions of 2YA? He has investigated for himself, which is evidently more than you have done. I should like to see the "Record" run on the same lines as the "Radio Times," the B.B.C.'s official organ, and not dabble in highly controversial matters on which its outlook appears to be influenced by a desire to show the company in the light of a public benefactor, and listeners as ingrates.

[Our correspondent's letter is apparently aimed at "Megohm's" article in last week's issue on "The Causes of Distortion." "Megohm" is a very experienced and competent experimenter and writer, and has a perfectly free hand to express his views and experiences, the whole purpose of his writings being to benefit listeners. We do not dictate his writings or even the subject of them in the slightest, and in most cases do not peruse them till after they are printed. The personal tone of our correspondent's letter is therefore quite uncalled for. On perusing "Megohm's" article we cannot see any justification for sensitiveness on the part of Taranaki. It is a purely general article, and is certainly not aimed at Taranaki reception or distortion. It is aimed to help listeners analyse the causes of poor reception. What does seem puzzling is why some parts of Taranaki should get poor reception from 2YA while other parts of the country get it well. Our correspondent is quite welcome to express his views, but a slightly different tone might be more pleasant. "Megohm" will be quite pleased to have any errors in his article pointed out.—Ed. "Radio Record."]

Query Answered.

A correspondent advises "A Listener," in response to his query, that the station he heard "helloing" is 2BH, an amateur transmitter in Wright Street, Wellington.

Eulogy of 3YA.

Ferry Road (Christchurch).—In view of the commencement of a new radio year and also in view of the controversy regarding the affairs of the R.B.C., I wish to just express very briefly my opinions on some of the matters concerned. I have written the company many times, and certainly whatever my letters have lacked they have never been lacking in candour and frankness, and they have at the same time, I trust, been free from any suggestion of personal bitterness or animosity, which seems to pervade all correspondence from the Queer (pardon!), I mean "Queen" City. As one who has often groaned in spirit over the presence of, or the lack of, certain classes of entertainment, I will admit freely the programmes are wonderfully good now, and show an enormous advance on those of even six months ago, and that they are improving every night. I have been watching the programmes from the other centres, and, though good, they cannot compare with the ones sent out from 3YA. Many items presented here are often put over the same night or week from one of the "Aussies" with the credit balance strongly on this side of the Tasman. I say that although I am strong for Australia in lots of ways! Mr. Clyde Carr is equal to, if not superior to, most announcers, either here or "across the way."

I am glad that musical comedy and comic opera (especially the former) are now being regularly presented. "Going Up" was a "rattling good show," and so was the "Country Girl" and "Monsieur Beaucaire." At the same time the fact that many items apart from the piece set down for the evening are introduced is an excellent idea. That is where the 'permanent staff plan" crashed, for the same little "set" over and over again in one evening "bored us stiff" even though the singers were really fine.

The increasing use of the gramophone is a splendid sign despite whatever may be said by those who have a worn-out portable and half a dozen scratched records. These are the ones who write to the "Record" saying "we have our own gramophones, so cut it out of the radio programmes." It causes me no tears that the movie shows have got greedy and withheld their music (good though it was!). The overtures each night are miles better, and we don't have to endure the laughing, which was very irritating at times. Being able to select an overture in keeping with or from the piece for the night is worth while losing the other. Saturday night at 3YA is as good as any from "Aussie." The big roster of artists is astonishing, and they are all "top-notchers," too.

The re-broadcasts of 2YA of late have been good, and are always welcome (especially Friday's "All Black" farewell). Could the Aucklanders find fault with that? The gramophone sessions in the afternoon and between the races are splendid; the selection of records being as wide and diverse as possibly could be.

In regard to Rugby football in Christchurch, "Don't come at their bluff" is the advice of dozens of listeners. Once relays are paid for—"good-night" programmes! Doubtless something else could be put across, but don't let it be League or Soccer—"small-time stuff" as they say in vaudeville. Once more admitting that 30s. is cheap.

The Programmes.

Philip Williamson (Whangamata): I have been quite interested, not to mention somewhat amazed, to read of the various complaints put forward regarding the programmes put on the air by the N.Z.B.C. Considering the comparatively small population of New Zealand and consequent limitation of talent, it seems to me that the company is to be highly commended for, not only the exceedingly fine quality of the programmes broadcast, but also on their variation, and the manner in which all tastes are catered for. I notice that there have been complaints regarding the constant re-appearance of the same artists, but when one considers that such artists are among the very best in New Zealand, I, for one, fail to see any cause for complaint. I think that I am right in saying that those who complain about the Broadcasting Company are very much in the minority. The bulk of listeners are, I think, more than satisfied with the entertainment provided. It is, of course, impossible to please everyone, but the Broadcasting Company seems to do all that is humanly possible in this direction.

Another bone of contention among a certain section of the public seems to be with reference to the non-publication of detailed financial statements. I may ask, do the regular patrons of picture theatres and so on expect it to be their right, since they pay for admission, to be informed exactly how the sum total of their various payments are expended by the management of the places they patronise? A certain section, however, argues that since the license fees are collected per the medium of th Post Office—a Government institution—that the people have a right to know all about the exact manner in which their fees are expended. To my mind, the Post Office, in this direction, acts purely in the nature of a collecting agent, for which service it is paid in much the same manner as any other collecting agent, such as a solicitor is paid by his client

I understand that it is stated by some people that since the Government helped to finance the Broadcasting Company, that the company should publish detailed financial accounts. Here again, I may ask, does the Government, which has advanced vast sums of money to farmers, expect each farmer, particularly if he pays his interest, etc., regularly, to forward copies of his profit and loss account and balance-sheet for the perusal of the general public?

While writing, there are two small suggestions I would like to make. The first is with reference to the "Radio Record," in which I think publication of photographs of the various station announcers would be greatly appreciated. We all know their voices, and if we knew their faces, too, a still closer personal touch with them would be felt. I suppose there is no voice better known in New Zealand than that of the editor announcer of 2YA, and many would probably be interested to see photographs of him and the other announcers.

The second suggestion is with reference to an educational hour for children, particularly for those in country districts. I would suggest that each station devote one afternoon session a month in this direction. I should like to see some country schoolmasters take up the matter in these columns.

[We undersand this matter is in hand with the Department of Education, and an announcement may be expected soon.—Ed.]

News and Inquiries.

J. W. Hannan (Matiere): In last week's issue of the "Radio Record" Mr. Johnstone reported reception of the unknown station working below KFON. The station is probably the first harmonic of 4YA, on about 233 metres, which can be tuned in clearly. There is also an American station, KFWM, Oakland, Cal., on 236 metres, which I logged to-night (Sunday) for the first time. Hawaiian music was being broadcasted on request. At 7.30 this evening, on about 234 metres, I heard a station close down thus: "After 2BL, station 2GHG, now closing down. Goodbye everybody." Mr. Bank also reports reception of an unknown station between 220-240 metres early in the morning. At 2.30 this morning I logged a station on 232 metres. Hawaiian music was being broadcast, and one of the performers was whistling the tune. The station closed down at 2.35, without giving the call sign. I logged another station at 1 o'clock this morning, which I believe to be an Indian station, working one and a half degrees below 2BL. Orchestral music was being broadcast. The announcing was in a foreign language, sing-song fashion, almost a wail, in fact. The station closed at 1.10. At 1.45 a station was heard one degree below 5CI, broadcasting queer organ music, closing down at 1.50, giving no call sign. The station is situated in the Philippine Islands, I think. Can any listener enlighten me regarding the above stations?

What's Wrong, Anyway?

"Programme" (Hunterville): Lately I have read many letters about radio programmes not being up to the mark. Well, I am informed that the listeners pay 30s. per annum to install and operate a radio set, not to manage the programmes. Perhaps if the dissatisfied listeners petition the N.Z.B.C. they may be allowed to run the stations too. If there were no stations in New Zealand the listeners would be paying their money for Australian reception, which is not always good. Now what's wrong with the programmes? The N.Z.B.C. can't please everyone. The programmes here are just as good as anywhere else, if not better.

The Programmes.

N. S. Francis (Lower Hutt): I would like you to grant me a little more space in your valuable paper. It was with much interest, and quite a little amusement, that I read the letter written by "Satisfied," or was it "Easily Satisfied," in this week's "Radio Record." He helps my side of the question along quite a lot. One can at once see, by the way in which he replies to the few words which I wrote merely expressing my opinion of the programmes, an opinion, by the way, which I am quite entitled to express, that he is either connected with the radio business or else he is one of those persons who can't be convinced that an improvement in the programme is necessary, for I am sure that even the Broadcasting Company themselves

(Continued on Page 14.)

LOOPS OF LARGE DIMENSIONS.

A READER of a London wireless journal gives an account of experiments which he has made with large loop aerials formed around the walls of a room, and some of the results he has obtained are really surprising. As a matter of fact, in view of the difficulty of erecting a good outdoor aerial, as well as the objection which many people seem to have to an outdoor aerial in any case, it has always seemed to me that a good deal more attention might, with profit, be devoted to the loop aerial. The reader in question sets up two loops on two adjacent walls of the room, that is, two walls meeting at a corner. These loops are made by means of a few turns (usually not more than half a dozen) along the floor, up the wall, along the ceilings of picture rail and down the wall again. They are further arranged so that they may be put electrically in series.

When receiving a station, first one loop is tried, then the other, and then the two in series. It may be that one or the other gives the best results, according to the bearing of the desired station, or it may be that the two together give a resultant directional effect better than that obtained with either separately. Furthermore, the loops are arranged so that they may be reversed electrically. In these and various ways it is evident that, although the loops are actually fixed, it is possible so to manipulate them electrically that practically the same result is obtained as if they were mechanically movable.

Although there is a good deal in all this that is well known, it seems to point the way to interesting and useful developments.