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EDITORIAL COMMENT

Television

Accelerating Rate of Progress

THE combined efforts of the Government-appointed Committee, the B.B.C. and manufacturers have succeeded in establishing here a television service which is the envy of all other countries. It is a service of which we may very justly be proud ; but public response has been slow and when we consider the excellence of the pictures, the reliability of the sets and the continually improving programmes put out by the B.B.C., there seems to be something wrong if the public does not respond and take advantage of it.

In a recent Address which he gave before the Royal Society of Arts, Mr. Kirke, of the B.B.C. Research Department, said that the television service was being seriously handicapped because the public was not responding by buying a sufficient number of sets. He emphasised the difficulties which lay in the way of justifying an extension of the service to other areas, which would involve great expenditure, until a really enthusiastic interest on the part of the public in London to the service already operating is assured.

It is not surprising, in these circumstances, that the manufacturers, in co-operation with the B.B.C., should now be launching a campaign with the object of bringing home to the public the fact that a television service is now really established and that sets can be bought at prices which are remarkably low for the entertainment provided. Whatever steps are possible will be taken to make the public television conscious, and the slogan of the campaign is "Television is here : you cannot shut your eyes to it !"

There have been, during recent weeks, indications that the public is beginning to show greater enthusiasm and every possible encouragement should be given to this attitude, not only to ensure that the present expenditure on programmes and transmissions can be justified, but to pave the way for the further extension of television to other parts of the country.

National Service

The Wireless Register

IN this issue we publish again the National Wireless Register Form which first appeared last week. *The Wireless World* has inaugurated this National Wireless Register in conjunction with the Wireless Telegraphy Board in order that the Authorities may be able to assess the potential resources in trained or partially trained wireless personnel in the country.

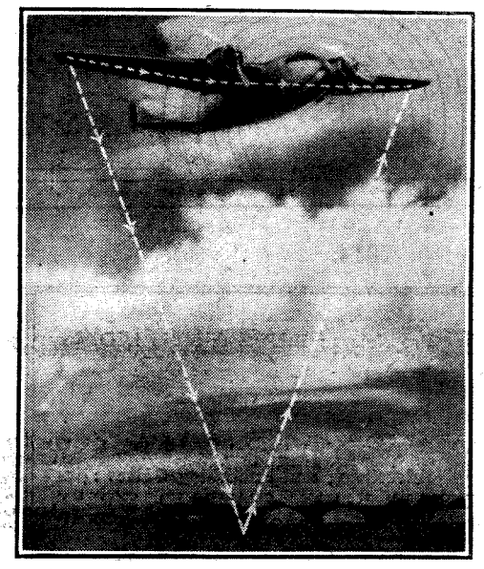
As we have already explained, filling up the form does not involve any liability, but will provide a means of classifying those experienced in wireless, so that in the event of an emergency which would require that everyone should put himself at the service of the country, the right job could be found for every person with wireless qualifications ; either continuing in his present occupation or in some other where the utmost use could be made of his capabilities.

Those who are in reserved occupations would not, of course, be required to volunteer for other work, but it would still be valuable that they should be included in the Register for the sake of completeness, and because no matter what occupation of value you may at present be in there is always the possibility that you can render still more valuable service in another capacity.

It is hoped then that every reader will make it his business to complete and post this form as early as possible

Wireless Altimeter

"ECHO SOUNDING" FOR AIRCRAFT



By Our New York Correspondent

THE radio altimeter for aeroplanes has been something of a will-o'-the-wisp. Though presenting the attractive theoretical possibility of measuring the plane's height above the ground, rather than the sea level, it has encountered major difficulties in a rather long experimental life. One such difficulty was that the simplest of the radio altimeters has the unfortunate property of repeating the same indication for a number of altitudes at regular intervals, making possible an error somewhat like that of confusing a.m. and p.m. when reading a clock. Such uncertainty may be serious. Another outstanding shortcoming was that with the commoner schemes the readings of altitude were only as accurate as the frequency constancy of the transmitter which sent the radio signal employed in making the measurements. Since the ultra-high-frequency transmitter is installed in the plane, and aircraft conditions are severe, this is no minor problem. Both difficulties have been avoided very neatly in the new Western Electric Model 1 altimeter recently described before the American Institute of the Aeronautical Sciences by Lloyd Espenschied and R. C. Newhouse, of the Bell Telephone Laboratories (New York City).

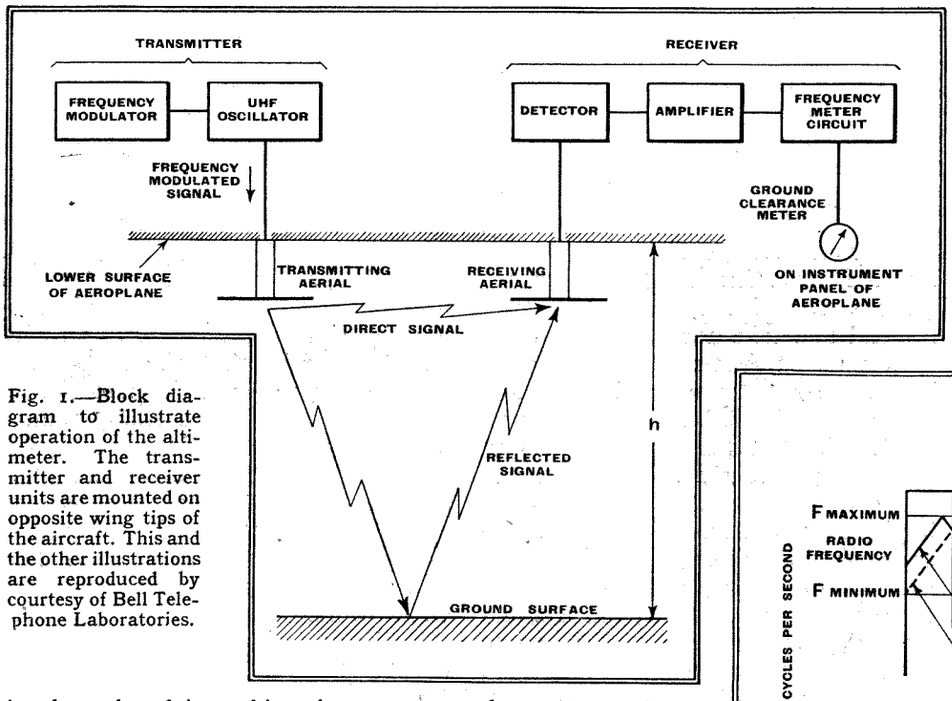


Fig. 1.—Block diagram to illustrate operation of the altimeter. The transmitter and receiver units are mounted on opposite wing tips of the aircraft. This and the other illustrations are reproduced by courtesy of Bell Telephone Laboratories.

The Model 1 altimeter begins with the familiar basis of an ultra-high-frequency transmitter carried by the plane and transmitting to a receiver in the same plane as suggested by the block diagram of Fig. 1. The UHF oscillator at the left feeds the small half-wave dipole transmitting antenna via a short concentric feeder line. The transmitting antenna radiates in most directions, hence the dipole "receiving antenna" at the other end of the wing of the plane receives both a "direct signal" and a signal which has gone down to earth and rebounded to the plane ("reflected signal" in the diagram). Both paths are shown in Fig. 1. Since the two paths are not of the same length, the two signals do not arrive at the same time. To be of practical use a radio altimeter must be able to measure this time-difference automatically, translate it into terms of plane height, and indicate this result promptly. The Model 1 altimeter differs from others principally in the manner of making this measurement and indicating the result. The transmitter does not operate at a fixed frequency, but is "wobbled" rapidly in a regular manner. The frequency modulation is in a saw-tooth pattern as shown by the solid line in Fig. 2 marked "direct signal." When such a frequency-modulated signal is received it is impossible for the frequency variation of the direct signal to be in step with the variations of frequency of the reflected signal, because of the difference in travel time. The delay of the modulation pattern is proportional to the difference in path length, which difference is almost exactly twice the plane's height. The use of the saw-tooth variation pattern, which is made up of straight-line sections, insures that the frequency difference between the two signals is likewise proportional to the delay. Now this difference-frequency can be taken out by an ordinary detector, amplified and made to operate a direct-reading frequency meter calibrated in feet of ground clearance. The process of detection of the difference-frequency is very much like the analogous process effected by the first detector of a superheterodyne.

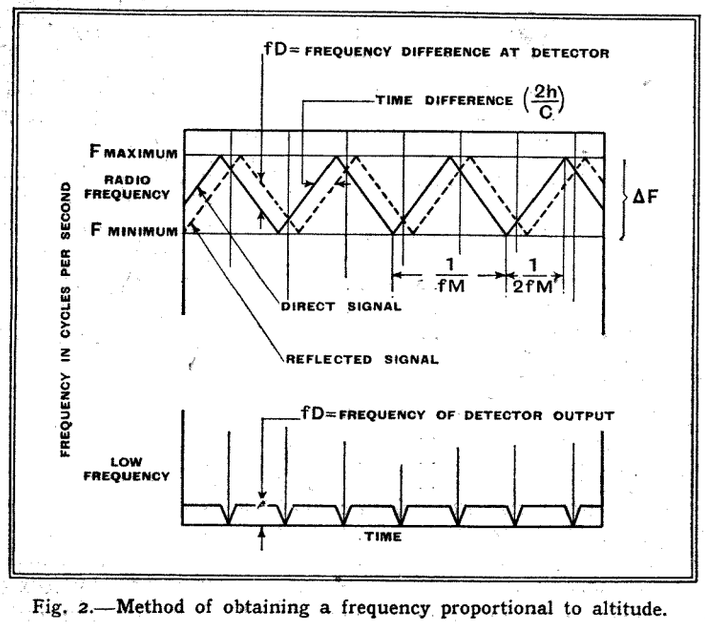


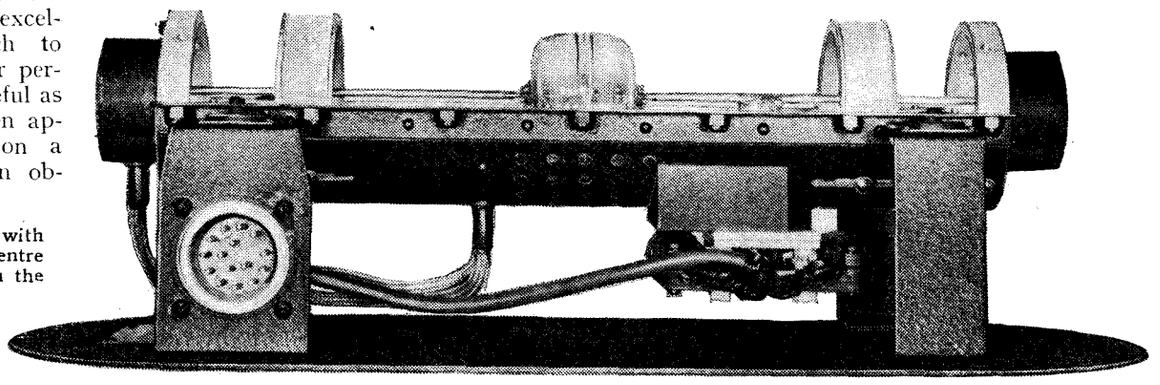
Fig. 2.—Method of obtaining a frequency proportional to altitude.

Describing the functioning of the device, the Western Electric Company states "a city usually causes rapid fluctuations of the order of 50 feet . . .

FOR fairly obvious reasons, the pilot of an aircraft flying over, say, hilly country in conditions of poor visibility is less interested in knowing his height above sea level than in the height above the surface of the earth immediately below him. The Western Electric Altimeter described in this article gives a direct indication of ground clearance (height above the surface of the earth) which is precisely the information needed under the conditions envisaged.

Wireless Altimeter—

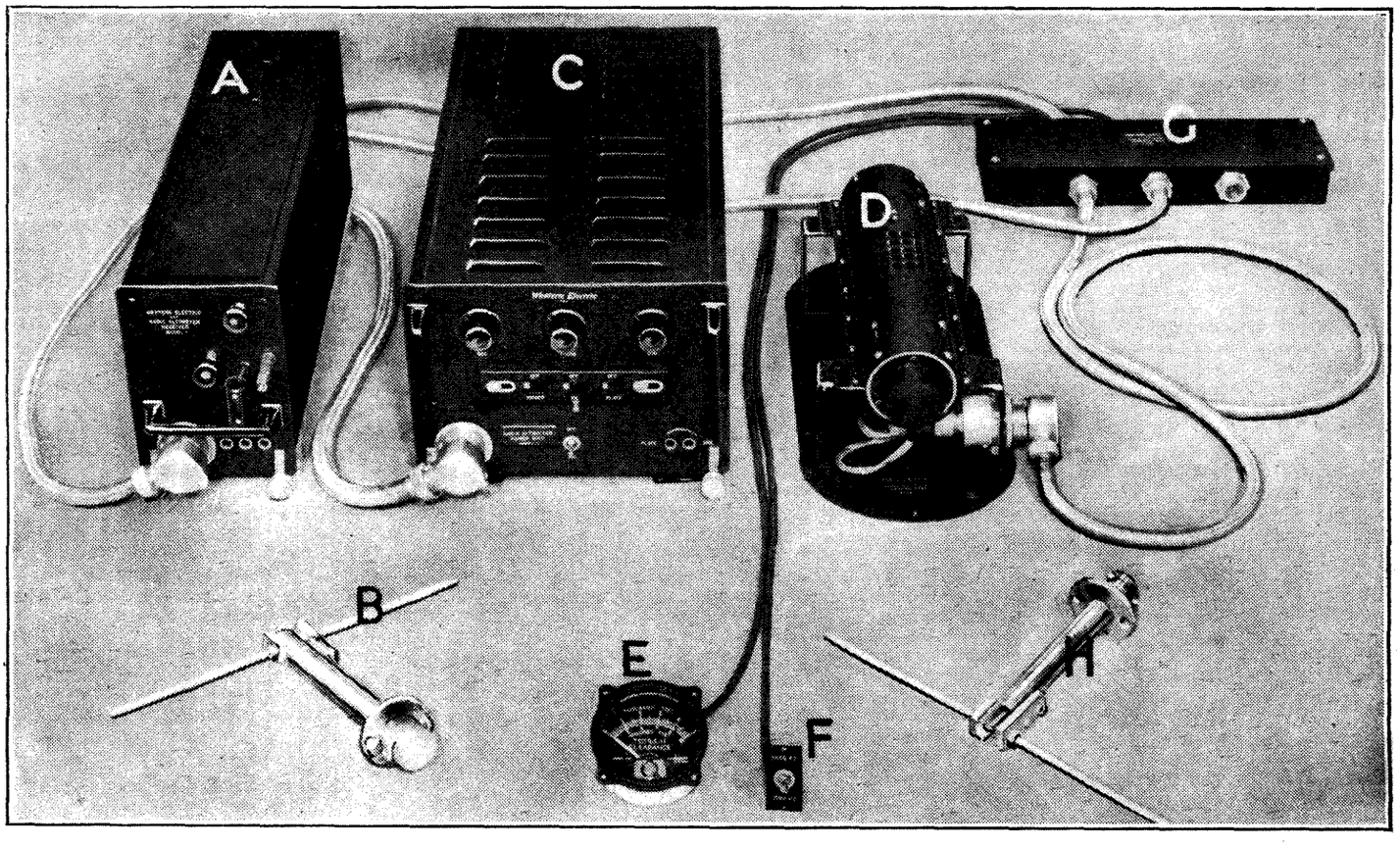
farmland causes fluctuations of lower frequency and amplitude. An isolated high object such as a skyscraper or a chimney is indicated only by a slight meter kick as the aeroplane passes over it, which may not be noticed by the observer. . . . The gas storage tank near the Chicago airport is an excellent thing upon which to demonstrate the altimeter performance. It is very useful as a position indicator when approaching an airport on a course which crosses an obstruction of appreciable height and size, since the moment of passage over the obstruction is clearly indicated."



View of the transmitter, with cover removed. At the centre of the framework is seen the double triode "door-knob" valve, mounted directly on the Lecher wire tuning system.

Fig. 2 is largely self explanatory, except as to the symbols employed. "h" is the height of the plane, "C" the speed of propagation, and "ΔF" the peak value of the frequency variation or modulation. The proportionality between time-difference and frequency-difference is due to the use of a modulation curve made up of straight-line sections. The difference-frequency is not actually constant for a fixed altitude, but drops to zero momentarily at each point where the dashed and solid curves cross. This is shown by the lower pattern which is the form of the detector output. The flat tops of this curve predominate and represent the frequency to which the indicating meter responds. The height of the tops changes with the plane's height, but their length depends upon the frequency of the modulation.

It is very desirable to provide two ranges for an altimeter, one for normal use and one for landing or other close approaches to the earth. The Model 1 altimeter provides snap-switch selection of ranges of 0-1,000 and 0-5,000 feet. It is interesting to note that multiple ranges can be obtained in several ways with a circuit of this sort, since it is possible to cause a selector switch to operate on the meter itself, or on the frequency modulating device. The latter is possible because the difference-frequency is proportional to both the number of frequency-modulation cycles per second and to the amplitude (f) of these cycles. This is true because these two factors multiplied together represent the rate-of-change of the transmitter frequency, which when multiplied by the time difference (2 h / C) becomes equal to the detector output frequency fD. It is,



The various units of the altimeter equipment. A, receiver; B, transmitter dipole (length is about 11in.); C, power supply unit, including HT generator; D, UHF oscillator; E, indicating meter, calibrated in hundreds and thousands of feet; F, range switch (hundreds to thousands of feet); G, junction box; H, receiving dipole. Total weight of equipment is 70 lbs.

Wireless Altimeter—

therefore, necessary that the modulation be very constant. This problem partially replaces the one of oscillator constancy. Frequency variations of the oscillator, unless they are rapid and of considerable amplitude, do not have the serious consequences which would appear in a system attempting to establish standing waves between the plane and earth on the basis of a single frequency.

"Door-knob" Valve

The transmitter is shown partially disassembled in the first photograph. It employs one of the special double-ended Western Electric triodes previously described in *The Wireless World*. These "door-knob" tubes have the plate and grid support rods carried straight through the bulb so that the tube may be inserted in the centre of a Lecher wire tuning system whose ends are short-circuited (for RF). This arrangement minimises radiation losses from the rods forming the tuned system and approximately halves the RF current flowing into each lead-in wire of the tube. Since the wavelength is below 1 meter this effects a considerable gain in efficiency. The adjustable tuning bridges and the upper tuned rod are visible in the photograph, as is the tube at the centre of the housing.

The second photograph shows the essential component parts of a Model 1 equipment. The front row consists of the sending and receiving dipoles and the indicating meter with its range-selecting switch. The dipoles are less than a foot long. They are carried on short lengths of tubing which with the enclosed concentric rod act as impedance-matching devices and in turn connect to the feeders (not shown) from sender and receiver. The indicating meter is a normal DC meter working in conjunction with a frequency-measuring circuit. In the rear row from left to right are the receiver, the power supply and control box, the transmitter, and a junction box, all connected by such lengths of shielded multiple-conductor cable as may fit the particular installation. Definite information is lacking, but the frequency employed and the appearance of the receiver both make it fairly certain that the coupling devices are concentric tuned lines with trombone adjustment at the front panel.

PROBLEM CORNER—5

Test Your Powers of Deduction

HENRY FARRAD, another sample of whose correspondence is given below, has a reputation for correctly diagnosing his friends' radio troubles. Readers are invited to work this one out for themselves before turning to p. 112.

99, Blomfontein Parade,
Surbiton.

Dear Henry,

Since you last heard from me I, too, have been confined to my room—sciatica, it seems. A most unfortunate time, for I wanted to give the garden a good digging before the winter is too far advanced, and now I have had to pay a fool of a man to do it for me.

Another regrettable occurrence is that just when I wanted the wireless most it has let me down. Not altogether, you understand, but it is definitely not as good as it was, and there seems to be more hum than usual. Another thing—when your aunt was connecting up the extension loud speaker for me she says she got quite a shock from it. I am quite certain that has never happened before. Can you understand it, my boy?

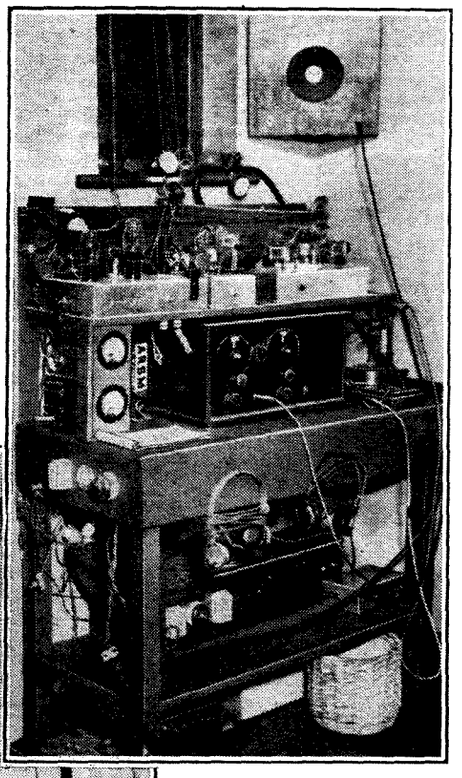
Your affectionate
Uncle Adrian.

What was wrong with "the wireless," and why?

Amateur Transmitting Station G5CD

At Hendon, London, N.W.4

This station, owned and operated by Mr. D. N. Corfield, carries out experimental transmissions on 1.7, 3.5, 28 and 56 Mc/s wavebands.



A considerable amount of work is done under artificial aerial conditions. The inset picture above shows the equipment used for transmission on 57.68 Mc/s, which can operate on an input up to 100 watts. The station is usually to be heard on Sundays, in the morning on 1.7 and 3.5 Mc/s bands and in the evening on 3.5 and 56 Mc/s bands. HT voltage supply for the various transmitters and test equipment is derived from a comprehensive unit seen on the left of the lower picture.