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Editor :  
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Editorial,  
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DORSET HOUSE, STAMFORD STREET,  
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COVENTRY: Hertford Street.  
Telegrams: "Autocar, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:  
Guildhall Buildings, Navigation Street, 2.  
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*As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.*

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## EDITORIAL COMMENT

### Television's Future

#### Financial Problems of B.B.C. and Manufacturers

**T**HERE are signs that the public is now settling down to a more sober view of television after the first outburst of excitement following the publication of the Television Committee's Report to the Postmaster General. The problems involved begin to show themselves in their proper perspective and it is realised now that when the proposed station in London starts transmitting this will only be a modest beginning, and that the development of an efficient service of public interest must be a gradual process.

In an article published in the issue of *The Wireless World* of August 3rd last year, under the title "Financial Aspects of Television," it was brought home to us how serious an obstacle to rapid development was the probable high cost of organising a national service. It was shown that the future of television was so bound up with the financial side that the technical aspect could not properly be considered except in association with financial considerations. Elsewhere in that article the statement appeared "It does not look as if the finances of the B.B.C., on the basis of their present proportion of the licences, could stand the strain of endeavouring to provide television programmes, even if they might scrape together the cost of erecting the stations over a fairly long period of time."

Fortunately, the B.B.C. is to have some assistance on the financial side, for it has now been announced that a grant of £50,000 is to be made to the B.B.C. through the Post Office estimates to aid the development of the television service. This sum should be a considerable assistance, but it looks

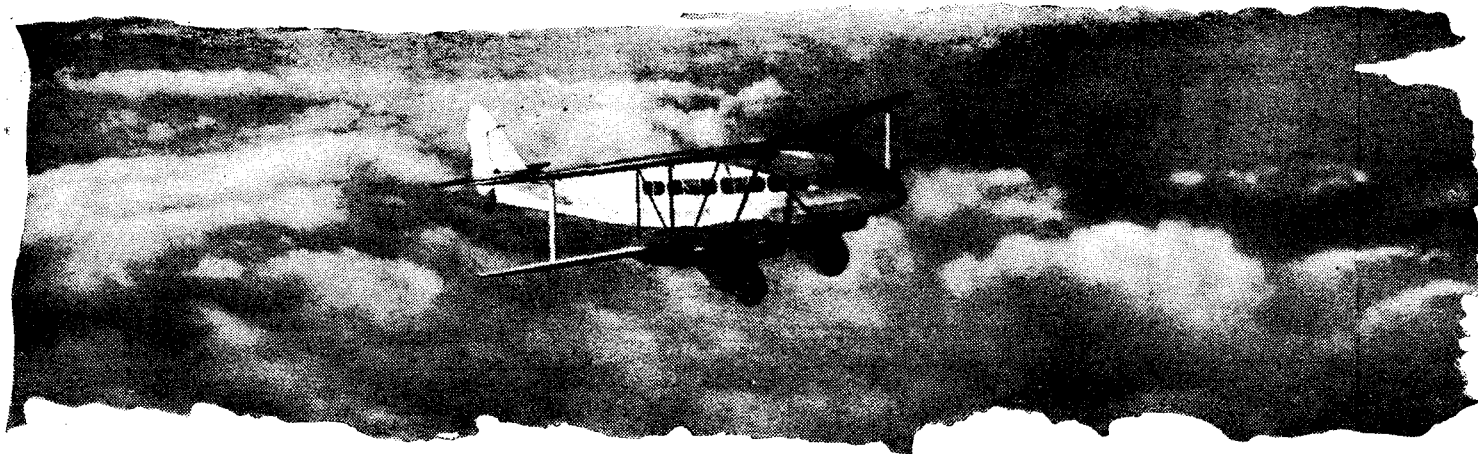
as if an equal amount at least will have to be found from year to year for the provision of programmes alone, quite apart from the erection of stations.

On the commercial side, too, there are difficulties. Those concerns which have done most of the development work on television have already sunk large sums which have so far been unproductive of revenue, and if royalties paid to them as owners of patents by manufacturers of television receivers and profits through the sale of their own receivers are to be their only sources of revenue, it may be some time before any appreciable reward for their efforts can be garnered. In order to popularise television in this country too, manufacturers will undoubtedly endeavour to put out sets at the lowest possible prices, thereby leaving themselves a somewhat meagre margin of profit.

#### Financial Risks

It would be over-optimistic, too, to suggest that there is no element of risk attaching to the future success of television from the point of view of public appeal, and this, as we have pointed out before, is where the B.B.C. has had to shoulder a big responsibility. If the public has been led to expect too much of television and the scope of the programmes when they start is disappointing, then development may prove to be very slow indeed.

Meanwhile, we should do all that we can, short of raising the hopes of the public too high, to support the B.B.C. in their effort, as well as giving encouragement to those pioneer companies who have invested so much capital in the enterprise and who merit a full reward for their efforts and for the risks which they have been prepared to take.



By Courtesy "Flight"

# The Lorenz Blind Landing System

## A NEW RADIO AID TO AERIAL NAVIGATION

By RODERICK DENMAN, M.A., A.M.I.E.E., A.F.R.Ae.S.

*WHEN a pupil is taken up for his first flying lesson it is quite usual to find that he can fly straight, by watching a mark on the horizon, from the first moment that the controls are handed over. When the horizon is obscured, however, things become more difficult for him, and in the limit when visibility is reduced to zero only a skilled pilot whose aeroplane is equipped with gyroscopic blind flying instruments can remain aloft. The importance of means which will make possible blind landing in safety cannot be over estimated. The following article, describing a new system ingeniously based on the properties of ultra-short-wave radio transmission, is, therefore, of special interest.*

THE requirements for instrument flight are well understood and they can easily be met so long as the height of the aeroplane above ground obstructions exceeds the maximum error of the instrument used to indicate height. In the best modern altimeters this error does not exceed about 75 feet. Now, with no more detailed height information than is provided by such means as this, it is actually possible on a large aerodrome to land an aeroplane in safety, by throttling the engine down and awaiting contact with the ground. But greater precision results, and the landing can therefore be made in a shorter length, if the pilot is shown how to follow a predetermined path of descent, and can train himself to use it. This is by no means easy, for throughout the approach and landing he must simultaneously and within narrow limits preserve a straight course towards the landing runway. In this article, however, we are less concerned with the airman's residual difficulties than with the technical aids that radio can offer him. With a passing observation that these difficulties are not insuperable, therefore, we will proceed at once with a description of a system which not only lays down a fixed horizontal path of approach but at the same time offers the pilot a variety of vertical paths of descent from which (it is claimed) he may choose the one best suited to the aerodynamic properties of his aeroplane—an assortment of Jacob's ladders, reshaped (as it were) to modern requirements.

A distinctive feature of the blind land-

ing system to be described is that a single transmitter is used to delineate both the horizontal and vertical paths. This leads to a considerable simplification of the equipment which it is necessary to carry in the aeroplane, but however desirable this may be as an ultimate goal the writer shares the view of the American workers in this field, that at the present time it would have been better to keep separate the functions of a horizontal approach beacon and of a vertical landing beam. To this the Germans may fairly reply that

use of the vertical radiation characteristic of their beacon is entirely optional, and that its performance as an aid to the approach in the horizontal plane has been in no way compromised. Whether the converse is also true, however, remains to be seen.

The basic principle of the German beacon is due to Herr P. Von Händel, of the Deutsche Versuchsanstalt für Luftfahrt, but the system has been worked out in its present commercial form by the Lorenz Company. The horizontal directional effect will first be explained.

### Horizontal Navigation

Fundamentally this depends on continuous indications of field strength at the position occupied by the aeroplane at any instant. Comparison is made of the field strength due to two radiation characteristics in the horizontal plane which are created alternately by the action of two reflectors on a dipole transmitting antenna. Since the dipole is erected vertically, the waves are polarised with the plane of the electric force perpendicular to the earth's surface. This avoids the introduction of any unwanted directional effects by the receiving antenna. The wavelength chosen is 9 metres.

Consider first the effect of a single reflector (Fig. 1) where T is an elevated transmitting dipole and R1 a vertical reflector with a remote-controlled switch inserted at its mid-point. When this switch is opened the shape of the resultant space pattern is circular, for the radiation is

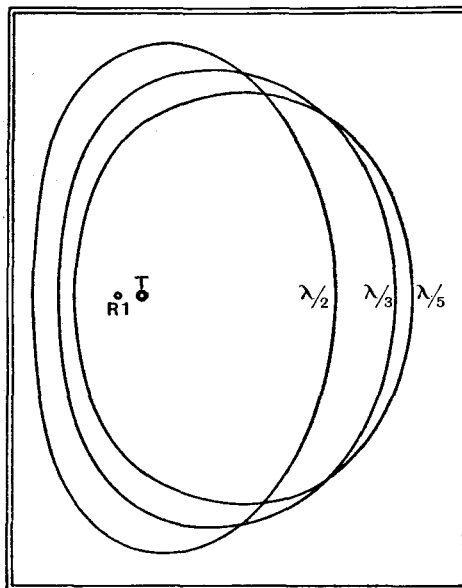


Fig. 1.—Horizontal field patterns. T, vertical dipole; R1, reflector, spaced  $\lambda/2$ ,  $\lambda/3$ ,  $\lambda/5$  from T.

**The Lorenz Blind Landing System**—uniform in all horizontal directions. When, however, the switch is closed, the reflector becomes operative and the space pattern assumes an elliptical shape. The energy radiated in any given direction depends upon the phase of the current induced in R1 by the radiation from T, and this in turn obviously depends upon the spacing between the transmitter and the reflector.<sup>1</sup>

**Equisignal Course Indication**

The spacing actually used is about half a wavelength. The field strength in any given direction from the transmitter is proportional to the length of a line drawn in that direction from T to the boundary of the curve, and it is seen that the action of the reflector is to increase the field strength on the side of the transmitter opposite to it. If a second reflector R2 is now added as shown in Fig. 2, and this is keyed alternately with R1, then the field strength pattern will change from one ellipse to the other according to which reflector is keyed. At the points X and Y, which are common to both curves, the field strength will not be affected by keying, and as the curves corresponding to other values of field strength are all symmetrical with respect to a line joining these two points, XY is the line of equal strength. In order to provide distinctive signals for the areas lying on each side of this equisignal line, the reflector R1 is keyed with dots and R2 with dashes, it being arranged that the signals interlock

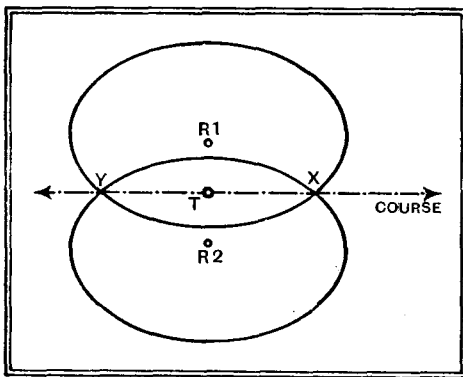


Fig. 2.—Constant field strength is maintained along the line XY.

and that the combined length of a dot and a dash is one second. This is shown in Fig. 3, where the area in which dashes are heard predominantly is at the top of the figure, and the area where dots are loudest lies at the bottom. Along the equisignal line the dots and dashes are of equal strength and merge into a continuous monotone, while slightly to each side of this line the dots (or dashes) will lack contrast in relation to the background signal. Along the line SAB, for example, the intervals between the dashes will be filled with dots having a signal strength relative to that of the dashes of SA/SB. Owing to the inability of the ear to detect differences of sound intensity of less than about 1 decibel, the area in which the signals, heard aurally, will be judged to

<sup>1</sup> The polar diagram is somewhat similarly affected by the length of the reflector wire.

be of equal strength will occupy an angle of a few degrees, and it is within this angle that the pilot must endeavour to keep his aeroplane. If he deviates to the right or left, dots or dashes will predominate in

and deliver about 5 watts output to a horizontal dipole mounted either one quarter or three-quarters of a wavelength above the earth, or (what is equivalent) above a wire netting reflector laid on the attic floor of a house. This arrangement gives the vertical polar diagram an inverted cone-shaped appearance in the plane of approach. The width of this cone is such that the duration of the marker signals will be from about six to ten seconds, depending on height. The vertical range of the marker beacons is at least 1,500 feet.

So far we have considered only the horizontal distribution of the energy radiated by the main beacon. To understand how the same beacon can be used to mark the path of descent, the reader should

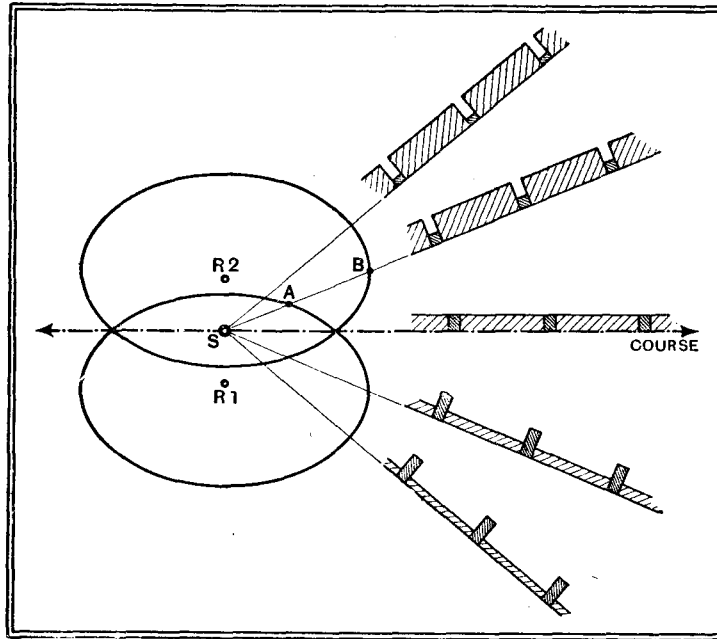


Fig. 3.—The "on-course" signal is formed of interlocking dots and dashes of equal strength.

now turn to Fig. 5, which shows how the field is distributed in a vertical plane through the equisignal line. The curves of Fig. 5 are contours of equal field strength, and if all the conditions remained constant it would be possible (in theory at least) to provide the pilot with apparatus for the absolute determination of field strength, and for him to select thereby a certain number of millivolts per metre, known to correspond with the best landing path. In practice it is not possible to proceed by way of absolute field strength measurements, for over any long period the sensitivity of the aeroplane receiver is subject to large variations. It is comparatively easy to maintain steady

the signal he hears in his headphones. These deviations are also made visible to him by means of a vertical pointer actuated by the receiver and mounted on the dashboard in front of him (See Fig. 4). Some approximate indication of the distance of the aeroplane from the main landing beacon can be derived from estimates or rough measurements of signal strength. But experience has shown the necessity for accurate localisation of the machine's position at two strategic points in its advance. The first is the point at which the pilot should begin his final descent (or with reference to which he may estimate this point). The second comes just before the aerodrome is reached, when the pilot will often be able to complete the landing without further aid from his instruments.

The necessary warning signals are given by auxiliary transmitters of very low power. In the Lorenz system they are both operated on ICW on a wavelength of 7.9 metres, and they are keyed automatically, the one farthest from the aerodrome with 1,700 cycle dashes, and the second, or inner one, with 700 cycle dots. The transmitters are contained in boxes about eighteen inches square and are crystal-controlled. They are put in operation from the aerodrome

conditions while the actual landing is being made, however, so, instead of waiting till he reaches a particular line of constant field strength, the pilot, on nearing the aerodrome, descends to a height of

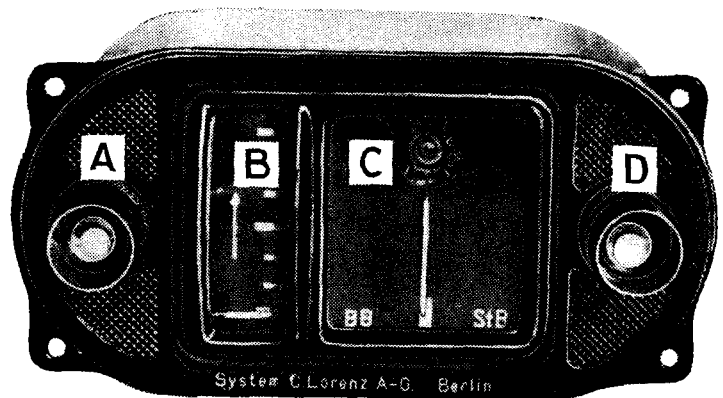


Fig. 4.—A, Neon lamp (first marker beacon signal); B, indicator for approximate distance and vertical landing path; C, on-and-off course indicator; D, Neon lamp (second marker beacon signal).

conditions while the actual landing is being made, however, so, instead of waiting till he reaches a particular line of constant field strength, the pilot, on nearing the aerodrome, descends to a height of

**The Lorenz Blind Landing System—**

about 600 feet, as measured by his altimeter, and awaits the signal from the first marker beacon (Fig. 6). This is given him in two ways—visibly, by the flashing of a neon lamp on his dashboard instrument, and audibly, by the modulation tone of 1,700 cycles per second in his headphones, superposed on the signals from the main beacon. Receiving this warn-

the earth. Thus, at a height of 3,000 feet the range of the beacon is about 40 miles, but at 1,000 feet it is only about 15 miles. This, except in hilly country, is a suffi-

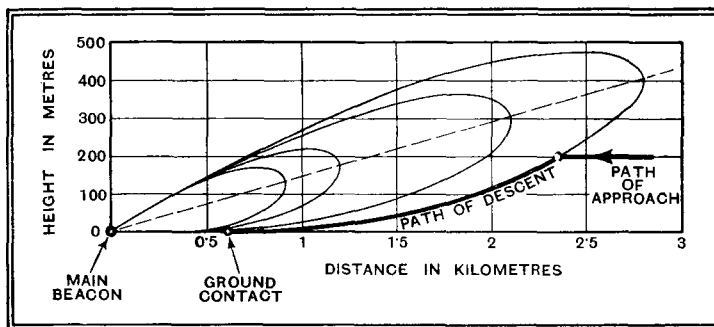


Fig. 5.—(Above) Vertical radiation pattern from an elevated dipole.

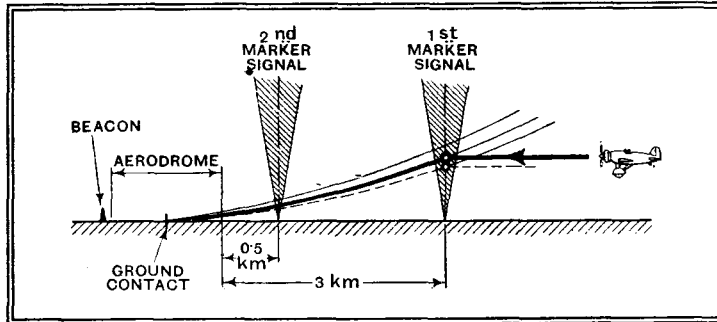


Fig. 6.—(Left) Near ground level the contours converge.

ing the pilot glances at a signal strength indicator on the left of his dashboard instrument (Fig. 4) and notes the horizontal graduation mark against which the pointer rests. At the same time he closes the throttle and begins to glide down, keeping the pointer as nearly as possible on the same horizontal mark by the use of his throttle and elevator controls. The altimeter and the marker beacon have given him the co-ordinates of one point on that curve of constant field strength, which, whatever its absolute value, is the best one to pursue at that moment (Fig. 6). So he follows it as closely as he can, and a few seconds later hears the 700 cycle tone of the second marker beacon, which also causes the second neon tube to flash. Unless the visibility is almost zero, he is now low enough over the aerodrome to see the ground, but a completely blind landing can perhaps be made if necessary.

**Details of Transmitters and Aeroplane Receivers**

In using the method described it is evident that an error in the altimeter reading will cause the pilot to follow some other contour line than that shown in Fig. 6. These all converge as they near the ground, however, so that the effect of the error is very slight.

A point of considerable importance concerns the interference range of the beacon. As is well known, the range of ultra-short waves near the ground is limited by the curvature of

the earth. Thus, at a height of 3,000 feet the range of the beacon is about 40 miles, but at 1,000 feet it is only about 15 miles. This, except in hilly country, is a suffi-

cient height and distance from which to begin the approach, so that it should be possible to repeat the wavelength of 9 metres at many aerodromes, without mutual interference below 1,000 feet. At greater altitudes, on the other hand, the interference would be severe, and the use of a common wavelength is therefore possible only if independent DF methods are available by which the pilot can first find his way to within the service area of the chosen beacon.

The transmitter is shown in Fig. 7. It is crystal-controlled, with five stages of amplification, modulated about 90 per cent. in the third stage. The input power from the mains is about 4 kW., metal rec-

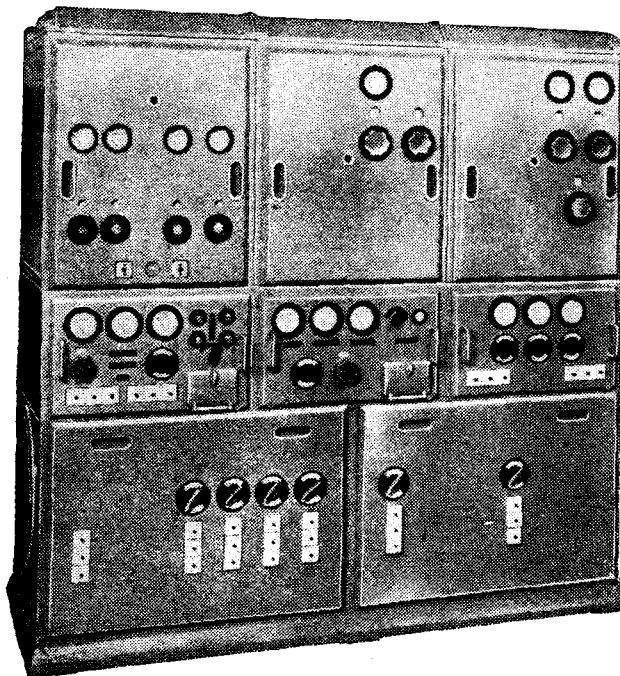


Fig. 7.—Remote-controlled 500-watt main beacon transmitter.

tifiers being accommodated in the base of the transmitter bay. The centre bay contains the measuring instruments, remote control relays, and the equipment for keying. The transmitter itself occupies the upper bay, and the whole equipment measures 7ft. square by 2ft. in depth. In an English translation the makers state that the transmitter operates "without multiplication" with a frequency stability of 1 kilocycle for temperature variations between 20 deg. C and 35 deg. C. If by this it is meant that frequency doubling has been avoided, the combination of these two qualities in a quartz crystal seems to point toward the use of the new "AT" cut described last year in a communication from the Bell Telephone Laboratories.<sup>1</sup>

Monitoring and control equipment (Fig. 8) is centralised at the airport. Here

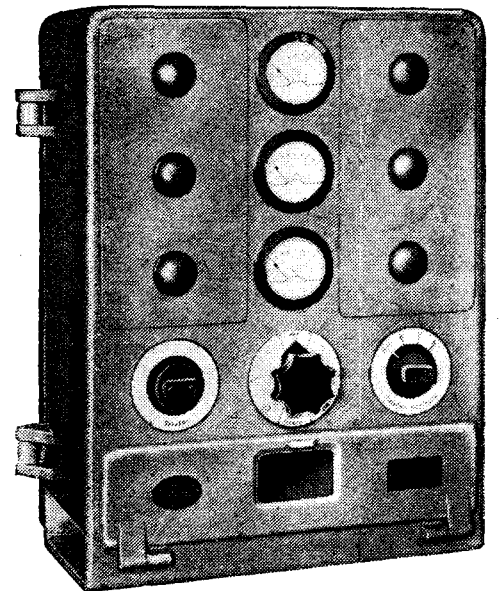


Fig. 8.—Airport monitor and control panel.

audible and visible signals are given if the main or marker beacons fail to operate, while for airports which can be approached from opposite directions two alternative marker beacons can be provided and controlled by switchgear, the keying of the main beacon also being made reversible. Due to the position of the beacon on one side of the aerodrome, the vertical landing path can only be followed from one direction, but the correct horizontal direction of approach from either side can be given. The receiving apparatus for the aeroplane is shown grouped in Fig. 9 and diagrammatically in Fig. 10. The signals from the main beacon (9 metres, modulated 1,150 cycles per second) are received on a vertical rod antenna about 2ft. 4in. long and are passed through HF and detector stages.

They then combine with the output from a separate detector, connected to a horizontal dipole for the reception of the signals from the two marker beacons (7.9 metres, modulated 1,700 and 700 cycles per second respectively). Two stages of low-frequency amplification

<sup>1</sup> "Some Improvements in Quartz Crystal Circuit Elements," *Bell System Technical Journal*, July, 1934.

**The Lorenz Blind Landing System—**

follow, and here headphones are connected so that each of the signals can be heard. (Fig. 11 shows the distinctive character of each signal.) For purposes of visual indication the various audio-frequencies are

and Munich, and in one form or another seems destined to become standardised in Europe. Medium waves are being used for approach beacons in Holland, but it is anticipated that the British Air Ministry, faced with acute wavelength congestion, will soon declare for the ultra-high frequencies, and that other countries will follow suit.

The next step should be to develop directional receiving apparatus for use on aircraft on these wavelengths, for the coming short-wave television transmitters will constitute a valuable network of high-power beacons for general air navigation purposes, and

the time is drawing near when we shall no longer be able to deal with individual requests from aircraft for bearings or positions.

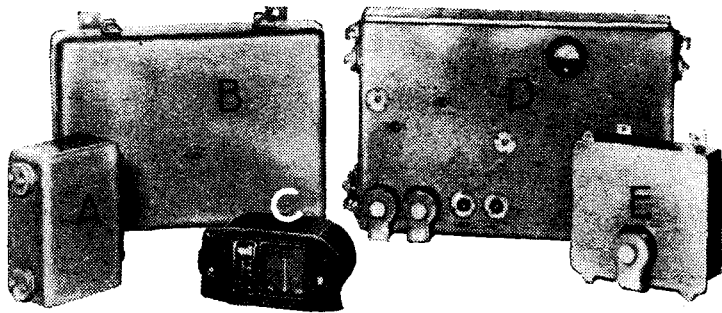


Fig. 9.—A, separate detector for 7.9 m. marker signals; B, battery box; C, flight panel instrument; D, H.F. stage and detector for signals from main beacon. Common L.F. stage for signals from main and marker beacons. E, filters for separation of audio-frequency signals.

now separated by a filter system. As shown in Fig. 10, the instruments for approximate distance and landing path indication and for on- or off-course indication, respond only to the main beacon frequency of 1,150 cycles per second. Neon lamps each respond to one of the marker beacon frequencies and glow intermittently with the appropriate keying rhythm.

The whole of the equipment (with the exception of the flight panel instrument) can be stowed away in any part of the aeroplane. The consumption is about 15 mA. at 150 volts HT and 0.7 amps. for filament current, which is taken from the usual aeroplane battery.

The above system has already been installed abroad at Berlin, Zurich, Hanover,

It is understood that arrangements are under discussion for the manufacture and sale of the Lorenz beacon equipment in this country.

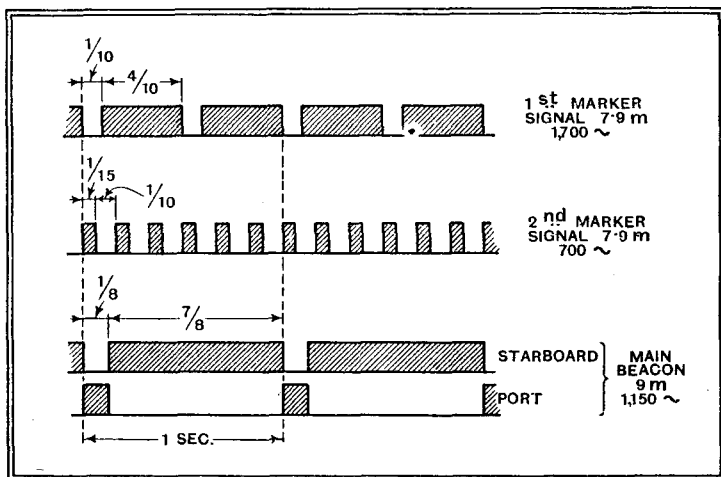


Fig. 11.—Distinctive modulation frequencies and keying speeds are assigned for each signal.

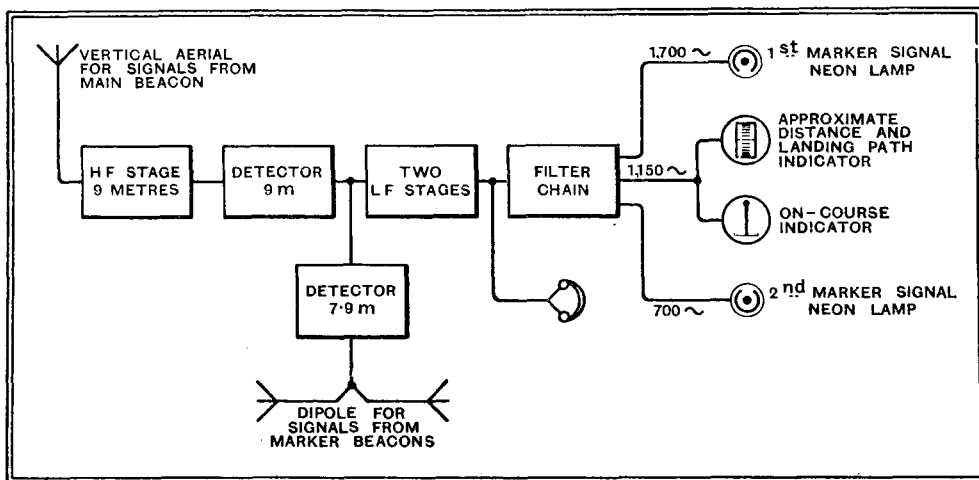


Fig. 10.—The main and marker beacon signals are first combined for aural reception and then filtered out to separate visual indicators.

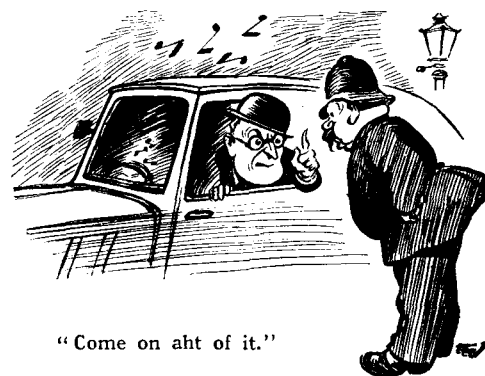
# UNBIASED

By FREE GRID

## Liberty of the Subject

THINGS are coming to a pretty pass in this once glorious country when confidence men and thugs go free while ordinary honest citizens like myself are molested and interfered with by the police.

I was recently taking a stroll through the West End of London in the small hours of the morning in order to get a breath of fresh air after a strenuous day in the laboratory. In my hurry to get out into the open I did not bother to don appropriate dress but sallied forth in my laboratory gear.

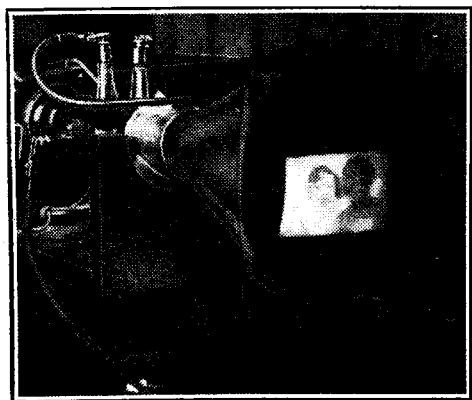


Suddenly I recollected an important experimental broadcast which was to be given by the B.B.C. for the benefit of the Nottingham transport depot. Glancing at my watch I saw that, even if I raced home at top speed, I should not be in time for the concert, so it occurred to me to knock up one of the residents of Fashionable Square with a request to be allowed to use the wireless set. And then a brilliant idea struck me. All round were serried ranks of parked cars, the owners of which were evidently deporting themselves in one of the numerous night clubs which infest these parts.

I was not long in locating a car fitted with radio. Slipping inside I soon had the programme tuned in and was at once carried away by the lilt of a Viennese waltz. Almost immediately an enquiring constabulary head was thrust in the window with a coarse command to "Come on aht of it." I raised my hand to enjoin silence but was roughly bundled out on to the pavement and marched off to the station, where the sergeant-in-charge, after listening in stony silence to my explanation, advised me in an exceedingly unmannerly way to "Try and think of a better one to tell his nibs in the morning."

Although my explanation was accepted next morning I could not help feeling that I had, to say the least of it, suffered loss of dignity. Incidentally, while the constable was engaged in his altercation with me in the car a successful burglary was, I found out later, perpetrated in the vicinity.

## More About



A small television image shown on a large tube: part of the screen has been unmasked.

**L**AST week I explained how to put together an excellent mechanical model for demonstrating the principles of the cathode-ray tube. Examples of the use of the tube had to be left over until now; but it will be easier to understand why it is used, in preference to any other contrivance, if its unique features are first pointed out.

We already know that the spot of light thrown on the screen is shifted a distance proportional to the voltage applied between a pair of plates situated near the nozzle, or—to use the correct term, which is more in accord with the velocity of the ray—the “gun.” Therefore, by first noting the distance for a known voltage, it is possible to measure any unknown voltage within the limits of the screen. So far it is on all fours with an ordinary voltmeter. But whereas an ordinary voltmeter is quite incapable of measuring even slow alternating or fluctuating voltages, except as a sort of average, the cathode ray is so nimble that it can be made to follow every detail of a wave of voltage that is all over in a hundred-millionth part of a second. I have seen photographs of oscillations as rapid as this.

Another fault of the ordinary voltmeter is that, to a greater or lesser extent, it affects the circuit to which it is connected, and this rules it out from most of the really interesting duties, notably in radio circuits.

### The Greatest Advantage

But the most fascinating possibilities of all are presented by the two dimensions in which the spot of light can move. A rapidly alternating voltage applied to one pair of plates would merely draw the spot out into a straight line, which would show the maximum voltage reached in each direction, but nothing else. If a suitable alternating voltage is applied to the second pair of plates, at right angles to the first, the line is opened out into a wave picture. So the tube shows not only the *amount* of the voltage wave, but its form, too.

By connecting up to a loud speaker one can see the wave-forms of the programme being received.

# Cathode Rays

## Wave-forms Made Visible

By “CATHODE RAY”

*A*N article in last week's issue explained the action of the cathode ray tube by a simple analogy. The author now proceeds to describe some of the most valuable properties of the tube.

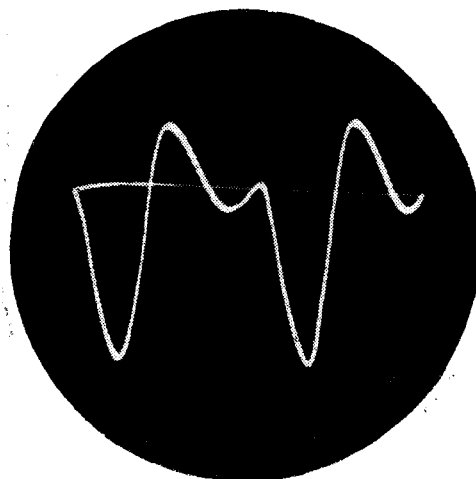
There is no end to the ways of juggling with the two pairs of plates. Incidentally, if it is more convenient to work with currents instead of voltage, it can be done by substituting coils for the plates.

The two dimensions at right angles immediately suggest a graph; and, instead of laboriously taking a number of readings of two quantities and plotting the points on a sheet of paper and joining them up into

rather like the old petrol-electric bus, in which the petrol engine was used, not to drive the vehicle direct, but to generate electricity for driving an electric motor, so that advantage could be taken of the better qualities of electric control and transmission.

There are endless uses for cathode rays in shedding light (literally!) on laboratory problems; but even before the war Campbell Swinton, one of the early contributors to *The Wireless World*, had realised that an obvious application for such a wonderfully controllable form of light is television. His ideas about this are amply justified to-day, for many television experts now believe that cathode-ray tubes will eventually find a place in every home—by easy payments!

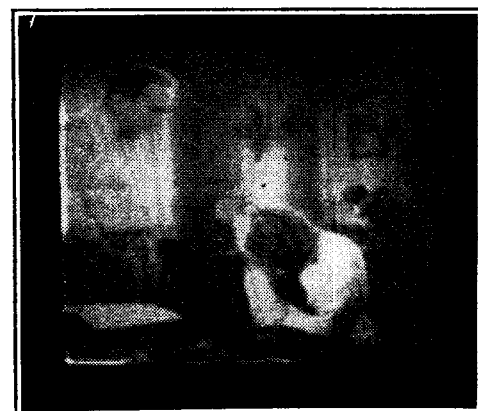
It is conceivable how even our children in the conservatory (see last week) might, if provided with a stop-cock and a good deal more skill and co-ordination than is probable, succeed in producing a crude sort of moving image on the dome. And without going into any of the complicated details, it does not require a vast deal of imagination to see how a cathode-ray tube, with so much greater speed and obedience, can be used to distribute light on to its screen so as to give a picture. There is no great difficulty about that. Some of us have seen excellent cathode-ray television. The real problem is one of distribution of programmes to “lookers-in.”



Wave-form investigation: illustrating the introduction of second-harmonic distortion due to over-biasing an amplifying valve.

a curve, one can connect up a cathode-ray tube, and, by arranging to keep on repeating the test continuously, the spot of light retraces its path so rapidly that the eye sees the curve on the screen; and the shape of it responds to every adjustment of the circuit. If you have ever tried to “line up” a band-pass tuner, in a superhet or elsewhere, you realise how delightful it would be to see the resonance curve of the set thrown on a screen, so that you could adjust the trimmers and couplings until it was right. That can easily be done with cathode-ray equipment.

Do not imagine that, because the cathode-ray method responds to voltages or currents, it is limited to electrical problems. It is so valuable for showing up what is happening rapidly that it is sometimes found well worth while to transform mechanical quantities into electrical ones, so as to be able to use the cathode ray in studying mechanical problems. It is



Reproduction of an untouched photograph of a television image appearing on the screen of a cathode ray tube.

# CURRENT TOPICS

## Events of the Week in Brief Review

### French Regional Scheme

THREE of the new French stations are to start operations at the end of this month, namely: Murat-Toulouse (120 kilowatts); Lyons (90 kilowatts), and Lille (60 kilowatts). The entire Regional scheme is expected to be complete by the beginning of July.

### Car Radio Test

A NOVEL car radio competition will be a feature of the Paris-Nice International Car Rally between April 13th and 18th. The test will be the accurate reception of several sets of figures broadcast by a local transmitter. It is to be hoped that competitors will not attempt such a complex receiving feat while on the move.

### Radio and Riches

NEARLY half the world's wireless sets are in the United States, according to an estimate of the U.S. Department of Commerce, where the theory is being discussed that the prosperity of a country may be judged by the number of its "radios." The total number of sets in the world is put at 53,500,000, with 25,500,000 in America.

### Holland's Highest

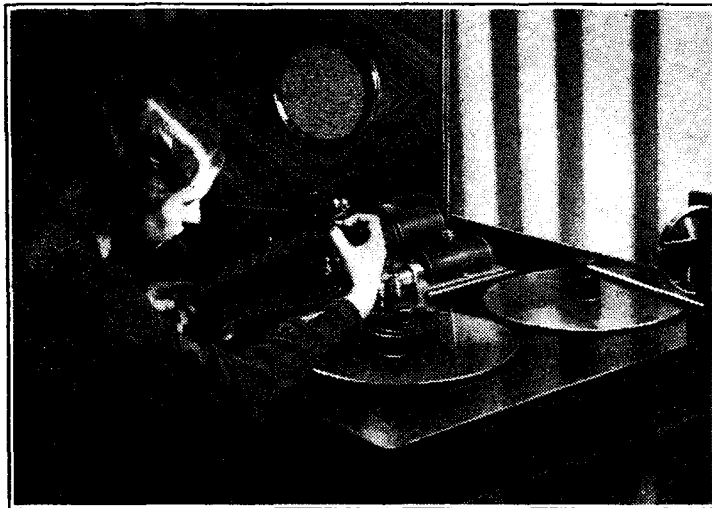
WHY is Holland's most famous station situated at Hilversum? The broadcasting authorities there have at last revealed the reason to a well-known French artiste who asked why a spot should have been chosen which was a long way from Amsterdam and not within easy reach of the capital. Hilversum, it seems, is the highest point in Holland, the base of the mast being at the dizzy altitude of 164 feet.

### Where Ceylon Scores

FOR over a year Ceylon has picked up the B.B.C. Empire programmes on a special receiver, relaying them via the Colombo medium-wave station. "Given reasonably good atmospheric conditions," writes a correspondent, "these relays are excellent. . . . No such arrangements have been installed in India, however, and the Bombay transmitter has to do its best with old receiving equipment and without anti-fading devices."

### "B.B.C." for South Africa

SOUTH AFRICA has decided to adopt Sir John Reith's recommendation for a public Corporation to take over the present African Broadcasting Company. The new Corporation will be created by statute and



PROGRAMMES FOR TELEVISION. Regular transmissions of high-definition television are now made from the Berlin Broadcasting House, the programmes being changed once a week. The photograph shows the film-cutting table.

will not be under the control of the Government.

### Television in France

GLOWING tales of the nearness of television have deceived the French public in much the same way as their British neighbours, and a falling off is recorded in the sale of broadcast receivers. The Paris Radio Manufacturers' Association has now issued a statement pointing out that the existing type of receiver will always be necessary, and adding: "At present there is nothing to suggest the sale of television apparatus at popular prices.

### Speech Speed at the Microphone

TESTS at the Warsaw microphone have convinced the authorities that the ideal rate of broadcast speech is 120 words per minute. This rule may be adhered to in Poland; it is certainly not the case in France, where the announcers appear to manage 200 words per minute with ease. The Germans are not fast speakers at the microphone, but the slowest appear to be the preachers at the Dutch religious services.

### Bones and Bores

THE charge that radio is responsible for 25 per cent. of domestic unhappiness should be invalidated by "bone-oscillator" attachments which are being advocated by Dr. O. H. Caldwell, director of the new American League for Noise Abatement. Hitherto, Ossiphones and similar devices have been intended for the use of the deaf, but Dr. Caldwell considers that they should be generally used to avoid imposing hardship

outside assistant without the knowledge of a caller.

"The bone-oscillator," says Dr. Caldwell, "is useful in another way when a boring visitor calls. By holding a pencil or pen thoughtfully against my teeth and also in contact with the oscillator hidden in my hand, I can listen to sweet music from a silent radio set while simulating polite attention to the bore's remarks."

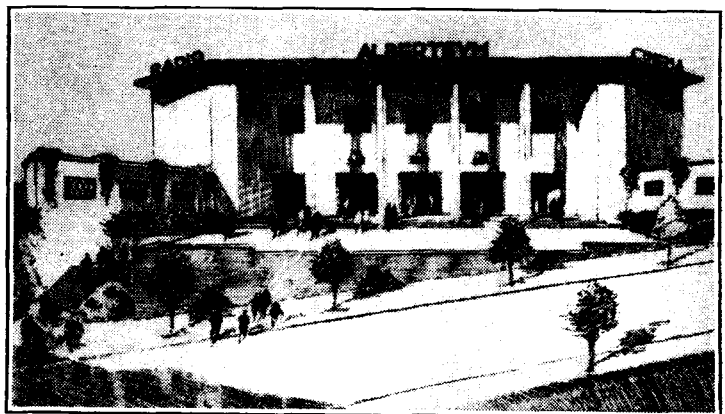
### Swiss Licence Drop

SWISS licence figures dropped slightly during February, the figure on March 1st being 363,814, as compared with 366,286 a month earlier. Approximately 24,000 Swiss listeners receive their programmes over the telephone lines and 17,000 subscribe to private relay exchanges.

### Calm After U.S. Radio Storm

A STORM of criticism from Congress has led to sweeping changes in the organisation of the American Federal Communications Commission, which exercises complete control over all radio services, commercial and broadcasting. It has been alleged that the broadcasting regulations have been loosely interpreted and that politics have played a large part in the handling of applications for broadcasting facilities. The new chief of the "F.C.C." is Anning S. Prall, while Judge E. O. Sykes becomes chairman of the Broadcast Division.

Mr. Prall has stated that his first task will be to remove the stigma of a "political agency" from the F.C.C. and place it on a plane with such respected governmental agencies as the Interstate Communications Commission and the Federal Trade Commission.



AT THE BRUSSELS INTERNATIONAL EXHIBITION a Palace devoted to Radio and Films will be an important feature. Here is an architect's drawing of the building, known as the "Alberteum."