THE AUSTRALASIAN

Radio World

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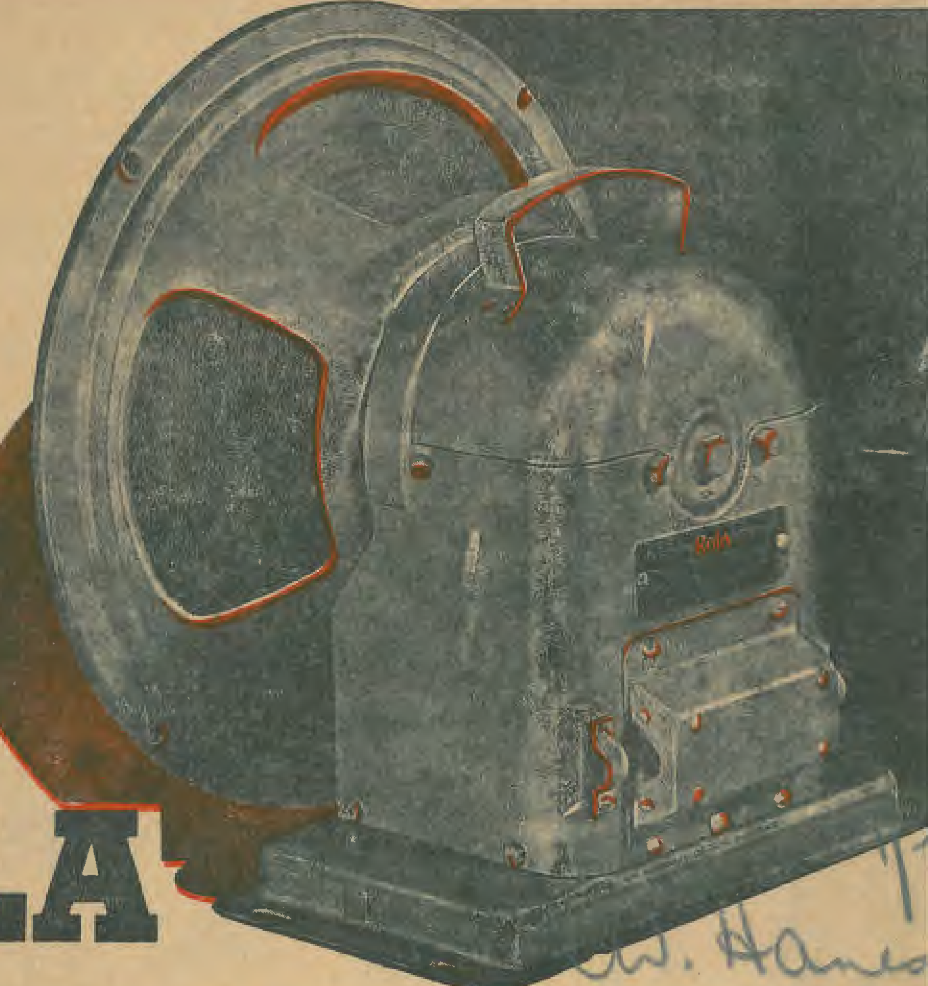


THE AUSTRALASIAN RADIO WORLD

Devoted entirely to Technical Radio

and incorporating

ALL-WAVE ALL-WORLD DX NEWS

Vol. 10. **JUNE, 1945** **No. 1**

CONTENTS

EDITORIAL

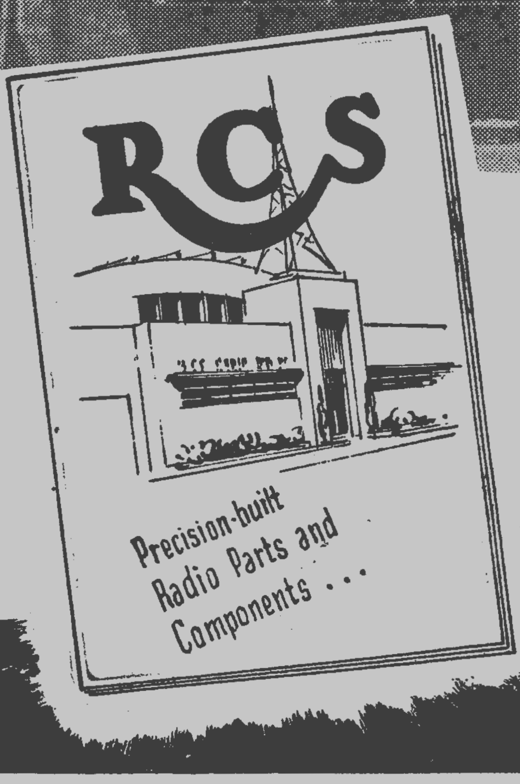
Of tremendous interest to all radiomen and to the radio trade as a whole are the announcements from both England and America that the use of the walkie-talkie in peacetime is to receive official encouragement.

Elsewhere in this issue we give details of the American plan, which sets out to encourage manufacturers to market cheap transmitterreceivers for civilian use. Applications of walkie-talkie will become accepted as just another modern convenience. The wavelengths allotted for use with walkie-talkie may appear startling to those who have not been in close touch with recent radio development. The use of wavelengths below one metre calls for special technique, but there is nothing to be afraid about and we look forward to that not too far distant day (we hope) when we will be running constructional articles telling you how to build and operate your own transmitter for use on this band.

It is expected that some sort of licence will be required. but no qualification tests, such as a theory examination or a speed test in morse code as was, and probably will be, required for the licence to operate an experimental transmitter working on the longer wavelengths. It should be clearly understood that there is no question of the walkie-talkie licence replacing the amateur experimental licence, and, if everything turns out as we have every reason to hope, the two classes of transmitting licences will be complementary to each other, co-operating to create even greater interest in technical radio than ever before. The prospects are exceedingly rosy.

READY FOR TO-MORROWS' RADIO!

Designed in keeping with the latest trends in factory construction, the new R.C.S. Factory, 174 Canterbury Road, Canterbury, has now commenced production.



In the modern factory illustrated above will continue to be manufactured the complete range of R.C.S. components so long and so favourably known to the radio trade and to amateur constructors.

Every new and improved technique of production has been incorporated in the precision machines installed. Although at present last-minute additions prevent public inspection of the factory, Mr. Ron Bell, Managing Director R.C.S. Pty. Ltd., will later announce the throwing open of the factory to inspection by interested radio people.

In the meantime write for the leaflet shown at left, illustrating the complete range of R.C.S. radio precision components. R.C.S. RADIO PTY. LTD., 174 Canterbury Road, Canterbury.

RADIO LOCATION --- WAR WINNER

FOR security reasons, "Wireless World" has hitherto been unable to publish more than a few lines of the essential facts of RDF, Radiolocation or Radar — the various terms applied to the location of distant objects (more particularly, enemy aircraft) by wireless methods. It is now possible to describe for the first time fundamental principles of the apparatus which, in the competent hands of the R.A.F., provided essential tactical information that enabled our fighter aircraft so decisively to smash the mass daylight attacks of the Luftwaffe during the Battle of Britain.

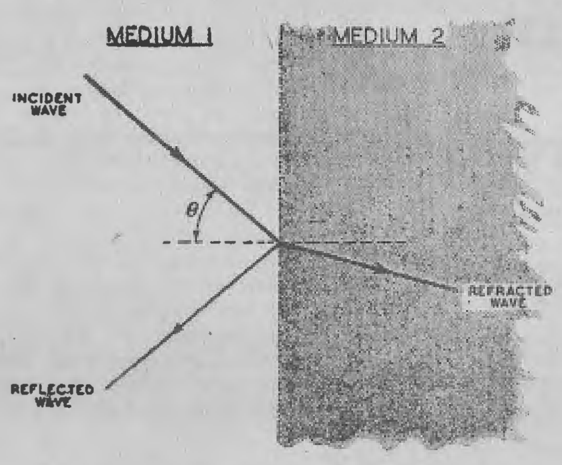


Fig. 1. Illustrating the production of reflected and refracted waves when the incident waves strike the boundary surface of two media (1 and 2) having different electrical properties.

R. L. SMITH-ROSE,
D.Sc., Ph.D., M.I.E.E., F.I.R.E.
(National Physical Laboratory)

(Reprinted from "Wireless World," England)

When England entered the European War in September, 1939, she was already partially equipped with a new technical weapon in the form of a novel application of radio waves to the detection of objects such as aircraft and ships. The technique of this new weapon was then known as RDF, those mysteriious initials, the precise meaning of which was never quite clear even to the original band of workers in this field. At a later stage the term Radiolocation was introduced, and this certainly had the advantage of being almost self-explanatory; but it has now to be admitted with some regret that, in the technical field at any rate, this has been largely eclipsed by the arrival from America of the short word Radar, which we are told means "radio-detecting-and-ranging."

Radiolocation or Radar may be described as the art of using radio waves for the detection and location of an object, fixed or moving, by the aid of the difference of its electrical properties from those of the medium adjacent to or surrounding it. An intrinsic feature of the art is that no co-operation whatsoever is required of the object being detected, and it is in this particular sense that RDF, as it was formerly known, differs from the long-established practice of radio direction-finding. The technique of direction-finding, as known and experimented with for half a century, is really confined to the determination of the direction of a primary source of radio waves, either for intelligence purposes or for use as a navigational aid. In such cases the source of the radio waves may be on the one hand an illicit sending station, the position of which it is required to determine; or on the other hand, the source may be a friendly radio beacon transmitter, for the use of ships or aircraft fitted with direction finders to assist the navigator in determining his own position. A third source of radio waves which are not of man-made origin, is a lightning flash; and for many years past, the positions of such lightning flashes have been determined by using two or more radio direction finders to determine the direction of arrival of the electric waves radiated from each flash. Such measurements have contributed materially to our knowledge of the nature and origin of atmospherics as they are encountered in radio communication, and they have also been applied to the location of storm centres in meteorology.

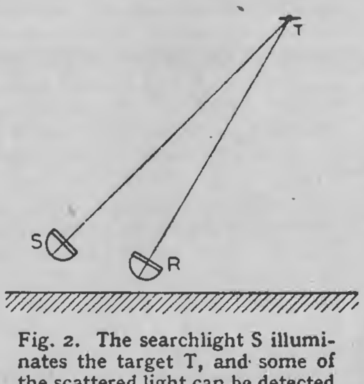


Fig. 2. The searchlight S illuminates the target T, and some of the scattered light can be detected by the observer at R. The direction, both azimuth and elevation, of the target is thus determined, but not its distance or range.

The new art of radiolocation, however, as developed during the past two decades, requires no such co-operation, as it were, on the part of the object under examination; the latter, be it an aeroplane, ship, building or human being, is merely required to reflect or scatter some of the radiation which reaches it from a radio transmitter forming part of the whole Radar installation. The detected object is thus merely a source of secondary radiation which results from its being illuminated, as it were, by the incident radiation from the primary sending station. With this definition of the subject with which we are concerned, we may now proceed to an explanation of the fundamental principles forming the basis of this new application of radio waves.

Reflection and Refraction of Electric Waves

In his classical experiments carried out towards the end of last century, Hertz demonstrated experimentally the salient properties

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RADIOLOCATION

(Continued)

of the newly-produced electromagnetic waves, and showed that these were similar to those of light waves when allowance is made for the difference in wavelength, the former waves being a few million times as long as those of yellow light. Hertz showed that these long electric waves could be reflected from metallic sheets, concentrated into beams by suitably shaped reflectors, and refracted by passage through prisms of insulating material. These phenomena are due to the fact that when electric waves, of whatever length, impinge on the boundary separating two media of different electrical properties, the path of transmission of the waves is altered; some of the wave energy passes across the boundary, but in doing so its path is bent or refracted; another portion of the wave energy is turned back from the boundary, and forms the reflected portion of the waves on the same side as the incident waves (see Fig. 1). The relative magnitudes of the reflected and refracted waves depend upon the electrical properties of the media on the two sides of the boundary, the angle of incidence (o in Fig. 1), and the frequency or wavelength of the waves. If these quantities are known, the reflecting power of the surface of separation of the two media can be calculated; and in many practical cases, this calculation is made easier by the fact that the first medium is air under normal atmospheric conditions, when its electrical conductivity is very small and its dielectric constant is approximately unity. If the second medium is a sheet of copper, of which the conductivity is very high, nearly all the incident energy in the arriving waves will be reflected; this is the result of the re-radiation from the conduction currents set up in the copper sheet by the arriving waves. Alternatively, the same result will be obtained with radio waves if the second medium consists of fresh water; for although in this case the conductivity is low, its permittivity is high and thus strong dielectric currents will be set up, particularly at high radio frequencies. In the case of soil or earth, which has both a moderate conductivity and an intermediate value of permittivity, a portion only of the incident wave energy will be reflected, the remaining energy passing into the medium to form the refracted waves.

From these considerations it is seen that reflection of radio waves is caused at a discontinuity or boundary between two media, and when waves in air strike a surface, which may be either a metallic conductor or an insulating medium, the waves are reflected in some degree by the surface. If this surface is smooth in the sense that it is free from irregularities of a size approaching the wavelength, then the reflection is of the specular type such as we meet with in light waves; and in such cases if the waves impinge normally on the surface, they will be reflected back along the original direction towards the source of the incident waves. If the surface is not sufficiently smooth the reflection will take place in various directions, or the incident waves are scattered, as it is termed; and in this case only a portion of the reflected or scattered energy is returned along the path of the incident waves.

Measurements with Light Waves

It is thus easy to understand how light reflected from solid or liquid media enables us to see the existence of these objects, and Fig. 2 illustrates the manner in which a searchlight enables a target — aircraft or cloud — to be seen by an observer situated at R, who can then determine its bearing and angle of elevation. This is an art which is well known and has been practised for a long time; but it suffers from one serious drawback: this simple combination of a searchlight and an observer does not enable the **distance** of the target to be determined.

In order to make this valuable addition to the observation, it is necessary to interrupt or modulate the beam of light in such a way that the time of transit of the waves between the source and target and then back to the receiver may be determined. This important addition to the technique of visual observation was actually made as long ago as 1849 by Fizeau in his classical experiments to measure the speed with which light waves travel. Fizeau used a mechanical method of measuring the time of transit of an interrupted beam of light over a return path about three or four miles long. At that time, the distance was accurately measured and so was the velocity of the waves determined: but if, as is done nowadays, a knowledge of the wave velocity is assumed, then the length of an unknown path with a reflector at the end of it can be determined.

A possible arrangement of this method of determining the distance of a reflecting object by the aid of light waves is illustrated in principle in Fig. 3. As before, light from a source S is transmitted to a target at T whence some of it is reflected back to a detector or receiver at R. In front of both S and R rotates a disc or wheel W, with an even number of radial apertures in it, so that the beam of light is alternately interrupted and allowed to pass. With the disc stationary the outgoing and incoming beams pass through the corresponding slots at the end of a diameter. As the disc is rotated and its speed gradually increased, some of the light which has passed through a slot A1 in front of S will be cut off, because by the time it has traversed A1TA2 the corresponding slot A2 will have moved round through a small angle. As the rate of rotation of the disc is increased, a speed will be reached at which the returning light will be cut off by the portion of the disc between the slots. As the speed of the disc is further raised the light will again be perceived at R, since while the light is traversing the path A1TA2, the disc will have rotated through an angle equal to that separating adjacent slots. Hence from an observation of the speed of the disc under these conditions, and assuming the velocity of the waves, the distance A1T can be determined. From this type of measurement and the associated observations of the angular directions of the reflector T in both the horizontal and vertical planes, the position of T in three-dimensional space becomes known.

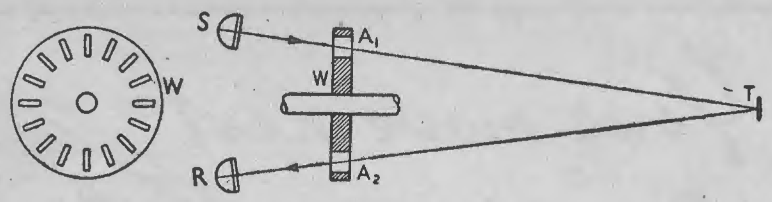

Fig. 3. Adaptation of Fizeau's classical experiment to determine the speed of light. If the speed is known, the distance A_1TA_2 can be measured by the same technique.

This, in essence, is the fundamental principle of radiolocation as it is practised today. The writer is not aware to what extent, if at all, it became practicable to use it with light waves, but in any case, its use in this way would be severely limited to ranges normally detectable by the human eye* under conditions of darkness and the occurrence of clear weather. Furthermore, in typical circumstances, the time intervals to be measured are very small — about 10 microseconds per mile — and the consequent practical problems involved in the rotation of the disc at the required speed are not easily solved. The use of this technique, initiated by physicists in the latter half of the nineteenth century, thus remained limited to determinations of the velocity of light; and the resulting measurements attained a surprisingly high accuracy, notably due to the activities of Professor A. A. Michelson, who worked in this field over a period of some fifty years. In more recent times, the principle of the method was varied by modulating the beams of light at a radio frequency instead of interrupting it by a mechanical method.

The Principles of Modern Radar

The reader is now in a position to appreciate and understand the elementary principles of radiolocation, or Radar, in so far as these are analogous to the experiments with light waves described above, but making use of the longer electric waves in the radio-frequency portion of the spectrum. A complete station consists of a combination of a transmitter and receiver. The transmitting or sending portion emits radiation over a broad arc in the approximate direction it is desired to explore. When this radiation strikes an object having an appreciable conductivity or dielectric constant, some of the energy is reflected or scattered back towards the receiver which is installed moderately close to the transmitter. If the latter emits the radio waves in short trains or pulses, the time of transit of these to the reflecting target and back to the receiver can be measured, by displaying the received signals on the screen of a cathode-ray tube. The arrangement is indicated schematically in Fig. 4, where successive pulses P1P2P3-P4 have been emitted from the sending aerial A1, the first two pulses having already reached the target and been reflected back towards the receiving aerial A2. It is now required to determine the time of transit of any one of the pulses over the path A1TA2.

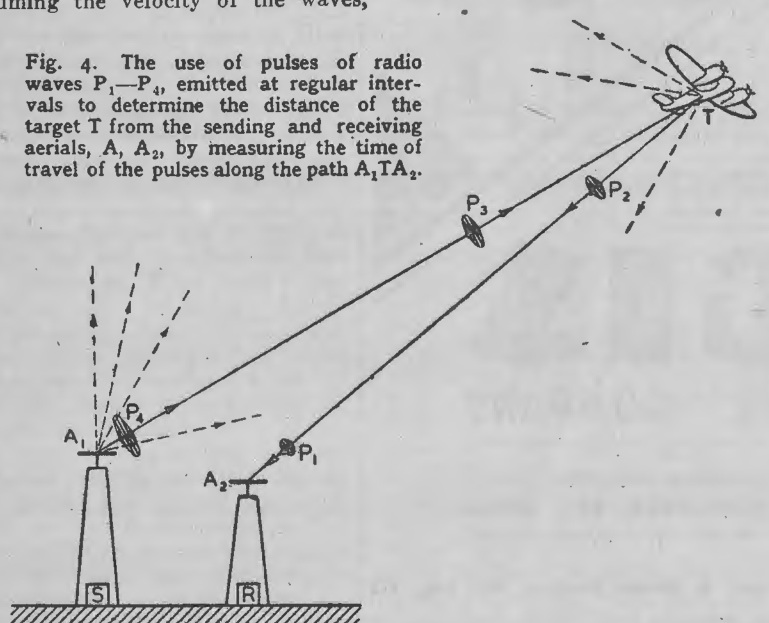

Fig. 4. The use of pulses of radio waves P_1—P_4, emitted at regular intervals to determine the distance of the target T from the sending and receiving aerials, A, A_2, by measuring the time of travel of the pulses along the path A_1TA_2.

The pulses of radio-frequency oscillations arriving at the receiving aerial are suitably amplified and

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RADIOLOCATION

(Continued)

rectified, and then applied to the vertical deflecting plates of a cathode-ray tube. If the horizontal deflecting plates are connected to a suitable time-base circuit operating in synchronism with the pulse generating circuit in the transmitter, then for a fixed distance A1TA2 the received pulses will appear superimposed on one another as vertical deflections from the horizontal time-base. If, furthermore, the time-base is made to start its deflection from the left-hand side of the screen at the same instant as the pulse of radiation leaves the sending aerial, then the distance along the time-base from its origin to the position of the pulse displayed on it is a measure of the length of path A1TA2. The type of picture obtained on the screen of the cathode-ray tube is illustrated in Fig. 5, in which the line OA represents the time-base which is locked to the transmitter in such a way that the length OT1 represents the time taken by an emitted pulse to arrive back at the receiver after reflection from a target T1. As we know that the velocity of radio waves is substantially 186,000 miles per second, the scale of the time-base can be graduated in miles, so that the distance of the target T1 is seen to be about 19 miles. A second received pulse is seen at T2 returned from another target at a range of about 35 miles. If one or both of these targets are moving their changes in position are indicated by the movement of the pulses along the base-line on the screen of the cathode-ray tube towards or away from the point O.

The amplitude of the pulse on the tube is proportional to the strength of the received signal, so that this naturally increases as the target from which the echo is returned approaches the receiver. When other conditions remain the same, the amplitude of the echo is also a measure to some extent of the reflecting target, for example, its size; and an experienced observer may be able to guess the nature of the target from the echo pulse seen on the tube screen.

This measurement of the distance of the reflecting body responsible for the echo signals must be supplemented by a determination of the direction of arrival of the waves in both the horizontal and vertical planes, before the actual position of the reflector in space is completely known. These measurements can be made by well-established methods for observing the bearing or azimuth (o in Fig. 6) and the angle of elevation above the horizontal (O, Fig. 6). The first observation can be made by rotating the receiving aerial, which may at certain wavelengths be a horizontal dipole, about a vertical axis until the amplitude of the corresponding pulses decreases to zero; it is then known that the bearing is in line with the direction of the dipole. Alternatively, a pair of fixed aerials at right angles to one another can be used, connected to the field coils of a radio goniometer in the usual manner of a direction finder. Rotation of the search coil to the signal minimum position again enables the bearing to be determined.

The angle of elevation of the arriving waves can be measured by comparing the amplitudes of the voltages induced in two similar aerials mounted one above the other at a known distance apart, depending upon the wavelength in use and the range of angles of elevation it is desired to cover. This technique has been used for many years past by several investigators for measuring the angle of arrival of radio waves over long-distance communication paths, and it is directly applicable to the problem now under discussion. If the reflecting object being observed is an aircraft, then a knowledge of the range R and elevation O (Fig. 6) enables the altitude at which the craft is flying to be determined. If the object of interest is a ship, then the angle of elevation is negligible, and the range and bearing determine its position.

The above considerations all apply to the use of wavelengths of the order of, say, 5 to 50 metres, for which the dimensions of the aerials are such as to make it impracticable to obtain very concentrated beams of radiation by the use of local reflectors. If, however, much shorter wavelengths are used, then it becomes possible to arrange what is in effect, a radio searchlight, but with the addition of the facility for determining distance. This type of equipment was used, for example, in 1931 in the radio telephony system which was set up for operation across the Straits of Dover between England and France, using a wavelength of 18 cm., and parabolic reflectors about 10 ftt. in diameter. A combination of transmitter and reflector constructed on these lines, and moved together in both vertical and horizontal planes, is analagous to the searchlight and observer depicted in Fig. 2. When this type of radiolocation set is trained on the target to give the maximum deflection of the received pulse, the azimuth and elevation can be read off the horizontal and vertical scales respectively, while the range of the target is observed from the position of the pulse along the time-base on the screen of the cathode-ray tube.

This is the principle of the modern radiolocation set, in the development and exploitation of which so much technical and operational effort has been devoted in the past five years or so. The story of its success, and the technical details of its development must await description for the time being; but there is no doubt that the early establishment and use of Radar stations has contributed very materially to both our defensive and offensive operations at various stages of the present war.

*Modern photoelectric cell technique could be used with advantage at the present time.

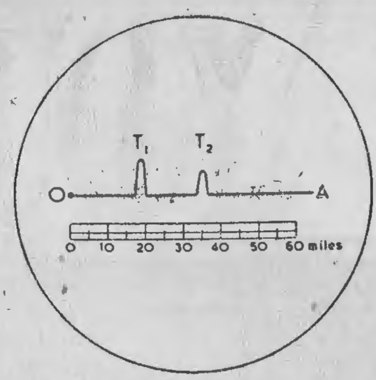


Fig. 5. Type of echo display seen on screen of cathode-ray tube. The fluorescent spot sweeps along the time base OA in synchronism with the transmitted pulses. The received echoes from two targets are seen at a distance from O corresponding to the time taken for the pulses to travel to and from the targets T_1 and T_2. The time-base can be provided with a range scale as shown.

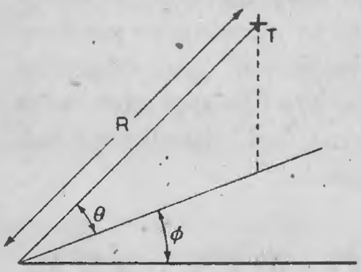


Fig. 6. The position of the target is defined by its range R, angle of elevation θ, and bearing or azimuth ϕ.

ELECTRONIC MARVELS!

Ex-Governor Charles Edison, of New Jersey, has his father's love of a joke. The inventor's distinguished son is an M.I.T. graduate and knows his way around in electrical and electronic matters, as might be surmised. Recently, after listening to an amateur electronics enthusiast become eloquent about post-war electronic marvels, Gov. Edison asked whether the spellbinder had yet witnessed a demonstration of "the electromagnetic ray that can stop an automobile." "No, I've heard about such a ray," replied the electronic prophet, "but I didn't know it was yet practical." "Well, jump into my car and come down to our laboratory and I'll show you."

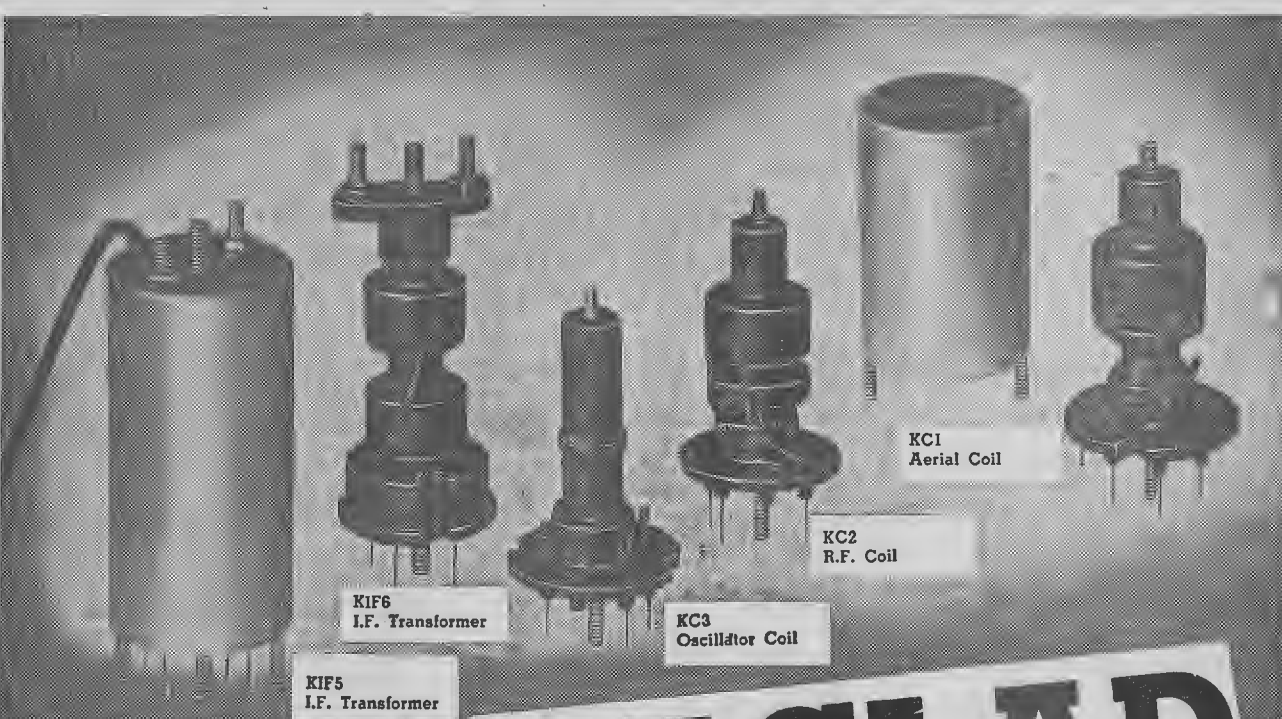
As the car approached the main street of Orange, N.J., the traffic signal turned red, and the Governor's chauffeur put on the brakes, bringing the car to a grinding stop. Pointing through the windshield at the red traffic light, Gov. Edison chuckled: "See, just as I told you; there's the ray that stops automobiles—and it is thoroughly practical, too!"—From "Electronic Industries," New York.

RAILWAY RADIO IN U.S.A.

It is reported that one of the chief railways in the United States, the Kansas City Southern, is installing radio equipment over 560 miles of its main line operating in the western parts of America. In addition to radio, induction telephony will also be employed, utilising carrier current wires along the track. The system is intended to provide end-to-end communication on trains, as well as between stations and trains en route.

YOU

Mr. DEALER "COME A GOOD SECOND"



PERMACLAD

STILL HAS AN IMPORTANT WAR JOB!

Happy the day when all our energies can be devoted to fulfilling dealer requirements. Right now, of course, our Defence commitments come first, as they have done since 1938. We are straining every nerve to accelerate production of "Permaclad" components, however, and essential civilian replacement requirements are being met with increasing success. Your local "Permaclad" distributor can help you. See him, "he means business!"

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WALKIE-TALKIES IN PEACE

Interesting American Plan

OUTSIDE of the amateur allocations, the most interesting feature to us in the Federal Communication Commissions report on its proposed postwar allocations above 25 Mc. was its announcement of its intention to create a new Citizens Radiocommunication Service for the use of the general public under minimum licensing requirements.

Here is the Commission's own language from its report, which tells the tale very well indeed:

"The development of light-weight portable short-range radiocommunications equipment of the 'walkie-talkie' type has opened the door to a large variety of new private applications of radio. The success of such communications on the battlefront has been followed by many suggestions for peacetime use of low-power portable transceivers in the cities, on the highways, and in rural arears. To make possible the fullest practicable development of private radiocommunications within the limits set by other demands for assignments in the spectrum, the Commission on its own motion proposes to allocate the band from 460 to 470 Mc. to a new 'Citizens Radiocommunication Service.'

"The possible uses of this service are as broad as the imagination of the public and the ingenuity of equipment manufacturers can devise. The citizens radiocommunications band can be used, for example, to establish a physicians' calling service, through which a central physicians' exchange in each city can reach doctors while they are en route in their cars or otherwise not available by telephone. Department stores, dairies, laundries and other business organisations can use this service in communicating to and from their delivery vehicles. Similarly, it can be used in communicating to and from the trucks, tractors, and other mobile units operating in and around large industrial plants and construction pro jects—many of which spread over a number of square miles. It can be used on farms and ranches for communications to and from men in the fields; on board harbour and river craft; in mountain and swamp areas, etc. Sportsmen and explorers can use it to maintain contact with camps and to decrease the hazards of hunting, fishing, boating, and mountain climbing. Citizens generally will benefit from the convenience of this service by utilising two-way portable radio equipment for short-range private service between points where regular communication facilities are not available. During emergencies when wire facilities are disrupted as a result of hurricane, flood, earthquake, or other disaster, the service, as has been demonstrated by the amateur service, will be of inestimable value.

"Separate allocations are being made for urban and for rural transit radio communications, which will be available for communicating with city or intercity buses, trucks, taxicabs, etc. These services may develop on a common carrier or private basis on the frequencies set aside for those purposes. In either event, the citizens radiocommunication band will be open to taxicabs, delivery vehicles, or other mobile units, as well as for incidental communication between fixed points.

"Common carrier operation in the Citizens Radiocommunication band will not be permitted, and no charge can be made for the transmission of messages or use of the licensed facilities. The service will thus be for the private use of the licensee who will be responsible for the use of the facilities under the regulations to be promulgated by the Commission.

"The 460-470-Mc. band which the Commission proposes to allocate for this service is essentially adapted to short-range communications, and as such, is admirably suited to the uses proposed. The rules will permit the use of 'booster' or automatic relay installations where necessary. It is anticipated that most transmitters on this band will be of low power and will not utilise extreme antenna heights. Higher power may be permitted in rural areas where no interference will result.

"The design of equipment for use in the citizens radiocommunication band should challenge the ingenuity of radio designers and engineers. A combination transmitter and receiver of reasonable weight can no doubt be mounted in a suitcase; a broadcast receiver, an alarm system, remote control systems, and other devices can perhaps be added to meet particular needs. By keeping the rules and regulations to a minimum, the Commission hopes to encourage ingenuity in design and in utilisation.

"As in the case of the amateur service, the Commission proposes to assign no channels within the band. It is reasonable to suppose that most equipment will utilise a channel of 150 kc. more or less, making possible some 60 or 70 channels; but, as in the amateur band, these matters will not be determined by rule or regulation. It should be possible by the use of comparatively simple circuits already known to provide both transmitters and receivers tunable over all or most of the 460-470-Mc. range and emitting signals sharp enough to minimise interference.

"The bands both above and below 460-470-Mc. are assigned to other services; but the allocation is such that if the utility and requirements of citizens radiocommunications warrant, the band can at some future time be expanded. Alternatively, if a demand for assignments in this band does not arise, the band can be reassigned to another service at a later date.

"The essence of this new service is that it will be widely available.

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PRIVATE RADIO

So far we have not heard of any Australian plans for the post-war use of the walkie-talkie, but in both America and England it is evident that official encouragement will be given to the development of this modern convenience.

WALKIE-TALKIES
(Continued)

Accordingly, only the minimum requirements of the Communications Act, plus a few minimum traffic rules, will be set up. Operator licences will be granted only to citizens of the United States. To procure such a licence, an applicant need only show familiarity with the relevant portions of the Communications Act and of the simple regulations governing this service. No technical knowledge will be required. It is hoped that the licence can be in the form of a small card, with the operator's licence on one side and the station licence on the other, and that these will remain in force for five years with simple renewal provisions. Station licences will be limited to point-to-point, fixed point-to-mobile, mobile-to-mobile, and multiple-address communications; broadcasting is not contemplated.

"A concomitant of the widest possible availability is that particular licencees are not accorded protection from interference. A licence in this service does not guarantee the right to a channel; it affords rather an opportunity to share with others the use of a band. The success of this arrangement in the amateur bands gives every reason to believe that it will be equally successful in the citizens radiocommunications band. In the event that intolerable abuses arise, the Commission will of course take steps to eliminate them. The 10,000 kc. width of the band will no doubt be sufficient, however, to make possible simultaneous and efficient use of the limited-range service for many purposes, with serious interference limited to few if any parts of the country.

"In any areas where serious interference is experienced, it is the expectation of the Commission that various users of the band in a particular community will jointly seek, perhaps through local organisations similar to the American Radio Relay League in the amateur field, co-operatively to solve local problems of interference and to ensure maximum utilisation. The new service is essentially a local service; the problems will differ widely in an urban and rural area, in the mountainous West and the flat Middle West, etc. The Commission is prepared to co-operate with local groups which may be formed in the working out of co-operative arrangements and it will resort to limiting regulations only in the event that an imperative need is shown."

RADIO RIGHTS

"All men have the inalienable right to transmit and receive by means of radio" is the first Article of a Charter of Radio which has been drawn up by the Cambridge (England) Wireless Society. It is claimed that radio communication should be conducted for the greatest good of the greatest number.

WIRELESS RULES THE WAVES

The Adventures of a Ship's Radio Operator

WHEN I was thirteen years old a rather great event occurred in my life, for it was then I purchased my first "Wireless Weekly," and was inspired to do great things. While reading it under the desk at school, the teacher caught me. Tearing up the "Wireless Weekly," he said, "You will never get anywhere reading that kind of stuff." Ever since I have tried to prove him wrong; as yet, I am not sure, but I have had a lot of fun trying!

That notable issue contained the

xxxxxxxxxxxxxxxxxxxxxxx

By
CHARLES ASTON
21 William Street, Double Bay
N.S.W.

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circuit of the '34 Advance that looked just a mass of wires to me then, and I decided that it was definitely too ambitious, both technically and financially, so I spent the next year playing with cantakerous crystal sets and advanced into the valve class with an increase of finance and ability. It was shortly after this I nearly fell by the wayside. I attempted what was known as the "Beam Standard"; it probably would have worked, only the coils did not match the I.F. transformers; they were the wrong type, anyway. I sent a tale of woe to the Technical Editor of "Wireless Weekly," Mr. A. G. Hull, who put himself to a great deal of trouble, more than he thought I realised, to straighten out my mistakes, and once again I was back on the road to success, full of encouragement, solely due to the efforts of Mr. Hull for a complete stranger. May I spare his blushes but one does not forget these things in a hurry.

By the time I had reached the age of seventeen I had commenced a course in commercial radio operating and, by diligent application and hard work, mostly on the part of the instructor, I was ready to proceed to sea with a brand new ticket two years later. I was very fortunate as there were any amount of vacancies at the time and, within a week of passing the exam, I was sailing through Sydney Heads in a small Australian tramp for climes unknown, as the war was well in progress and we all know about national security regulations.

The transmitter was a self-excited oscillator—two 852's in parallel with an input of 500 watts tuned to three frequencies in the medium wave band. Ships' electric mains are invariably direct current to avoid a separate excitation generator, and to convert this to alternating current for the transmitter, a motor-alternator is used; in this case the output frequency was 500 cycles per second and applied to the plates of the oscillating valves modulated them at this frequency; not the best idea in the world, but cheap and quite effective. The receiver was a four-valve T.R.F. with a band coverage of 180 to 3,200 metres, and was fitted with a beat-frequency-oscillator valve, accumulators being used for both the low and tension supplies. There was also a set of heavy duty accumulators for driving an inductor type motor-alternator that worked the transmitter at reduced power for emergency operation.

Accumulators are a pain in the neck, requiring a great deal of attention, and there always seems to be acid burns appearing on the clothes worn no matter how carefully. However, a little extra effort towards their well being is more than repaid by kind words instead of harsh ones from the man inspectors who visit the ships. Actually, most of them are decent fellows, having been to sea themselves, and do what they can to help rather than otherwise.

One operator I heard about had the misfortune, while testing the speaking tube between the bridge and wireless telegraph office, to blow some water that had deposited in the tube on to the face of an inspector listening at the other end. The R.I. did not appreciate the humour of the situation!

During this first year at sea I saw a great deal of Australia and New Zealand, with an occasional trip to New Caledonia and the Solomon Islands. While in N.Z. I managed to get down to Rota Rua from Auckland, and there is no doubt about it being a thermal wonderland; and when in Greymouth, on the west coast of the South Island, out to the Hoka Tika glaciers. I really enjoyed my stay in New Zealand and will always have a soft spot for it, but was not too keen on the very cold weather they enjoy (?).

The next ship was a Norwegian gasoline tanker; it was a big ship, 500 feet long, 65 feet beam, and carried about 15,000 tons of spirit, usually the high octane stuff. I had the distinction of being the only foreigner on board for six months; that means the rest were Norwegians and, on the whole, treated me exceptionally kindly and could all speak English with varying degrees of correctness.

The radio equipment on the tanker was rather interesting, being of French design, part of it built in France and the rest under licence by a Norwegian company. The main transmitter was rated at 1,000 watts input of the self-excited type, consisting of a large size radiation-cooled valve with 8,000 volts on the plate. It was not a bad set, but a frequency drift of 10 kc/s was more the rule than the exception. It used to get out well, probably due to the aerial, which was constructed of inch copper rigging wire. When it was lowered, it took all hands and the cook to pull it up again!

The emergency set was a 300-watt quenched gap spark transmitter and could be operated from either the main power supply or from a 14-volt inductor motor alternator run from accumulators.

The Chief Mate possessed a mate operator's ticket, as well as a rather distorted sense of humour, and, when I was having a bit of trouble with the gear, he came and gave me a bit of assistance; shortly after, up came the Skipper. The Mate said to me, "We will soon get rid of him." When the Skipper went to put his hand in the transmitter to show us how to repair it, a nice fat spark jumped across to his finger, for, at that moment, the

(Continued on next page)

WAVES

(Continued)

Mate pressed the key. The Skipper said a lot of things in Norwegian, and, just then, in walked the Chief Engineer, also to show us how to fix the trouble. The Mate's eyes gleamed as he thought he had another victim, but the Chief Engineer was a bit more cautious and did not fall into the trap.

The French receiver did not measure up to Admiralty specifications, so it was taken out in New Zealand and a marine receiver manufactured in Auckland was installed; mechanically, it was a well-built job.

An automatic alarm is a device that was undoubtedly devised solely as an instrument of torture for marine wireless operators. During the day they spend the greater portion of their time making it respond to the required signal and, during the night, not only does it haunt their dreams, which is not too unbearable, but when it rings an outsize in bells over the bunk of the unfortunate operator at most inconsiderate times, it is really a bit beyond a joke. Just as well it is installed by Government regulation, else the number of these monstrosities that would have "accidentally" fallen over the side would have undoubtedly reached amazing proportions. The one on the tanker was a particularly peculiar one and would have rivalled a small automatic telephone exchange, having in all twenty-four relays, not just ordinary ones at that. It had to be seen to be believed. I kept a copy of the circuit as a curiosity.

In Wellington, N.Z., I met the gentleman, a relay expert, who claimed to have designed this brain-shattering device while in France some years ago.

Arriving in San Pedro, the port for Los Angeles, California, I had installed one of the new types of auto alarms, which was a reliable machine.

The next trip was to Peru, where we were not allowed ashore, which meant that we were sixty-eight days without putting foot on solid ground. Australia to Peru, then back to New Zealand. If it had been much longer, I would have flung myself over the side just to break the monotony.

Returning to San Pedro from New Zealand, it was decided by the powers that be that the ship was due for an overhaul, which took exactly one month, and, as it took only threequarters of an hour to arrive in Hollywood and its attendant night clubs, it is easy to imagine the time I had.

I had the good fortune to visit and be shown over one of the shipbuilding yards that are turning out the Liberty ships. It certainly was an eye-opener.

Also installed was a 500-watt shortwave transmitter that had a coverage of from 13 to 75 metres, if my memory serves me right. There was no coil changing; quite a blessing. A rotating loop direction-finder and a so-called echo meter were also fitted. The echo meter consisted of a microphone on the bottom of the ship, the output of which was amplified and brought out to a pair of headphones on the bridge. To measure the depth of water, throw one of the bombs that are supplied, over the ship's side and, as soon as it hits the water, start counting the seconds; then go and listen on the phones, still counting, until the board is heard to explode on hitting the bed of the ocean, and, as this bomb is supposed to sink at the rate of a foot per second, the number of seconds indicates the depth of the water in feet. See?

On returning to Sydney, I was put on leave until one Saturday afternoon when I was waiting for a friend to come down and take me around to the local—this fellow recently went down in a ship—the telephone rang. I was greeted by the Chief Inspector and told there was a ship leaving in an hour's time and they could not locate the operator, so I was called upon to go. I vaguely remember throwing some clothes into a case, while my Dad was frantically searching for a taxi. When I arrived on board, I was greeted by the Skipper with: "It was bad luck they managed to locate an operator; I was hoping to get the week-end at home."

It was a small passenger ship, rather comfortable and built for the tropics. Just as well, for that is where it went. The equipment was of English manufacture and, although the transmitter was of comparatively recent design, it still retained the self-excited oscillator that most countries now regard as obsolete, even for marine work, but it was a neat little model and efficient. A copper-oxide rectifier was utilised in the high-tension supply so it could transmit with either continuous or interrupted continuous waves. The receiver was an insult to modern radio communication—a two-valve regenerative detector for communication in the year 1943 A.D.

Not only the weather was hot in that part of the world at that time, you can take it from me!

Taking garrison troops north one trip, who should one of them be? Everybody who has been connected with amateur transmitting in N.S.W. will know him—Sergt. C. Horne, one-time hon. secretary of the W.I.A.

I signed off that ship on my twenty-first birthday in Cairns, after being to practically every northern port worthy of mention, and some that were not, on the Australian coast, with a few in New Guinea thrown in for good measure.

After a couple of weeks' leave in Sydney, I was put on a ship on the interstate coal run. There was a change of transmitter—a master oscillator power amplifier type, with all modern cons, including a couple of 866 mercury vapour rectifiers, with a time delay to protect them. Although a bit low in power—300 watts—it was not a bad sort of a set and was pretuned to four frequencies. The emergency set was a very neat and compact 100-watt spark transmitter that could be put

CLEANING WIRES.

When soldering many of the finer gauges of wire difficulty may be experienced due to rapid oxidation of the wire, and thus although good flux may be used it may be found that the wires will be burnt away before the solder becomes attached. Chemical cleaners should not be used to clean fine wires, and one of the most satisfactory plans is to rub the wire very carefully between a sheet of very fine glass-paper doubled.

Emery is probably too coarse and will take away too much of the wire, whereas the finer grades of glass-paper will only remove the enamel covering and will be unlikely to remove any of the actual wire. The iron must be really hot and a drop of solder should be supported on the iron, and the tip of the wire, after dipping in the flux, should be plunged into the molten drop of solder and withdrawn fairly quickly.

on the air very smartly, a point that counts for a lot these days. The portable lifeboat transmitter was run from two six-volt accumulators with a 12-volt vibrator supplying the high tension. The circuit was a 6V6G oscillator driving an 807 that was modulated by an 807 tone oscillator and could be keyed by hand or automatically and did not require a skilled operator. It was a nice job and easy to put on the air.

After three months on this ship I was put on leave again, while awaiting an overseas vessel, when I received another urgent call and was sent away as Senior on a three-operator ship up north again. Actually, I was only relieving and, after three months, the other fellow returned and the next thing I knew I was sailing out of the harbour in a tug.

The gear consisted of a 100-watt quenched gap emergency set, together with one of the latest six-tube superhets. Really a fine job, comparing more than favourably with the American prototype. To give some idea of how it was constructed, it had a good bath in sea water, of which there was half an inch deposited in the bottom of the steel cabinet, and it worked as well as ever for the rest of the trip.

The hardships that we put up with on that tug! I was young and knew it could not do me much harm, but the Chief Mate was 72 years old and he took it with the best of us. The tug had not been outside the Heads for twenty-five years and leaked like a sieve. My bunk was in the wireless-room, which, in common with the rest of the accommodation, was below the water-line; the only direct air inlet was a three-inch ventilator and a door leading into the saloon, which usually stunk, as it was also used as a food store. More often than not there were three or four inches of water on the floor of the cabin, and I used to lie in my bunk in the tropics, sweltering with a blanket on. No, I was not "troppo"; the blanket was just to stop the water dripping on me—the lesser of two evils. The cook was an interesting old cove. He liked to get his hands well into everything before we ate it. Boiled eggs annoyed him, as we opened them ourselves. I saw him open a tin of fruit one day and just dip his fingers in amongst it for no apparent reason. He always had a cigarette in his mouth, with a long ash ready to fall off into the soup.

After three months the tug finished its contract and serenely returned to port. The only thing water did not come out of was the tap.

I was then sent to a ship with a real echometer, a very interesting instrument. I never tired of watching it operate.

As I write this, I am back on the same ship that was on the interstate coal run, having the time of my life. Recently I was in Fremantle for five weeks and, as one of the commercial broadcasting stations was very short of operators, I worked there for three weeks at the transmitter. It was good experience and rather interesting, and I met all the nice young lady announcers.

In a couple of days the ship will be in Sydney after a trip of three months. Whence then? I do not know, but it will undoubtedly be new and interesting.

A SHORT COURSE IN RADIO

PART 5 . . . RADIO VALVES

THE most universally-used device in radio is the valve. There are hundreds of different types designed to perform dozens of various operations, but they all work on the same underlying principle.

Generally, the valve makes use of a glass envelope containing two or more elements which are separated from each other. One element is the electron emitter, while the other attracts these electrons, and as we know, an electron flow constitutes an electric current. This is illustrated in Fig. 49(c) and this type of valve having two elements is called a "diode."

The electron emitter is known as the filament or cathode; this would have to be raised to a very great temperature in air before any appreciable amount of electrons would be liberated and this temperature may be higher than the melting point of the substance, which would be a very unsatisfactory state of affairs and the other electrode would have to exert a larger than practicable attraction on these electrons before they would pass to it through the air.

To overcome these difficulties the envelope is evacuated to a high degree, and the filament is coated with special substances that will emit copious amounts of electrons at low temperatures, at orange-red heat. It would be a bit difficult to apply a flame to the filament for it to attain this temperature, so use is made of the heating effect of an electric current passing through a resistance. The two ends of the filament are brought out of the envelope at the base, through which a current may be passed. It is now pointed out that this current is for the sole purpose of raising the temperature of the electron emitter and other than this has nothing to do with the flow of electrons.

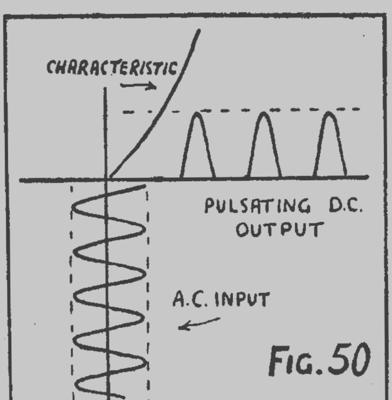


FIG. 50

The "filament" type of electron emitter is a hairpin loop of wire as shown in Fig. 49(a), coated with an electron emitter and is used when direct current is available for the heating current.

The "cathode" type is shown in Fig. 49(b) and can be seen to consist of an insulated hairpin loop of wire, the heater, around which a metal tube is placed on which is the electron emitter; this type is used when alternating current is used for heating the emitter.

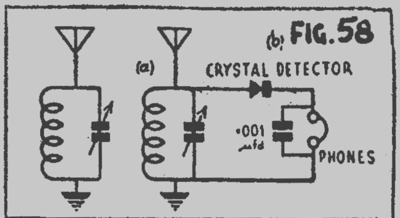
If the filament type were used with A.C., for example, a 50 cps supply, it would have 100 current impulses passing through it every second. This continuous variation in the heat supplied to the filament would, unless the latter was of fairly heavy gauge, result in a corresponding pulsation in the supply of electrons emitted. This in turn would give rise to a bad hum in the output.

The element that attracts the emitted electrons is known as the "plate" or "anode," and consists of a cylindrical shaped piece of metal surrounding the emitter and separated from it by the vacuum. The plate is made to attract the electrons by making it positive with respect to the filament as shown in Fig. 49(c) and as the electrons are attracted to the plate so current will flow through the valve. If the connections to the "B" battery were reversed the plate would be negative to the filament and the electrons would be repelled by this negative charge and thus there would be no current flow through the valve.

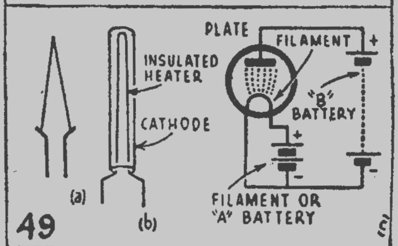
The diode may be used for the detection of radio signals or as a rectifier of low frequency alternating currents.

Diode Rectifier

Now imagine a source of AC connected between plate and filament.



(b) FIG. 58



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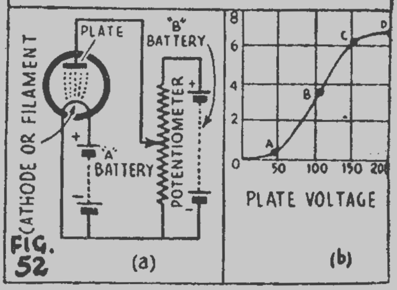

FIG. 52

On the half cycles when the plate is positive to the filament, current will flow, but there will be no electron flow (no current) when the plate is negative to the filament.

Thus the valve is acting as a rectifier in that it has changed an alternating current into a pulsating direct current (Fig. 50). This alternating current can be of any frequency, from the 50 cps variety to the highest radio frequencies. Hence, the diode can be used in a power supply to rectify A.C. from the mains or as a detector for radio frequency currents.

The half wave rectifier just described, rectifies only half of each cycle, as its name implies; so the negative half cycle is completely lost.

It is possible, by using two diode valves, to rectify both halves of the cycle as shown in Fig. 51(a) and the input and output curves are shown in Fig. 51(b). This is called full-wave rectification and the output will have twice as many pulses per second than the half wave rectifier, so if 50 cps is being rectified the output will be 100 pulses per second. The action of a full-wave

FUNDAMENTALS - - By CHARLES ASTON

rectifier will now be given.

The plate of each diode is fed from an end of a centre-tapped winding on the transformer. When the A.C. is flowing in one direction one end of the winding will be positive to the centre tap, so its associated diode's plate will be positive to the cathode and the valve will be conductive; during the same half cycle the other end of the winding will be negative to the centre tap, making its diode's plate negative with respect to its cathode, so this valve will be non-conductive. When the first half cycle is complete and the current is starting on the second half cycle, in the opposite direction, it will induce in the winding a current that is flowing in the reverse direction to the first half cycle, making the end that was previously negative now positive, so that the diode that was previously non-conductive is now conductive; and the diode that was conductive on the first half cycle has a plate that is now negative with respect to the cathode. To summarise, each diode rectifies one half of each cycle and, as soon as one valve becomes conductive, the other becomes non-conductive; the centre tap is negative to the conductive diode, so the negative connection is made to this point; as the filaments are connected in parallel the positive connection is made to them, or in the "heater"type to the cathode.

Where only fairly low currents are involved, as in radio receivers, two diodes are incorporated in the one envelope, thus reducing the cost and space required for installation.

Space Charge

When the electrons are emitted from the filament they are not immediately attracted to the plate but form in a cloud or "space charge" around the filament. If no EMF is applied to the anode, the electrons of the space charge are continually leaving and returning to the filament. The space charge is a repellent discouraging other electrons leaving the filament.

When a positive voltage is applied to the anode it will draw electrons from this reservoir (space charge) which will immediately be replaced by electrons from the filament. The higher the anode voltage the greater will be the attraction, and so the electron flow will be increased, increasing the anode current. This is true until the anode is drawing electrons from the space charge as soon as they are replaced and any further increase in the anode voltage will produce only a very small increase in the anode current; this is "saturation" point. The whole process is illustrated in the anode voltage, anode current curve of Fig. 52(b), while the anode voltage is varied in a manner shown in Fig. 52(a), which will now be explained.

At low anode voltages, the current is also low as the attractive force of the anode is only sufficient to draw a few electrons across the vacuum. After the point "A" the increase in electron flow with rising voltage soon becomes rapid and even. At "C" the curve starts to flatten out (saturation point). The increase in voltage from "C" to "D" produces very little corresponding increase in anode current.

Triode

We have seen how electrons are emitted and how they are attracted to the anode, and we will now see how the introduction of a third element into the envelope can control the flow of the electrons from the cathode to anode.

This new element, called the grid, or more correctly the "control grid," is in the form of a widely-spaced meshlike structure. It generally consists of a spiral of wire, and is located between the cathode (or filament) and anode. In circuit diagrams, a grid is represented by the zigzag line shown in Fig. 53(a), separating the filament from the anode.

Now, if a triode is connected up in the circuit of Fig. 53(b), this is similar to the circuit used to illustrate the action of the diode, except that a third battery, known as a "C" or grid bias battery, is included, with its negative terminal connected to the grid and positive to the negative pole of the filament battery.

This arrangement obviously means that the potential applied to the grid is negative to that of the filament.

The effect of this negatively charged electrode between filament and plate should now be obvious. The negatively charged electrons leaving the filament for the plate under the influence of the positive voltage applied to the latter, come under the influence of the negative grid, which repels them. The number that manage to pass through the open spiral of wire constituting the grid, and reach the plate, depends on the repelling force exerted by the grid, which in turn depends on the negative potential applied to it.

Owing to the nearness of the grid to the cathode, it exerts a strong force on the passage of electrons to the plate and only requires a very small comparative negative value to completely stop the electron flow.

If a grid bias, of sufficient negative value is applied to a valve to stop the flow of plate current and the negative bias is gradually reduced to zero, then to a positive value, a curve similar to Fig. 54 will result; this is called the mutual characteristic curve of the valve.

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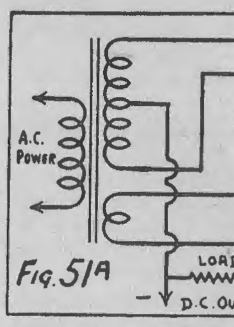


Fig. 51A

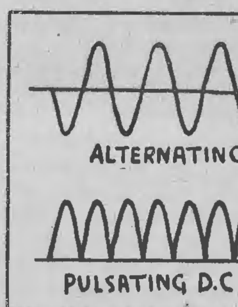


Fig. 51B

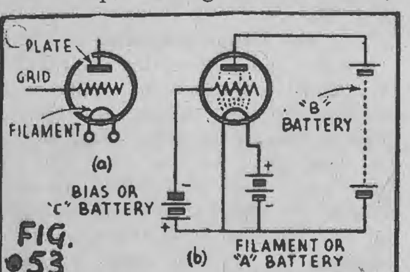


FIG. 53

FUNDAMENTALS
(Continued)

When the grid becomes positive it will attract some of the electrons to itself and grid current will flow; this will be of a small value.

From the curve it can be seen that a small change of grid voltage will produce a large change in the anode current.

Mutual Conductance (gm)

From the mutual characteristic curve of a valve it is possible to calculate the mutual conductance or "slope" of the valve which may be defined as the ratio of the small change in plate current to the small change in grid voltage causing it, the plate voltage remaining constant, and really represents the control of the grid voltage over the anode current.

Mutual conductance is measured in milliamps per volt for convenience, although the "mho" is the unit which is equal to 1000 ma per volt.

If we referred to a mutual characteristic curve and found, for a fixed plate voltage and a grid voltage change from -3 to 3 volts (6 volts) produces a change in plate current from 5 mA to 10 mA, the mutual conductance will be approximately .83 mA per volt.

Amplification Factor

Amplification factor may be defined as the ratio of the small change in anode voltage to the small change in grid voltage required to produce equivalent small changes in plate current.

If, with a certain valve, we were to vary the grid voltage from –4 to –2 volts (2 volts) and this altered the plate current, say, 5 mA and then returned the grid to –4 volts, and then varied the anode voltage until it produced an alteration in the anode current of 5 mA, which we found was a reduction of 20 volts, the amplification factor equals $20/2 = 10$. This simply means that the grid has ten times as much control over the plate current than the plate voltage.

Amplification factor may be represented by the letter "m" and is a pure number which cannot be represented by units.

A.C. Plate Resistance

A.C. plate resistance or "impedance" is the ratio of the small change in plate current to the small change in plate voltage causing it, while keeping the grid voltage constant.

Now, if the anode current of a valve is 20 mA for an anode voltage of 200 and is reduced to 18 mA when the anode voltage is altered to 150 volts, the impedance will equal 50 volts/2mA = 50,000/2 = 25,000 ohms.

The impedence of a valve is represented by "ra."

Relationship

It can be shown that amplification factor is equal to mutual conductance multiplied by the plate resistance.

Screen Grid

The triode valve was for some time regarded as perfect for the functions it had to perform, until there came a new development which made the valve far more useful in many ways.

Between the grid and plate of a triode valve there exists a tiny capacity which can cause serious trouble in some applications by providing undesirable coupling between the plate (or output circuit) and the grid (or input circuit). This drawback can be obviated by placing yet another element within the valve, increasing the number to four.

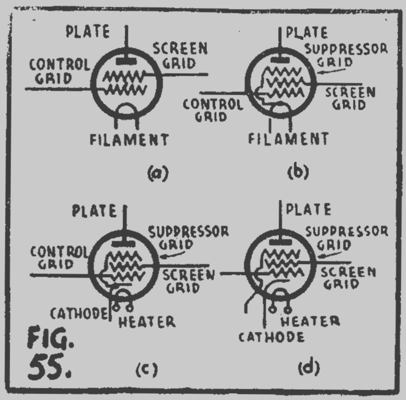


FIG. 55.

This new element — generally known as the "screen grid"— is interposed between the control grid and anode. In order that it will not have any detrimental effect on the electron flow from the filament to the plate, a positive potential is applied to it approximately equal in value to the potential of the electron stream at the point where the screen grid is inserted.

Thus this grid does not obstruct the flow of electrons, but provides an effective electro-static shield between the grid and plate that greatly reduces the capacity between these two elements. As this type of valve is fitted with four elements it is known as a "tetrode," the theoretical symbol for it being shown in Fig. 55(a).

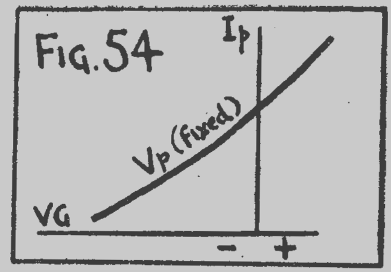


FIG. 54

Secondary Emission

It has been shown that the electrons travelling to the plate can hit it with sufficient force to dislodge electrons from the anode material which are emitted; these emitted electrons in certain cases may exceed the number of primary electrons. In a triode valve this is of no consequence as the negative potential of the grid will repel them, but in a tetrode where the screen is kept at a fairly high positive potential it will attract these electrons and a fairly heavy screen current may flow.

Suppressor Grid

To overcome secondary emission effect in a tetrode, another grid is introduced between the screen and the plate; this is known as the "suppressor grid," which is kept at cathode potential and will repel the electrons as the control grid in the triode, so that the secondary electrons will be attracted back to the anode.

This gives us the "pentode" or five-element valve.

In some types of pentodes, notably those of the output variety, the suppressor is connected to the centre point of the filament in the case of battery valves (Fig. 55 (b), and to the cathode in the case of indirectly-heated valves (Fig. 55c).

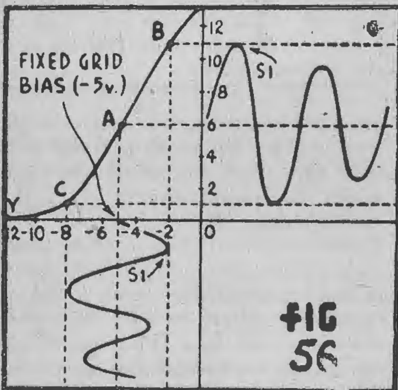
In RF pentodes the suppressor grid is not connected internally to the filament or cathode, but the connection from it is taken out to a separate pin in the valve base (Fig. 55d).

The Triode Amplifier

Imagine an alternating voltage, equivalent to a signal, is applied to the control grid, which has been given a bias of –5 volts (Fig. 56). The first peak of the curve (S1) has a peak valve of 3 volts, and so reduces the bias to –2 volts, taking the operating point in the opposite direction to "C." In other words, the application of the signal has caused the bias to vary from its normal figure of –5 volts to first –2 volts and then to –8 volts.

This variation in grid bias is reflected in the plate current in the following way. The first positive alternation of the signal, which reduces the bias from –5 to –2 volts, results in an increase in plate current from 6 to 11 mA (Fig. 56). The next alternation, which is negative, increases the bias to –8 volts, resulting in a decreased plate current from 11 to 1 mA. In this way, the plate current varies in sympathy with the applied signal, and so we obtain in the plate circuit an exact replica of the signal-variations as supplied to the grid.

The net result then, of applying



a small alternating voltage to the grid is that it produces similar fluctuations in the plate current drawn by the valve.

When some form of load (resistance or impedance) is connected in the plate circuit, this variation in plate current flowing through it will produce a corresponding variation in the voltage drop across it. This alternating voltage is a magnified version of the original signal, and thus the valve is an amplifier.

Overloading Distortion

In the above way amplification without distortion takes place. This is only true, however, if the signal voltage is not so large that the operating point passes off the substantially straight portion of the curve.

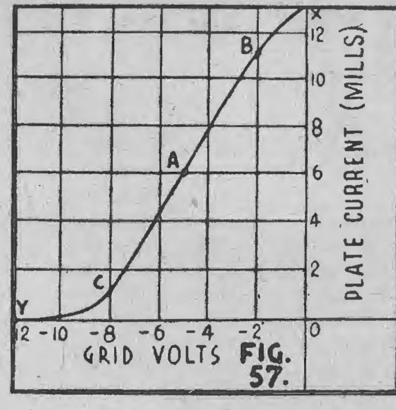
For example, from Fig. 57 we find that the permissible grid swing is between "B" and "C." If the signal is so great that the operating point passes off this line to the curved portions, distortion results, because then the plate current does not increase or decrease with the grid voltage variations to the same amount as it did over the straight portion.

In Fig. 57 we see that a signal with a total variation of 6 volts is the greatest permissible, as the resultant swing of 3 volts each side of the centre brings the operating point to "B" and "C." Thus the negative portion of the maximum permissible signal increases the bias by 3 volts, reducing the plate current by 5 mA, and vice versa with the positive portion. If, however, we apply a 14-volt signal, with a resultant 7-volt swing to the left, it would reduce the plate current by 5 mA for the first 3 volts, but only by 1 mA for the next 4 volts. Obviously this would result in a distorted form of signal.

The opposite half cycle would result in an even more violent distortion, as it will be seen that 7 volts to the right of the point marked "A" brings the working point past the zero line, and the grid would become positive. This briefly explains the restriction in undistorted output which is available from a single valve when used as an audio amplifier.

Actually, in one application of the valve—that of detection—this partial suppression of one half of the signal is desirable. Why this is so will be explained later.

The valve is a wonderfully versatile device in that it can be used



to amplify both audio frequencies (extending from about 80 to 1200 cycles per second) and radio frequencies (from 50 kc's upward).

Detection

One of the earliest forms of detector, widely popular many years ago, is the crystal detector. This, consists of a device using a fine wire, called a "cats-whisker," held lightly in contact with a crystal of a particular mineral such as galena.

These crystals have the peculiar property that, while they will allow current to flow readily in one direction, in the other it scarcely flows at all.

(Details of a crystal set are included in the next article of this series, to appear in next month's issue.)

FRAGMENTARY CRYSTALS

Radio communication might have been impaired and the work of producing quartz crystals materially increased had not an accidental fracture of a crystal revealed the usefulness of small crystals. A South African amateur, after dropping his precious "rock," reported his accident to the American crystal manufacturer when ordering a replacement, stating that his crystal was now in tiny fragments but that they still worked!

From this chance remark grew the design changes that produced millions of military crystals at an enormous saving in quartz and expense. The former one-inch square crystals were replaced by tiny bits of quartz averaging less than three-tenths of a square inch in area. The thickness of the new crystals runs from fifteen to eighteen thousandths of an inch. Reduction in crystal size resulted in the production of more plates per pound of raw quartz and also in the use of quartz of a size and quality formerly considered non-adaptable to radio use. The saving in quartz is estimated at 1,200 tons. — Q S T (U.S.A.).

SUN SPOTS

In the period from 1906 to 1942 magnetic storms occurred on 2,800 days. A study of these storms made at the Commonwealth Solar Observatory, at Canberra, Australia, revealed that they fall into four groups, divided into twenty-seven periods. Three groups were associated with visible eruptions or with sun spots. These storms took place 1.5 to 2.5 days after the disturbances on the sun's meridian. The fourth group, was not accompanied by visible outbreaks of the sun. It is estimated that three days are required for the particles causing these disturbances to travel from the sun to the earth.

A WELL-TRIED REFLEX CIRCUIT

A READER who was out to try a new circuit once alighted upon the "Everett" detector (May, 1944), and, hearing that it amplifies intermediate frequencies, detects the signal and amplifies the audio frequency produced, he expected remarkable results. He was immediately overcome with disappointment, so he fumbled with the circuit for a while, failed to get the expected amplification and finally discarded the detector in disgust. It so happened that, all

By
S/Ldr. S. J. Watson
RAAF, Pt. Cook
Victoria

unknowingly, he was rejecting a good detector. What then was the trouble? There was nothing the matter with the circuit; it was the experimenter—he was suffering from malady called "gullibility" and he had swallowed something he had read somewhere about the wonderful "properties" of the detector. Alas, it is too late now to raise that reader from his grave, but by reading the explanation about to be given, you (yes, YOU, dear reader) can save yourself from his fate before it is too late.

Look at the circuit shown in Figure 1. You will see that if a carrier of E volts peak is developed across the tuned circuit it is applied between grid and earth. Now, let us consider a positive half-cycle at the grid; then we put a + sign on the grid to denote this. This increases the valve current temporarily, which in turn produces an increase in the potential E1 across the cathode impedance. Again, we use a plus sign at the top of the r.f. choke to denote an increase in potential above earth. The actual difference in potential between cathode and grid is now E–E1, and you can see that if this were ever zero the valve current would have no a.c. component and we would have argued ourselves into an untenable situation. The fact is that it can never be zero, and **E1 must always be less than E,** although it is true that their differences can be very small.

Now you will see that this is rather unfortunate because E1 is the voltage between the anode and cathode of the diode detector, so the diode gets less carrier than if we had fed it directly from the tuned circuit. And, believe it or not, the system is a voltage reducer instead of a voltage amplifier as far as the carrier is concerned.

Detection in the diode takes place in the conventional manner, and if R1 is large the impedance of the diode circuit is large, because diode current flows only during a tiny fraction of the carrier cycle. You

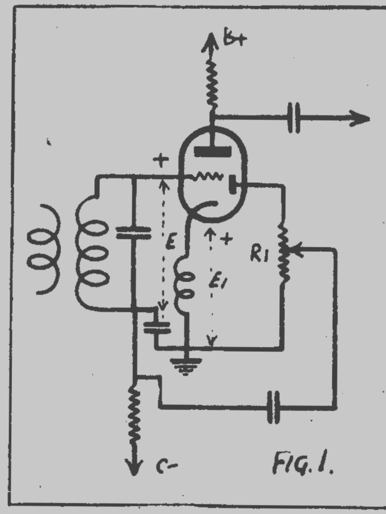


FIG. 1.

are now beginning to wonder what we have gained so far. Well, it is only this: that the diode does not damp the tuned circuit as in the conventional diode detector. The tuned circuit of Fig. 1 finds itself across an extremely high impedance in the grid-cathode circuit and is therefore subject to only negligible additional damping. This can be an advantage in special types of amplifiers, but with ordinary well-designed diode circuit (R1 = 1 megohm) the diode can be placed across a tuned circuit and the Q is reduced by a few per cent only (less than 5%). If you are building an average receiver, therefore, you will gain nothing in changing from a diode to the Everett circuit.

The audio is applied to the grid as shown, and is amplified in the usual manner. If the valve is under good Class A bias conditions, both r.f. and a.f. can be applied together to the same grid without any ill effects on the quality of the output.

Our unfortunate reader who passed away in the first paragraph was probably searching for the circuit of the true reflexed amplifier. This would certainly have saved his worthy soul as it would have given him an excellent case of i.f. amplification, detection, and audio amplification all in the same valve, with the additional feature of very high gain and low distortion. Look closely at Figure 2, and the differences between it and Figure 1 be-

(Continued on page 30)

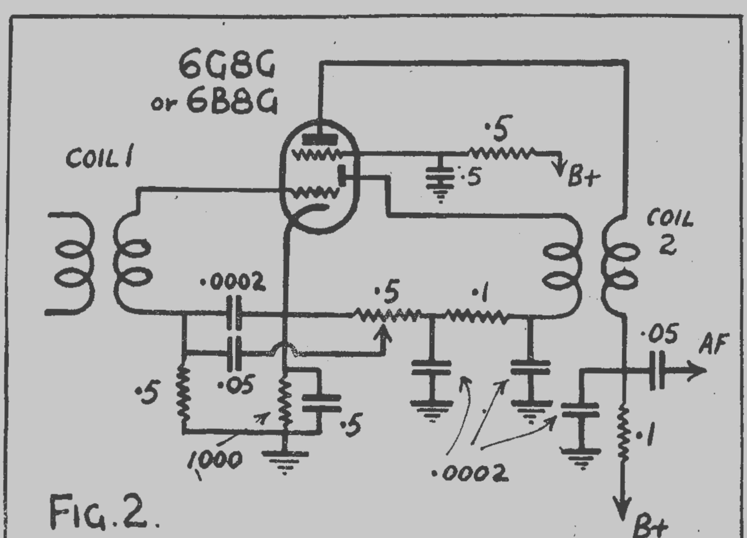


FIG. 2.

HISTORY and THEORY of MICROPHONES

In the year 1876 Bell transmitted the first complete sentence between two remote points and is generally accredited with the invention of the microphone.

A MICROPHONE is an instrument that is actuated by acoustical energy transforming it into corresponding electrical variations and is sometimes known as an electro-acoustic transducer. A perfect microphone will produce electrical variations which are exactly equivalent to the wave form of the sound.

For faithful reproduction of speech and music the microphone should respond equally to frequencies in the whole audible range, which is 30 to 15,000 cycles per second. Owing to the limited band width, 10 kc/s, of broadcasting stations, the frequency response is limited to a maximum of from about 30 to 9,000 cps, which is usually greater than the average receiver is capable of reproducing. For intelligible reproduction of speech a limited frequency of from 300 to 3,000 cps is all that is required.

Large variations in sound pressure should be capable of being reproduced without the introduction of distortion. When a microphone is used for speech, only low pressures are involved, but with a large band extremely high sound pressures are produced. It is not practicable at present to reproduce sounds below 40 cps at anything approaching their true relative intensity.

Inherent noise level of microphones must be low when used for high quality reproduction, as it is irritating to the listener when the desired sound pressure acting on the microphone is at a low level.

The acoustic properties of the room and the placement of the microphone also effect the naturalness of the reproduction as well as several types of distortion that will be discussed towards the end of the article.

A sound wave has a periodic variation in the pressure of the medium and a periodic variation of the velocity of the particles in the medium which are the properties that actuate the microphone. A pressure operated one is actuated by the variation in pressure of the medium, while if the response corresponds to the particle velocity in the medium it is known as a velocity microphone.

Carbon Microphones

The operation of this type of microphone is based on the fact that pressure variations on a mass of carbon granules produce equivalent variations of the electrical resistance of the mass of these granules. The carbon microphone consists of a number of fine granules—through which an applied steady current is flowing—in a cup or button over which is stretched a metal diaphragm so arranged that the sound waves impinging upon it will cause variations of the pressure on the granules, causing corresponding variations in the current flow—due to the altering resistance. This pulsating direct current is applied to the primary winding of a coupling transformer, which induces an alternating voltage in the secondary winding which can be amplified by suitable valves.

Where it is only required to reproduce intelligible speech — say, from 300 to 3,000 cps—the diaphragm is not stretched and a very high output is supplied. In this condition it has a resonant frequency which is within the voice range and, although increasing the sensitivity many times, results in very poor quality. When the diaphragm is tightly stretched, its resonant frequency will be about 9,000 cps, resulting in greatly improved fidelity but with a great reduction of sensitivity.

By utilising two buttons with a common diaphragm push-pull, output may be obtained with its associated advantages, such as reducing the even-harmonic distortion.

The use of the carbon microphone is limited by a number of serious disadvantages, the greatest probably being the self generation of a "hiss"; this is due to minute variations in the contact resistance of the carbon granules. It is sensitive to vibration and must be mounted on springs, as jarring displaces the carbon granules, causing a high noise level. "Packing" of the granules is another common fault. When it occurs it can be cured by gently shaking the microphone with the current turned off. Where ruggedness, portability and high output are required, this type of microphone is satisfactory.

Condenser Microphones

The condenser microphone is designed on the principle that a variation in the capacity of a condenser causes a change in the potential difference applied across it. In this microphone the condenser action is obtained by a tightly-stretched metal diaphragm, usually duralumin foil, about .001 inch thick, mounted on but insulated from a metal plate and spaced from it by about .001 to .002 inches. The movement of the diaphragm will result in a change in capacity which is in the vicinity of 200 to 400 mmfds. A high steady polarising voltage is applied across the plates. As the sound energy impinges on the diaphragm, the variation in capacity produces a variation in the potential drop across a large resistance, higher than 25 megohms, which is in series with the condenser and the polarising voltage. The alternating voltage generated by this type is extremely small, usually necessitating at least two stages of preamplification, as the output impedence is extremely high it is desirable and usual for the first preamplifier to be mounted in the microphone cover directly behind the microphone and is regarded as an integral part of it.

As there is no gain control in the preamplifier the sound energy applied to the diaphragm must be restricted to prevent overloading. The frequency response is subject to alterations with temperature—an increase will result in accentuating frequencies in the region of 5,000 to 6,000 cps and conversely a drop

(Continued on next page)

MICROPHONES
(Continued)

in temperature reduces the response in this region and also the higher frequencies. Moisture and dirt particles invariably collect between the plates of the microphone which, result in large "plopping" noises in the output of the amplifier.

For a number of years the condenser microphone was almost exclusively used in high quality systems and, with careful maintenance, is a good instrument, having a frequency response from 30 to 9,000 cps. Due to the disadvantages as outlined above, together with its lack of portability and ruggedness, its use to the studio is restricted. No noise is generated by the microphone itself, so very low sound inputs are within its capabilities.

Crystal Microphones

The crystal microphone depends for its action on the piezo-electric effect of rochelle salt crystals, which are double tartarate of sodium and potassium. If the crystal is correctly cut it will develop charges of opposite polarity on its faces when subjected to mechanical stresses—the greater these stresses the greater the charge developed. When the sound energy directly actuates the crystal it is known as the "grille" type.

In the grille type of microphone a number of crystal units are arranged to assist each other, considerably increasing the sensitivity of the microphone. A single cell microphone has an output of –90 db., while a multicell one may have an output as high as –68 db. The cells are connected in series parallel when a long lead is used between the microphone and amplifier. If the amplifier and microphone are close, the cells are connected in series. A grille microphone may be so designed that its frequency response is uniform to 17,000 cps.

The sensitivity of a crystal unit can be greatly increased by the use of a diaphragm as a coupler between the relatively low impedence of the air and the high impedence of the crystal, only a single crystal unit is required in this sytem to obtain reasonable output. The diaphragm may consist of specially-treated fibre connected to a bimorph element by a pin. This type of microphone is semi-directive, but with the diaphragm facing the ceiling of the room it is essentially non-directive. Long cables may be used to connect it to the amplifier, and the frequency response is substantially flat, from 100 to 5,000 cps, with an output of about –48 db.

The piezo-electric temperature operating limits of rochelle salt lie between –40 degrees and 130 degrees F.; temperature changes will cause a variation of the output voltage if the load impedence is comparable to that of the crystal. If the crystal is subjected to temperatures in excess of 120 degrees F. for several hours, it will be permanently adversely affected.

A volume control should never be connected between the microphone and the amplifier, as there will be a resulting loss in the low frequency response.

This type of microphone has for its advantages, as well as those already outlined, lightness of weight, ruggedness, ease of maintenance, and no battery supply is necessary; it is also practically impossible to be acoustically overloaded. It is evident that this grille crystal microphone is a particularly excellent instrument.

Dynamic Microphones

The dynamic or moving coil microphone consists of a former invariably of aluminium—in order to obtain a maximum ratio of conductivity to mass—on which is wound a coil consisting of a number of turns of either very fine edgeways-wound aluminium ribbon or round wire. The turns are insulated from each other and the former by a coat of suitable varnish, which also holds the assembly together. This coil is actuated by a free, unstretched diaphragm which may be constructed of aluminium alloys, bakelite, styrol or paper, which, when sound energy is applied, causes movement of the coil in an intense magnetic field in which it is suspended, thus generating an alternating current. Owing to the very small mass of the moving unit, it will respond to high frequencies and, owing to the freedom of movement of the diaphragm, responds very well to low frequencies.

The moving coil has a low impedence, usually to the order of 25 to 50 ohms, thus long cables may be used to connect it to the amplifier without any loss of the high frequency response. Owing to the low output of the microphone it is necessary to shield the cables to prevent pickup of stray fields. Owing to its rapid falling off in response to frequencies above 1,000 cps as the angle of incidence (the direction in which the sound waves impinge on the diaphragm) departs from 90 degrees, dynamic microphones are now fitted with a horizontal diaphragm in front of which is fitted an acoustic screen to overcome this effect.

This type of microphone may be designed to have a frequency response of from 40 to 10,000 cps. It is rugged, has no inherent noise, unaffected by air currents and may be handled gently while in operation without producing noise in the output.

Ribbon Microphones

All the microphones considered up to the present are pressure operated. The one about to be described may be designated as either a velocity or pressure operated type.

The microphone consists of a light ribbon of corrugated aluminium (about .001 inches thick), which is supported between the pole pieces of an extremely powerful cobalt steel magnet in such a manner that the ribbon's width is parallel to the magnetic lines of force so any back or forward movement of the ribbon will induce a current in it. The clearance between the pole pieces and the ribbon is kept to a minimum, yet permitting free movement of the ribbon; this keeps the field strength as high as possible.

In the pressure operated type of ribbon microphone, one side of the ribbon diaphragm is freely accessible to the atmosphere, while the other side is terminated in an acoustic impedence. A suitable acoustic impedence could consist of an extremely long pipe but would be far too cumbersome for practical purposes. A coiled shorter pipe will exhibit suitable acoustic impedence properties if it is loaded with sound-absorbing material such as tufts of felt.

The diaphragm of the velocity ribbon microphone is open to air vibration from both sides. The ribbon is drawn from its position of rest by sounds developing a pressure on one surface of the diaphragm and a vacuum on the other. The velocity component of the sound waves causes a proportional movement of the ribbon, thus inducing an electric current in it which is a replica, both in amplitude and frequency of the ribbon movement. Owing to the low impedence of the ribbon—a fraction of an ohm—it is difficult to design a suitable high fidelity transformer with a primary winding that will match it and, owing to the low output and impedence of the ribbon, it should be transferred to the transformer immediately.

If the low notes are not to be over accentuated, the microphone should not be closer than two feet to the sound source.

Special directional effects may be obtained by combining both types of ribbon microphones, utilising a common ribbon diaphragm, clamped in the middle, one half operating as a velocity and the other half as a pressure-operated microphone, so that the voltages developed across both sections are in series, which will result in cancellation for sounds in one direction and add for sounds from another. The advantage of such a microphone is that it may largely overcome the poor acoustics of a studio and will reduce unwanted noise, such as from an audience.

Hot-wire Microphones

Another type of velocity microphone is the hot wire one, which depends for action on the cooling effect of the particle velocity in a sound wave which changes the temperature of a fine hot wire, which causes a variation in the resistance of this wire.

As yet the difficulties associated with this type are as yet not overcome, which precludes the use of this microphone for sound reproduction.

Throat Microphones

The throat microphone is usually of the carbon type because of its high output. The microphone is kept in place near the larynx by a strap around the neck. The sound vibrations are transmitted from the vocal cords by flesh conduction. The sibilations are transmitted by air conduction through the throat. With the aid of suitable frequency compensating circuits, moderate intelligibility is obtainable.

This microphone is used where the wearer requires freedom of action that is not possible with the conventional microphones.

Lapel Microphones

Lapel microphones fulfil a field of certain requirements and are sufficiently small and light in weight to be worn on the coat lapel of the speaker. Both the carbon and ribbon microphones have been adapted for this service and, with the aid of suitable filters, passable reproduction is possible.

Microphone Distortion

The introduction of the microphone in the path of the sound wave will result in an alteration in the pressure of the sound wave at this point and is known as "pressure doubling." It is most apparent above 1,000 cps and can be reduced by keeping the microphone as small as possible and streamlined to sound waves.

If the diaphragm is recessed in the microphone cover the partially enclosed space may act as an acoustical resonator, increasing the pressure acting on the diaphragm at certain frequencies. This type of distortion is called "cavity resonance" and may be overcome by mounting the diaphragm as close as possible to the face of the assembly.

If the diaphragm resonates within the working frequency range, these frequencies are accentuated, which is "diaphragm distortion." It may be overcome by making diaphragm so that its resonant frequency lies outside the audible range.

ANOTHER HINT FOR HIGH FIDELITY

RECENTLY we mentioned in passing that "the output transformer in particular was a husky affair, having lots of iron and copper." We can say lots more about it than that.

Output transformers are apt to be on the skimpy side. They handle the power all right, but the core is run at such a high flux density that there is third-harmonic distortion. This probably does not make much difference in most applications, but in a high-fidelity job you have to guard against introducing distortion anywhere.

Also, the efficiency of the smaller transformers is not too good. We have never made accurate measurements, but the increase in available power is often quite noticeable when a well-designed transformer is substituted for a cheap one.

A transformer may have to handle only a few watts of signal, yet it has more of a job to do than the power rating would indicate. For instance, suppose a pair of 2A3's supply 7 watts to a 2½-ohm voice coil. The primary must handle 60 ma. of DC plate current plus about 44 ma. of AC signal current, making a total of about 74 ma. Secondary current is about 1.6 amperes. The a.c. voltage on the primary is about 160 volts r.m.s., plate to plate. This current requires more copper and this voltage needs more core than you will usually find in transformers of 7-watts rating.

As a matter of fact, the output transformer should be almost as large as the power transformer in a self-contained amplifier.

The obvious solution to this is to buy a good transformer. This is an excellent solution — if you can find any these days. However, your junk box may be able to help you even if your dealer cannot. A power transformer makes an excellent output-coupling device, so good that we often used them before the war when dealers' shelves had what you wanted.

The power transformer is run "backwards." The high - voltage winding is connected to the push-pull plates with the centre tap becoming the "B+" connection. The low-voltage winding becomes the output winding. Filament windings connected in series will often provide the proper impedance for voice coils, or the 115-volt winding may be used to couple to a line. It is easy to figure the various combinations if you remember that the impedance ratios are the square of the voltage ratios.

In using power transformers for outputs, we usually removed the primary and all of the filament windings, leaving the high-voltage winding intact. We then wound on a new secondary of heavy wire with just the right impedance. Voice coils have such low impedance that only a few turns are required. Be sure to count the turns in the old primary as you remove it. This will enable you to figure how many turns you will need in the new winding.

Perhaps an example will help. Suppose your transformer has a 115-volt primary and a 750-volt centre-tapped secondary, and suppose that you find the transformer has a 690-turn primary. From the ratio of voltages you know that there are 6.52 secondary turns for each primary turn, so there must be 4500 secondary turns. To couple push-pull 2A3's (5000 ohms plate-to-plate) to a 1.25-ohm voice coil, the impedance must be in the ratio of 5000 to 1.25, or 4000 to 1. The turns ratio must be the square root of this or 63.2 to 1. We found the secondary had 4500 turns, so the new secondary should have 4500 divided by 63.2, or 71 turns.

Modern tubes have largely made obsolete the power transformers having combination 2½-, 5-, and 7½-volt filaments. Many dealers still have such transformers in stock and are offering them at attractive prices and without priority. They are worth consideration as output transformers.

—William A. Ready.

RADIO AFFECTS HOMING PIGEONS

The United States Signal Corps has brought the use of homing pigeons to new peaks of service in the science of military communications but it has not yet solved the mystery of the strange instinct that drives these birds with such certainty to their proper destination.

The mystery is deepened by the apparent, though not conclusive, proof that pigeon-instinct is directly affected by radio waves. A recent series of tests by the Signal Corps supports the belief that radio transmission confuses the birds and retards them in fulfilling their flying missions.

Three successive tests, with three different groups of birds, were recently made and all brought virtually identical results. Each group consisted of ten birds, and was subdivided into two smaller groups of five birds each. All were held in a radio station just ten miles from their home loft. While this radio station was transmitting, the first five were released; and about 15 minutes later, with the radio station silenced, the second five were liberated.

These birds released while the station was transmitting seemed completely bewildered. They circled erratically, very close to the station, for 15 or 20 minutes, then took off uncertainly for their lofts, requiring a total of 42 to 52 minutes to complete the ten-mile flight. The birds that were released while the station was silent made the usual brief circling, then took off promptly for the home loft with no confusion whatever, covering the total distance in 18 to 21 minutes. There was very little difference in the results of the three tests. In every case the birds that were hampered by radio transmission bungled their tasks. In every case where there was no transmission the birds performed with the easy confidence which pigeoneers have learned to expect. All the birds were of similar type and training. All flew under practically identical conditions of wind and weather. Not a single bird upset the theory of flying noticeably better or worse than his mates under the same handicaps or advantages.

As the Signal Corps is slow to accept any theory on the basis of a few tests, there will be many more before the connection of radio with the homing instinct is conclusively established.

Latest Technical Notes from New York

By Cable—Courtesy U.S. Office of War Information

A transmitter-receiver for use in lifeboats, equipped for two-way manual radio telegraph and radio telephone and for automatic radio telegraph transmission, which can be operated by non-skilled men, is announced by the U.S. Maritime Commission. The set will enable occupants of lifeboats to maintain communication between lifeboats. It will operate on the pretuned international distress frequency of 500 kilocycles and on the high frequency adopted by the air-sea rescue programme. It can be operated by the use of a hand-powered generator and is entirely waterproof. The transmitter-receiver embodies balloon and kite antennas, enabling an average transmitting range ten times that obtainable with the present lifeboat transmitter on 500 kilocycles, and a range above 1,000 miles when used on the high frequency band.

A new television receiver for postwar homes that projects pictures like motion pictures and that are brighter and clearer and five times larger than was possible in the prewar United States was recently demonstrated by the Radio Corporation of America, U.S. electronics concern. The screen of the new receiver is sixteen by twenty-one and one-third inches in size and made of a special plastic that has been treated to make pictures show up brighter and clearer. The receiver is made possible by four prewar RCA developments—an improved high voltage projection tube, a unique high efficiency optical system, a plastic screen and an automatic frequency control system.

Floor or console models incorporating the new screen will cost under four hundred dollars (£A124), including equipment for receiving standard and FM programmes. Models at 150 U.S. dollars (£A46) will be equipped with tubes for viewing pictures directly in the manner similar to prewar television sets.

The optical system in the new television receiver consists of a bowl-shaped mirror and specially designed moulded plastic lens which delivers to the back of the viewing screen pictures six times brighter than could be obtained with an ordinary movie projector. The cathode ray receiving tube is mounted downward in the cabinet with the bowl-shaped mirror below it and facing upward. Light from the face of the tube is reflected upward from the mirror through the plastic lens to the flat inclined mirror near the top of the cabinet. From the mirror, light is reflected upon the back of the viewing screen. The entire set is not much larger than the average prewar radio receiver.

A recording set the size of a folding camera, completely built-in save for a microphone on the cord, has been developed by an inventor of Chicago's Armour Research Foundation. Powered by a battery receiver and destined for postwar civilian use, it weighs only three pounds. It picks up anything the human ear can hear. Its price is supposed to be about fifty dollars (£A15). Radio and newspaper reporters are the likeliest future users of this midget set. Other possible customers are travelling businessmen and detectives.

Shortwave Review

CONDUCTED BY L. J. KEAST

NOTES FROM MY DIARY

MAYTIME

May is the time considered by some for poets and love-song writers, whilst to others it brings up thoughts of one-time riots in Paris, now happily a time of rejoicing in Moscow, but, as for myself, I think the first week of May, 1945, will long be remembered as the time of the 'Frisco Frolics.

The Californian shortwave stations, apparently feeling the carnival spirit that preceded the 'Frisco Conference had been followed by a little gloom in the War Memorial Opera House, decided it was about time the distributors of entertainment by radio gave the world a brighter picture of the generally gay city. Well, kicking up their heels, adopting a caprcious air with very few exceptions they certainly went wild, threw off their familiar wavelengths, as good as said, "Nobody knows where I am." And, by jove, they were pretty well correct. Well, the hunt on my part lasted about a week, and I think I now have them fairly well tabbed. Elsewhere in this issue I am showing a list I have compiled. I enjoyed the chase and would not have missed it for worlds, but I do grieve about the programmes I did not hear.

Listening to, and recording in the manner suggested, the semi-monthly (given on 1st and 15th—the 2nd and 16th in some instances) readings of the schedules enables one to see at a glance the fine programmes offered by the Armed Forces Radio Service, justifying the claim of Col. Thomas H. A. Lewis that one of the greatest American Forces fighting the war was transmitters and receivers—words and ideas — "Victory through Air Power." Add to the schedules you hear, the contribution from the U.S. Office of War Information and you certainly have a programme to suit all tastes.

But, to avoid interruption, I wish the 'Frisco transmitters would give us better notice.

Perhaps we have become accustomed to regard the BBC as the yardstick by which all shortwave stations are gauged. In the Pacific Service particularly, a week before the decided-on change takes place, we are reminded over and over again, and if lucky enough to have George Henschel on duty that week, bless her soul, you are told so often—you could memorise it.

But, with all their shortcomings, the 'Frisco announcers can run rings around what I take to be the technical operators of the East Coast stations, who seem to garble the call-signs and frequencies more because they are compelled to do so by a regulation of the FFC than any desire to let some poor listener-in thousands of miles away know. One would expect them to be proud they were connected with an organisation capable of instantly reaching most corners of the world. And, if they only knew how many of us were sitting very often with headphones for long periods almost breathless, just to know to whom we were listening, or some sort of verification of our anticipated call and that it was altogether from a selfish point of view, we in our turn anxious to let the station know of our logging, I am sure they would give those calls a little slower and with better enunciation.

Shades of KZRH

In May issue I said I would not be surprised to hear our old friend, KZRM, Manila, any day, but it now looks as though it may be KZRH that is first in. Many readers of these pages will remember Don Bell of KZRH, one of the most popular war commentators who through that station, because of his fearless utterances, had a large audience in this country.

Don made his last broadcast from KZRH on December 31st, 1941, and about six months later we read that he had been tortured to death by the Japs.

Fortunately, this was untrue. Imagine my delight when I heard the announcement over KWIX, 'Frisco, 9.85mc, at 6.15 p.m. on Friday, 25th May, that Don Bell was there in the studio and would speak. Almost immediately the old familiar voice told of the fateful night of December 31st, 1941, and Mr. Bell said that a few hours after his broadcast the station was blown up by the Japs, and a couple of days later they took possession of it.

Since then, all sorts of things

had happened, but he was pleased to be able to say the reports of his death "were not correct." He said he was in Manila a few months ago and would be leaving San Francisco in a few weeks for Manila.

He said in concluding his broadcasts he could and would use the same words as those with which he closed his last broadcast from Manila, "God bless America, God bless the Philippines."

Another Selectivity Test

Another opportunity to test the selectivity of your set is afforded by tuning to the 16-metre band between 6.50 and 7.05 a.m. You will find KWID on 17.76mc, and KROU on 17.78mc, whilst at 6.58½ in comes KROJ on 17.77mc, beamed to Alaska, Aleutians and Chungking, and stays there till 10.45 a.m., returning to the air in 15 minutes on 17.76mc, on the S.W. Pacific-Pacific Ocean Area service.

SAYS WHO?

KRHO, Honolulu, 17.80mc, 16.85 m, now carries AFRS programmes from 12.15-1.30 p.m. and from 1.45-2.30 p.m.—L.J.K.

Miss Sanderson is looking forward to two things—the winter, with its fine daylight reception of overseas stations; and a trip to Sydney for a look-see during her vacation in August. Miss Sanderson enclosed in a letter giving the above information a very fine list of loggings, a good many of which are shown under "Loggings of the Month" in this issue. This lady, who says, "I am not sorry that I ever took up this grand hobby," has been most successful in logging the principal stations. But, what is more remarkable, is her tuning-in of many of the weak-sisters—as her numerous veries show—with a very modest receiver—a five-valve dual-wave mantel.

Hugh Perkins, of Malanda, Q., apologises for no log this month due to a breakdown in his set. As Hugh aptly puts it: "Fancy a set conking out and having to wait for spare parts . . . Wouldn't it?"

John Clifton, of Kingswood, Adelaide, with justifiable pride, reports having received veries from CR7BE, 30.40m; KWY, 39.66m; KNBA, 30.93m; KCBF, 26.92m; WOOC, 31.09m; and ZOJ, 25.40m.

"Airgraph verification from CHTA, Sackville, Canada, says mine was first report from the Pacific and they were thrilled to know of reception here, as CHTA was being beamed to Europe. This reception looks good for future transmissions, they say. They are adding 9 and 10 mc outlet as soon as antennae facilities are ready."—Cushen.

"The following information from a letter received from KU5Q will, I think, be of interest to ARW readers: 'KU5Q is a U.S. Navy Public Relations transmitter used for the broadcast of news regarding United Nations war activities in the Pacific Ocean area. Its transmissions are normally received in San Francisco and fed to the radio chains in the United States, which, in turn, service the BBC.

" 'KU5Q is the call-sign for three 3½KW transmitters, two of which normally operate dual on different frequencies beamed to San Francisco, with Rhombic antennae, and a third is a new directional Marconi rig. The dual transmission referred to would, I assume, refer to the 9760 and 7460 kc transmitters, both of which I have heard from 9 p.m. The 7460kc signal is the weaker. On 9670kc, KU5Q's signal has been very good lately. Strength is normally R7-8, but there is a bad heterodyne on the signal at times."—Clack.

"Received a few very good veries this week: HHBM, Port-au-Prince, 31.06m, replied with a very nice long letter from Frank C. Magloire, the manager and owner. A card came to hand from Radio Dakar, Senegal, 26.29m."—Gillett.

Verifications received are: Cards from KROJ for 17.76 and 6.10 mc, and a letter from NPM, 13.065mc. Also cards from KCBA and KCBF, KNB Aand KNBC and KRHO. Received a letter by "V" mail from Sgt. Bill Brundige, of "Sports' Page."—Clack.

Heard Okinawa on 28.20m at 6.30 a.m. in contact with KU5Q for dispatches.—Gillett.

Apropos of my remarks in May issue regarding KRHO on 31.28m. It now transpires that this station was, as I suggested, conducting a test. Reports to hand show the signal was quite good, particularly at night, but perhaps the result was not satisfactory in the area to which it was beamed. The test was from 18th to 25th April. They returned to the old night spot of 6.12mc, and were still there at great strength from 5.15 p.m. during May and up to the time these notes were typed. —L.J.K.

Since their occupation of Berlin, the Moscow transmitters have dropped the slogan, "Death to the German invader," but I heard a talk by a war correspondent from Moscow who says the Russians are great on slogans and the most popular or most used is: "Work harder and the country's war wounds will heal faster."—L.J.K.

NEW STATIONS

KRCQ, 'Frisco, 15.12mc, 19.84m: Transmits O.W.I. programmes to The East from 2-5 a.m., most of which is in English. Its sister station, KRCA, on 11.145mc, 26.92m, also carries the same programme to the Philippines.—L.J.K.

KROJ, 'Frisco, 17.77mc, 16.88m: Note slight change in frequency for transmission to South Pacific, Pacific Ocean Area from 4-5.45 a.m., and to Alaska and Aleutians from 8-10.45 a.m.—L.J.K.

XGOY, Chungking, 9.805mc, 30.58m: Open at 8.35 p.m. in parallel with 7.153mc. Signal is good and plenty of English is used, also many American transcriptions. At about 9.30 go into Chinese.—L.J.K. An air-mail from Rex Gillett states he has heard XGOY on this new frequency at 3.15 a.m.

KCBF, 'Frisco, 17.85mc, 16.81m: This new outlet carries the United Network' programmes from 7a.m. till 1.45 p.m. Quite a good signal and was R7 Q4 at 11.50. —L.J.K.

STATION CHANGES

KNBX, 'Frisco, is now heard from 7 p.m.-12.40 a.m. on 9.70mc, 30.93m, and KNBA opens at the same time on 7.565 mc, 39.66m, in parallel with KNBC on 9.49mc, 31.61m. KNBI has been dropped altogether as far as O.W.I. programmes are concerned.

KROJ, 'Frisco, 15.19mc, 19.75m, on MONDAYS only, continues till 8.45 a.m., giving Pacific Coast League Baseball from 7.15-8.45.

Changes in Department of Information Shortwave Overseas Service

VLC-4, Shepparton, 15.35mc, 19.59m: Now continues till 9.15 a.m. (8.30-8.45 Japanese; 8.45-9 relay BBC in English; 9-9.15, Japanese). Also replaces VLC-7 to North America from 3.10-3.45 p.m.

VLG-4, Melbourne, 11.84mc, 25.35m: Replaces VLG-3 to North America from 3.10-3.45 p.m. Joins VLC-6 to Asia from 7-8.15 p.m. Replaces VLG-3 from 1-1.45 a.m. in programme to North America with VLC-6.

VLG-9, Melbourne, 11.9mc, 25.21m: Replaces VLG-7 from 10-10.30 p.m. in programme to Batavia in Molay (10.30-11 p.m. in English to Shanghai; 11.01-11.35, French to Saigon; 11.35-midnight, in Thai to Bangkok.

Programme to Australian Forces in S.W. Pacific recently carried by VLG-4 from 7.30 till 8.15 p.m. is, I believe, withdrawn.

The MONTH'S LOGGINGS

ALL TIMES ARE EASTERN AUSTRALIAN STANDARD TIME

Pressure on space only permits of unusual Loggings or alterations in schedules or frequencies.

Readers will show a grateful consideration for others if they will notify me of any alterations. Please send reports to L. J. Keast, 23 Honiton Avenue W., Carlingford. Urgent reports, 'phone Epping 2511.

OCEANIA

Australia

VLN-9, Sydney 10.42mc, 28.78m
Heard at 3.15 p.m. (Young).
See Station Changes for several alterations in D.O.I. overseas service.

Guam

KU5Q, Guam 15.60mc, 19.23m
Heard at 3 p.m. (Young).

KU5Q, Guam 9.287mc, 32.30m
Good signal at 9.30 p.m. (Young).

New Zealand

ZLT-7, Wellington 6.715mc, 44.67m
Good at 7.15 p.m. (Young).

Philippines

WVLC, Manila 10.38mc, 28.88m
Heard at 3.15 p.m. (Young). (This looks like a new frequency.—L.J.K.)

WVLC, Manila 9.295mc, 32.28m
Good at 7.15 p.m. (Young).

AFRICA

Algeria

AFHQ, Algiers 6.04mc, 49.67m
Announces as "Voice of America in North Africa." At 8 a.m. with news in English (Gillett).

Belgian Congo

RNB, Leopoldville 9.785mc, 30.66m
Good in news at 4 p.m. (Miss Sanderson).

French Equatorial Africa

FZI, Brazzaville 9.435mc, 31.78m
This is my regular 6.30 a.m. dance music entertainment. This 50KW transmitter is normally R9 at that hour (Clack).

XGOY, Chungking 11.920mc, 25.17m
Now opens at 7 p.m. with news, closing at about 8.28. Then moves to 9.805mc. —L.J.K.

KGOY, Chungking 15.190mc, 19.75m
Heard calling KQJ, 'Frisco, on Monday, 28th May, in test transmission at 8.35 a.m. At 8.49 announced, "You are listening to the International Shortwave station, XGOY, Chungking, broadcasting on 15,190 kilocycles. We have been on the air for the last 35 minutes in test transmission with KQJ, San Francisco. We will now leave the air to come back in 10 minutes on 15,190kc, calling U.S. Forces in Pacific, and bringing latest news." Signal was quite good when calling KQJ, and their reply on 18.02mc was fair, but I could not hear XGOY when calling the Pacific. Morse beat me.—L.J.K.

XGOY, Chungking 9.805mc, 30.58m
See "New Stations."

XGOY, Chungking 7.153mc, 41.96m
Opens at 8.35 p.m. in parallel with 9.805mc (see "New Stations"). Fair signal, but morse and noise is prevalent. —L.J.K.

Great Britain

BBC, London

GRV 12.04mc, 24.92m
Very fair at 9 a.m. (Young).

GVX 11.93mc, 25.15m
Heard at 2 p.m. (Young).

GWP 9.66mc, 31.06m
O.K. at 5.15 p.m. (Young).

GRI 9.41mc, 31.88m
Very good at 2 p.m. C.B.S. programme to 1.15, then relays Big Ben and BBC Spanish transmission (Cushen).

GRS 7.065mc, 42.44m
Good at 6.30 a.m. (Young).

India

VUD-5, Delhi 17.835mc, 16.83m
Heard in afternoon now. News and P.O.W. messages 12.45 p.m. (Cushen).

VUD-9 .... 15.35mc, 19.54m
Calling the Far East with news and music at 7.30 p.m. (Miss Sanderson).

—— 9.68mc, 30.99m
"Services Broadcasting System," Delhi, heard on this frequency till closing at 11 p.m. Good signal but mixed with VLW-6 (Cushen).

UNITED STATES OF AMERICA

San Francisco unless otherwise mentioned.

KNBI 21.61mc, 13.88m
Not heard for a long time, now (Gaden).

KROU 17.78mc, 16.87m
Nice signal around 7 a.m. (Gaden).

KNBC 17.78mc, 16.87m
Heard a few times in a.m.; not as good as KRHO (Gaden). Heard until 2.45 p.m. (Cushen).

KGEX 15.21mc, 19.72m
News at noon (Miss Sanderson). Good reliable station right through from 7.15 a.m. till closing at 1.15 p.m.—L.J.K.

KNBA 15.15mc, 19.81m
Good till 2.45 p.m. (Cushen, Miss Sanderson).

KRCA 15.12mc, 19.84m
Heard till 3 p.m. (Cushen).

KWID 11.87mc, 25.27m
Was a surprise one afternoon—closed at 3. Was on the improve towards the end and would have been good in about half an hour (Gaden). (Schedule is 2.15-3 p.m.—L.J.K.)

KGEX 11.79mc, 25.44m
Very good from 5 p.m. (Gaden, Miss Sanderson, Cushen).

KCBF 11.77mc, 25.49m
Fair from 5-6.45 p.m. (Gaden, Cushen, Miss Sanderson). (Best of the 25-ers down here.—L.J.K.)

KROJ 11.74mc, 25.55m
Heard in afternoon but not as good as KGEX (Gaden, Cushen). (Has replaced 9.89 from 5-6.45 p.m.—L.J.K.).

KGEI 11.73mc, 25.58m
Blotted out by GVV at 5 p.m. (Cushen).

KRCA 11.145mc, 26.92m
Heard at fair volume in late afternoon (Gaden). Heard from 5 p.m. with KES-2. News on the hour (Cushen).

KWV 10.84mc, 27.68m
Good at 8 p.m. (Miss Sanderson). (Yes, is a surprisingly good signal and continues till 11 p.m.—L.J.K.)

KWIX 9.85mc, 30.44m
Best of the 'Friscians in late afternoon (Gaden).

KCBA 9.75mc, 30.77m
Very good from 5 p.m. (Gaden, Miss Sanderson).

KRHO 6.12mc, 49.02m
Back here again after being on 9.59 m.c. from 18-25th April (Cushen).

U.S.A.

Other than 'Frisco

WRUW, Boston 17.75mc, 16.90m
Fair from 9.30-11.15 a.m. (Cushen).

WGEO, New York 15.33mc, 19.57m
Very good at night (Gaden).

WNRE, New York 15.28mc, 19.63m
Fair at night (Gaden). Reported testing at 4.30 p.m. (Cushen).

WLWS, Cincinnati 15.20mc, 19.73m
Very good at night (Gaden).

WOOC, New York 15.19mc, 19.75m
Opens at 7.30 a.m. (Cushen). (Think you will find they are on pretty well all night and from a little after 6 a.m. Very often ruin KROJ right through till KROJ closes at 7.45.—L.J.K.)

WOOW, New York 11.87mc, 25.27m
Heard at 7.30 a.m. (Cushen). (Think closes at 9.15, then opens at 9.30 on 11.145mc, 26.92m.—L.J.K.)

WGEA, New York 11.847mc, 25.33m
Good at night (Miss Sanderson, Gaden).

WLWL-1, Cincinnati 11.810mc, 25.40m
Closes at 9.15 a.m. (Gaden).

WOOW, New York 11.145mc, 26.92m
Splendid reception at 11 a.m. (Gaden).

WNBI, New York 9.67mc, 31.02m
Opens at 8.45 p.m. (Cushen).

WNRA, New York 9.85mc, 30.44m
Puts in an R7 signal when KWIX closes at 8.45 p.m. In mornings good till about 10 o'clock, then fades out and comes back again at 1 p.m. with an R3-4 signal (Clack).

WOOC, New York 7.82mc, 38.36m
Opens well at 9.30 a.m. (Gaden).

WRUW, Boston 6.04mc, 49.66m
Heard opening at 11.30 a.m.—very poor (Cushen). (V.P. in N.Z. means N.G. in N.S.W.—L.J.K.)

SOUTH AMERICA

Brazil

PRL-8, Rio de Janiero, 11.715mc, 25.61m
Is very good strength some mornings, announcing as "This is the Voice of Brazil coming to you from Rio de Janiero" in their English transmission between 5.30 and 6.10 a.m. (Gillett, Cushen).

PRL-7, Rio de Janiero, 9.72mc, 30.86m
Heard till 2 p.m. on Sunday at very fair strength with usual Spanish programme and announcements (Cushen).

ZYC-8, Rio de Janiero, 9.61mc, 31.22m Heard till after 2 p.m. at excellent strength (Cushen). (GRY, here, upsets things a bit.—L.J.K.)

Ecuador

HC2AK, Guayaquil .... 9.42mc, 31.82m Great at 2 p.m. (Cushen).

Peru

OAX5C, Ica .... 9.785mc, 30.66m Good signal at 1 p.m. All Spanish (Cushen). (Note change of frequency—was on 9.815mc.—L.J.K.)

U.S.S.R.

Moscow unless otherwise mentioned.

—— .... 11.63mc, 25.79m News in English at 9.40 p.m. (Miss Sanderson).

—— .... 15.23mc, 19.7m News in English at 8.47 a.m.—L.J.K.

—— .... 12.26mc, 24.47m News in English at 9.20 p.m.—L.J.K.

—— .... 9.56mc, 31.36m News and Review of International Affairs at 10 p.m. (Miss Sanderson, Young).

—— .... 8.05mc, 37.27m Fair at 6.30 a.m. (Young).

—— .... 6.70mc, 44.70m Fair at 6.30 a.m. (Young).

MISCELLANEOUS

Canada

CHTA, Sackville .... 15.22mc, 19.7m Very patchy at night—not in same street as most of the Yanks (Gaden). Heard with news and music at 8.45 p.m. (Miss Sanderson, Gillett).

CKXA, Sackville .... 11.705mc, 25.63m Heard closing at 8 a.m. with nice signal—French and English announcements. This one should be a winner (Gaden). Heard till 8 a.m., seems to have dropped German broadcasts. Heard fine VE Day programme (Cushen). Heard opening at 6.10 a.m. (Gillett).

CBFX, Montreal .... 9.63mc, 31.15m Surprised to hear this chap at 7 p.m.—reasonably good signal, better later, if and when in the clear (Gaden, Gillett). Morning devotion and news at 10.30 p.m. (Miss Sanderson).

CBRX, Vancouver .... 6.16mc, 48.70m Despite weak signal, can be copied at 8 p.m. (Gillett).

VE9AI, Edmonton .... 6.005mc, 49.95m Being heard at midnight with news (Cushen).

CFVP, Calgary .... 6.03mc, 49.73m Relays CFCN, "The Voice of the Prairie," at 11 p.m. (Cushen).

France

Radio Paris .... 11.71mc, 25.62m Heard at 3.45 a.m. with usual French programme (Gillett).

Iran

EQC, Teheran .... 9.68mc, 30.99m At 4.30 a.m. announced, "Good evening, everyone. This is Teheran calling." A few items of local news followed, after which a commentary. Then uninterrupted music until 5.30, when station closed with clock chimes (Gillett).

Luxembourg

Radio Luxembourg .... 15.105mc, 19.86m Has been logged about 9.30 p.m., relaying BBC foreign programmes, and at 10.30 BBC news in English (Gillett).

'FRISCO AS I SEE IT

This list has been compiled from my own observations and air-mail material that has reached me. It is believed correct at time of compilation—June 2nd, 1945.

All Times are Eastern Australian Standard

Callsign	Freq. (m.c.)	Wavelength	Time on the Air
KNBX	21.61	13.88	Idle.
KCBF	17.85	16.81	7 a.m.-1.45 p.m.
KRHO	17.80	16.85	9-4.55 p.m.
KROU	17.78	16.87	6-8 a.m.
KNBA	17.78	16.87	11.20 a.m.-2,45 p.m.
KROJ	17.77	16.88	4-5.45 a.m.; 8-10.45 a.m. (Mon. from 9 a.m.)
KROJ	17.76	16.89	4-5.45 a.m.; 11 a.m.-1.45 p.m.
KWIX	17.76	16.89	**Midnight-6 a.m.**
KWID	17.76	16.89	**6-10.30 a.m.**
KNBI	15.34	19.56	**1 a.m.-3 p.m.**
KWIX	15.29	19.62	6.25-8.25 a.m.; 9.45 a.m.-1 p.m.
KCBA	15.27	19.65	
KNBC	15.24	19.68	6-11.05 a.m.
KGEX	15.21	19.72	7.15 a.m.-1.15 p.m.
KROJ	15.19	19.75	6-7.45 a.m. (Mondays till 8.45).
KNBI	15.15	19.81	3-4.45 p.m.
KNBI	15.15	19.81	11.20 a.m.-2.45 p.m.
KGEX	15.13	19.83	1-7 a.m.
KGEI	15.13	19.83	**7 a.m.-3.15 p.m.**
KRCQ	15.12	19.84	2-5 a.m.
KRCA	15.12	19.84	9 a.m.-3 p.m.
KNBA	13.05	22.98	6-11.05 a.m.; 3-4.45 p.m.
KNBA	13.05	22.98	5-6.45 p.m.
KNBX	11.89	25.23	
KWID	11.87	25.27	2.15-3 p.m.
KGEX	11.79	25.44	5-7.45 p.m.
KCBA	11.77	25.49	**7 a.m.-1.45 p.m.; 2-4 p.m.**
KCBF	11.77	25.49	**7 a.m.-1.45 p.m.; 5-6.45 p.m.**
KROJ	11.74	25.55	5-6.45 p.m.; 2-3.45 a.m.
KGEI	11.73	25.58	3.20-6.45 p.m.
KRCA	11.14	26.92	5 p.m.-1.15 a.m.; 1.30-5 a.m.
KWV	10.84	27.68	6-11 p.m.
KES-3	10.62	28.25	9 a.m.-3 p.m.
KROJ	9.89	30.31	2-4.45 p.m.
KWIX	9.85	30.44	5.30-6.30 p.m.; **7-8.45 p.m.**
KROU	9.85	30.44	9 p.m.-12.45 a.m.
KCBA	9.75	30.77	5-6.45 p.m.
KCBF	9.75	30.77	**2-4 p.m.;** 7 p.m.-3 a.m.
KNBX	9.70	30.93	7 p.m.-12.40 a.m.
KNBC	9.70	30.93	1-2 a.m.
KNBI	9.70	30.93	5-6.45 p.m.
KWID	9.57	31.35	**10.45 a.m.-2 p.m.; 5.45-6.45 p.m.** 7 p.m.-2 a.m.; 2.30-4 a.m.
KGEI	9.55	31.41	7 p.m.-1.15 a.m.
KNBI	9.49	31.61	7 p.m.-12.45 a.m.
KES-2	8.93	33.58	5 p.m.-1.15 a.m.; 1.30-2 a.m.
KNBA	7.805	38.43	1-2 a.m.
KCBA	7.57	39.60	7 p.m.-3 a.m.
KNBA	7.565	39.66	7 p.m.-12.45 a.m.
KNBX	7.56	39.66	Idle.
KGEX	7.25	41.38	8 p.m.-12.45 a.m.
KGEI	7.25	41.38	Idle.
KWIX	7.23	41.49	9 p.m.-11.45 p.m.
KCBA	6.17	48.62	Idle.
KRHO	*6.12	49.02	5.15 p.m.-1.15 a.m.; 1.30-5 a.m.
KROJ	6.105	49.18	7-11 p.m.

Station times in bold faced type are beamed to Latin Americas by United Network.

* Situated in Honolulu.

L. J. KEAST,
Carlingford.

2nd June, 1945

Poland

Radio Lublin .... 6.115mc, 49.05m Heard again after an absence of about 3 months. Signal is good, with music and foreign languages at 3.15 a.m. (Gillett).

Spain

Radio National Espania, Madrid 9.43mc, 31.82m Heard at 2.15 a.m. quite well, using English (Gillett).

Sweden

SDB-2, Stockholm .... 10.775mc, 27.83m Heard in relay with SBU, 31.46m, till after 7.30 a.m. with musical programme (Gillett).

Switzerland

HER-5, Berne .... **11.96mc, 25.08m** Very good on Tuesdays and Saturdays in special broadcasts to Australia from 3-4.30 p.m. Tuesday, English; Saturday, national lauguages.—L.J.K.

KEK-3, Berne .... 7.38mc, 40.65m Heard in French 6-6.25 a.m. (Cushen). (Hour later due to Summer time.)

Yugoslavia

Radio Belgrade .... 9.507mc, 31.56m News in English at 5.15 p.m.—off at 5.30 p.m.—good signal (Cushen). Heard opening at 1.30 a.m. (Gillett).

Radio Belgrade .... 6.10mc, 49.18m Have heard occasionally at 3.45 a.m. (Gillett). (This is old YUB spot and between programmes an interval signal of four notes is heard.)

Speedy Query Service

Conducted under the personal supervision of A. G. Hull

H.S.C. (Pacific) wants plans for building a portable set of which a full kit of parts is available.

A.—Sorry, but there is no such thing as a kit of parts these days. The manufacture and use of radio components is under the control of the Radio and Signal Supply Directorate, Ministry of Munitions. Components are only supposed to be used for the construction of equipment for the Forces or for the maintenance of existing receivers. Some parts are readily available for replacement purposes, but items such as metal bases, gang condensers, and loud-speakers are under strict control.

* * *

P.E.P. (Torrensville, S.A.) has built an amplifier using Radiotron circuit A504, with a Rola G12 on a yard square baffle board, but is not satisfied with the low note response, which, he says, "if the outfit is operated loud enough to rattle the roof, the lows do come to life, but at lower volumes it seems that some sort of loading horn is really essential."

A.—We cannot see any reason why the outfit should be short on low notes, apart from the normal way in which all amplifiers tend to sound better at moderate to high volume levels. You have to have power to reproduce the thumps and that is all there is to it. A properly designed loading horn would tend to flatten out the normal low note resonance of the speaker and would give you an impression of still less low-note response. A poorly-designed horn would give you a greater low note resonance, but we doubt if this is going to prove satisfactory. We feel inclined to doubt your statement that the pick-up shows plenty of bass. Normally the Zephyr is fairly high-pitched unless using a 1 megohm volume control and care is taken to avoid shunting this loading in any way, such as with long input leads or leads which are encased in metal shielding. Then, of course, there is the matter of recordings; are you sure the lows are on the records? This seems to be one case where an ordinary "condenser across the speaker" type of tone control could be handy if used intelligently.

* * *

D.C. (A.I.F.) wants a circuit for a modulated oscillator using two A609 type valves. He also asks, "Is there any advantage in using three i.f. transformers with an r.f. stage ahead of the oscillator, or could two sensitive i.f. stages be best?"

A.—Sorry, but there is nothing available in back numbers with a circuit to suit you. With regard to the last question, we presume you mean three i.f. stages, not three i.f. transformers, as the latter would be used with two i.f. stages. For special purposes, such as extremely sensitive and selective communications-type receivers it would be possible to design a set with three i.f. stages, keeping the gain down on each stage and allowing for sharp selectivity, but with a flat-topped characteristic, so that the overall performance would be better than normal with two i.f. stages, but it is a matter of fine points. For normal dual-wave sets it is possible to get ample selectivity and sensitivity with a single i.f. stage.

* * *

A.C. (Castlemaine) points out that in the articles on the cathode follower we did not give the value of the centre-tapped resistor across the filament.

A.—This can be any value from 25 to 100 ohms, or you can use the centre-tapping on the terminal strip of the power transformer if one is provided for the filament winding. The bias resistor value will depend on the actual resistance of the speaker transformer winding, the two resistances in series need to make up something between 350 and 750 ohms in all.

* * *

R.C.D. (Grafton) and others, enquiring about further data on amplifiers using the cathode follower system.

A.—No, so far we have not been able to go any further with these amplifiers, the problem being to get a satisfactory type of audio transformer, with a high ratio step-up and the right characteristics. There does not seem to be any chance of these being placed on the market until things get back to normal. A thought is to use an ordinary amplifier to drive a pair of cathode-coupled valves, practically considering these two as simply a form of coupling between the amplifier and the speaker. Even so, this arrangement would call for a special audio transformer. As mentioned in the original articles on the subject, the output valves need a signal input of about 300 volts, and there is no easy way of getting this signal. oLt's more will be heard of cathode-couplers later.

* * *

J.H.P. (Goodwood, S.A.) wants transit gears for a Presto cutting head. Can any reader help?

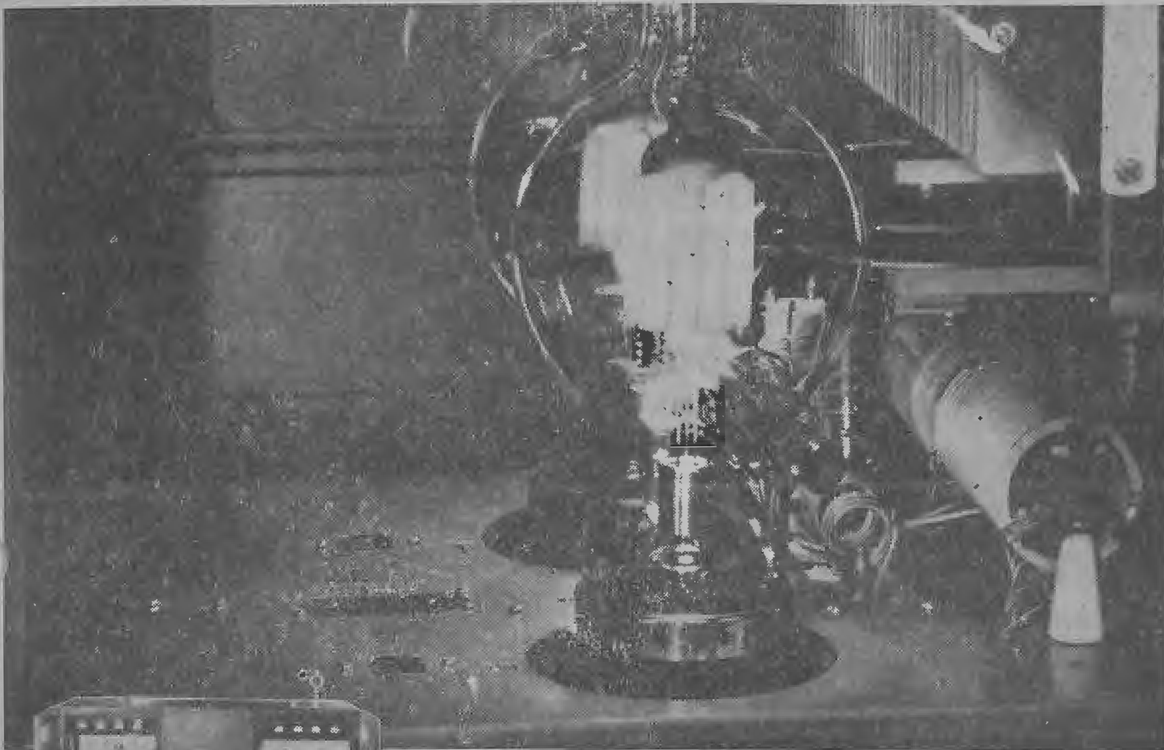
REFLEX

(Continued)

come immediately apparent.

The modulated i.f. signal from coil 1 is applied directly between grid and cathode. The amplified output from coil 2 is detected at the diode and the a.f. demodulation component is applied between grid and cathode via the coupling condensor C, and gives an amplified voltage across the resistor in the anode load circuit. The a.f. is not affected by any of the i.f. components in the circuit, and the performance is exactly the same as if two separate amplifiers were used. This circuit may provide the solution to many problems in these days of hard-to-get components. The other diode is available for A.V.C. if it is required.

Two points are worth noting. Firstly, the reflexted amplifier must be the final i.f. amplifier in the receiver. Secondly, a tiny a.f. voltage is developed across the cathode bias-bypass combination; and this, being between grid and cathode, gives rise to a little audible signal in the speaker even when the volume control is turned completely off. This "minimum volume" defect is generally negligibly small and is entirely eliminated, of course, if a gain control is used before the reflexed stage instead of the volume control as shown.



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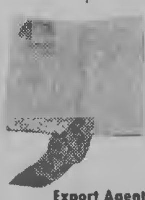

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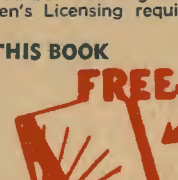

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