Rejecting Whistles—

Voltage with source at zero beat, which is background noise = V_B.

True output at filter frequency = $\sqrt{V_F^2 - V_B^2}$.

Note that if $V_F^2 = 1$V and $V_B = 0.95$ V, we have $V_F^2 = 1$, $V_B^2 = 0.9$; hence (True volts)$^2 = 0.1$, and true volts = about 0.3. In other words, if the true voltage is less than about one-third the total, it is not measurable with any accuracy. Conversely, if the total voltage is more than three times the background, the correction is negligible, and the total can be taken as the true output voltage.

Lastly, as the various additions to the circuit will affect the response of the amplifier, it is advisable to make each measurement by switching in and out the filter under test and plotting the actual drop in output thus found.

The filter used for the following tests had two small bakelite-dielectric condensers ganged up, and a smallish dust-cored coil measuring 1⅝in. diam. and 1⅛in. long. This was wound in three sections, two being L2 and one L4. No attempt at screening or shielding was made, and all parts of curves below 40 db. drop are shown dotted, as readings were uncertain. It is believed that in most cases the "cut" was 50 to 60 db.

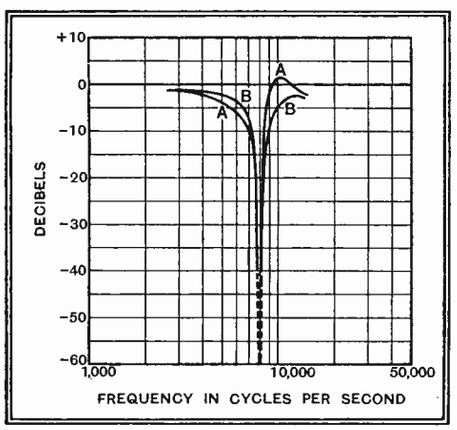

Fig. 10.—The effect of output load on the balance filter.

Fig. 10 shows the effect of output load. For curve A the filter was working into a 0.25-megohm grid leak; for curve B into a loaded AF transformer which put a load of about 10,000 ohms (besides inductance and capacity) on the filter. It will be seen that there is surprisingly little difference in performance.

Fig. 11 shows the effect of input load, and it is obvious that this is much more important. To emphasise the differences, these curves were taken with the filter tuned to a low frequency (7 kc/s) and working into 0.25 megohm as output load. For curve A the total input load was 2,500 ohms; for B 10,000 ohms, and for C 20,000 ohms. Curve A of Fig. 10 was for about 6,000 ohms, the input there being a 9,000-ohm valve with 15,000-ohm coupling resistor.

Lastly, Fig. 12 shows the effect of changing the filtered frequency, the conditions in each case being about 6,000 ohms input and transformer output load as for curve B of Fig. 10.

Two conclusions may be drawn from these curves. First, the filter always gives an exceptionally deep "cut." In most of the cases shown the actual output voltage at the critical frequency was adjusted to 100 without filter and the output with filter varied from 0.1 to 0.5 volt; in no case was the resulting signal audible above the background.

Secondly, there is no necessity for critical impedance-matching. Using the coils and condensers described, output impedance matters little so long as it exceeds, say, 10,000 ohms, and it need not be a pure resistance; input resistance should not exceed 10,000 ohms.

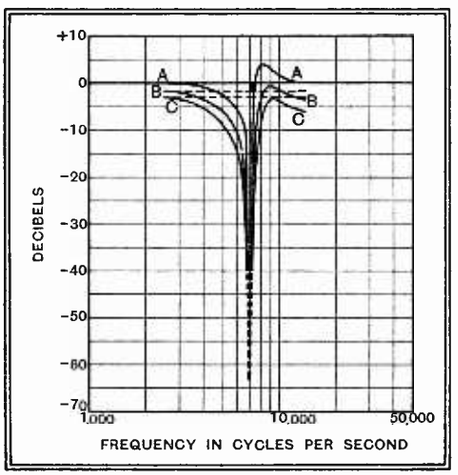

Fig. 11.—Showing the more drastic effect of input load variations (compare with Fig. 10).

It is, however, desirable to use a coil designed for the circuit[1]. Any old coil of the right inductance will give a deep cut; but if its losses are very high or the coupling between its two parts is too weak, the rest of the curve may be unsatisfactory.

APPENDIX I.

With R1 and R2 as in Fig. 3,

$$R' = \frac{R_a R_1}{R_a + R_1} + R_2$$

where R_a is the anode impedance of V.

Call X_0 the reactance of the coil at the tuned frequency f_0 ($X_0 = 2\pi f_0 L$)

Then, approximately,

(1) Depth of cut $= \frac{RR'}{X_0^2} = \frac{RR'}{4\pi^2 f_0^2 L^2}$

(2) There is 3 db. loss at p cycles off tune, where

$$p = \frac{\pi f^2 L}{R'}, \text{ or } \frac{p}{f_0} = \frac{X_0}{2R'}$$

In practice, the cut is controlled by shunting the grid-leak, as for the acceptor filter, to give the cut required at the moment.

There is, however, another method of control of the rejector which makes it often more convenient to use. This is shown in Fig. 4. In effect, it makes the coil into a transformer; the tuned frequency and losses are practically unaffected, but the matching to the rest of the circuit is controlled by the tap switch. When the rejector is used in a resistance coupled circuit, as in Fig. 3, the circuit resistance is usually too high, and a variable shunt across the grid leak is the best control. But for use in a transformer-coupled stage the tap switch of Fig. 4 is usually preferable.

[1] It is understood that separate parts and complete filters to the author's design will shortly be on sale.—Ed.

APPENDIX II.

Baggally shows that for minimum output we have the following condition, where R is the loss resistance of the acceptor:

$$R = R'_a/\mu',$$

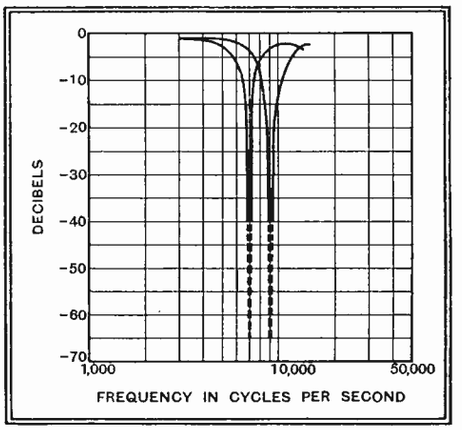

Fig. 12.—Effect of changing the filtered frequency.

R'_a and μ' being the *effective* anode impedance and magnification of the valve. Since the effective conductivity of the valve is μ'/R'_a we have

$RG' = 1000$, with G' in mA/volt.

Hence for a good modern valve of G = 2, or thereabouts, R cannot exceed 500 ohms for balance, which means a very good coil. If R is higher than this, G' must be reduced, say by artifically raising R_a by means of resistance added between the valve anode and the rest of the circuit. But since the effective mag. of the whole stage depends on G', one has to lower this, which is undesirable and may get one into other difficulties.

CLUB NEWS

The Ilford and District Radio Society

This old-established radio society has now entered upon its sixteenth year and is making a special feature of television and ultra-short-wave work. Those interested are welcomed at the weekly meetings, which are held at 8 p.m. on Thursdays at St. Alban's Church Room, Albert Road, Ilford. On Thursday next (December 10th) a demonstration of a new receiver will be given by Mr. H. T. Stott, A.M.I.R.E., of Bulgin's. Full details concerning the society can be obtained from the Hon. Secretary, at 44, Trelawney Road, Barkingside, Ilford.

The Croydon Radio Society

An interesting lantern lecture on cathode-ray tubes was recently given by Mr. A. F. Hollins, of the Mullard Wireless Service Co. A large number of questions, including television problems, were dealt with. On Tuesday, December 15th, at 8 p.m., Mr. H. G. Salter will conclude the first half of the winter session with another of his ever-popular musical programmes. The Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, South Croydon, will be pleased to give full details of the society's activities to enquirers.

The Radio, Physical and Television Society

Several interesting lectures have been given recently, including those on the cathode-ray oscillograph by Dr. C. G. Lemon, short-wave receivers by Mr. J. G. Hobbs, A.M.I.R.E. (G2QG), and bacteriological methods by Lt.-Col. C. G. Coppinger, R.A.M.C. Readers are cordially invited to attend the meetings, which are held at 8 p.m. on Fridays at 72a, North End Road, West Kensington, W.14. Full details of future lectures may be had from the Hon. Secretary, at 48, Fitzjames Avenue, W.14.

Current Topics

NEWS OF THE WEEK IN BRIEF REVIEW

A Noteworthy Anniversary

TEN years have passed by since the opening of the first Empire beam service. The first circuit linked England and Canada, the stations being Bodmin and Bridgwater at the home end and Yamachiche and Drummondville in Canada. This was followed by links to the other parts of the Empire. The success of the beam service led to the Imperial Wireless and Cable Conference and the subsequent amalgamation of these two services.

Arabian Nights Entertainments

THE Rome short-wave station which works on 25.40 metres now transmits certain of its news services in Arabic for the benefit of Italy's Moslem subjects. At these periods Arabian music is also transmitted. At present these special transmissions are given on four days a week only, but may be extended later.

Poland and Foreign Languages

IT is reported that the foreign language lessons which have been such a feature of certain Polish stations are to be discontinued on the ground that listeners are not profiting by them to the extent which was hoped. It is not stated whether or not the authorities have been influenced by the fact that increasing knowledge of foreign languages means increasing ability to imbibe foreign culture by listening to stations in neighbouring countries.

Europe Leads America

INTERESTING figures concerning the production of sets in the U.S.A. and Canada show that in the past six months of this year the former country produced $2\frac{3}{4}$ million sets valued at 10 million sterling. Canadian production figures for the corresponding period are not yet available, but during the whole of 1935 Canada produced rather less than a quarter of a million sets valued at some $3\frac{1}{2}$ million sterling.

In view of the above figures it is interesting to recall that a few years ago the United States possessed more broadcast receivers and listeners than the rest of the world put together. Nowadays, however, Europe is in front of America in the number of radio-equipped homes, the respective figures being estimated at 23 million for the U.S.A. and 25 million for Europe, excluding Russia.

An Ambitious Programme

CANADA'S new Broadcasting Commission is to make a thorough investigation into broadcasting conditions in the Dominion, and it is expected that several new stations will be built and others increased in power. It is a foregone conclusion that more attention is to be paid to broadcasting in French for the benefit of Canada's French-speaking population.

St. Bernard Up to Date

IT has been decided to equip all the refuges in the Italian part of the Alps with transmitting as well as receiving sets. Each life-saving expedition which sets out from the various refuges will be equipped with a portable transmitter and receiver so that it may keep in touch with its base. The refuge stations themselves will be able to communicate with special stations in the valleys in those cases where landline facilities are not available or have broken down through bad weather.

Jewish National Station?

IT is reported from Central Europe that plans are afoot to hire or build a transmitting station either in Switzerland or Czechslovakia for the purpose of spreading Jewish culture. In some quarters it is stated that the main object is the counteracting of anti-Semitic propaganda from certain other European stations.

Wireless Amateurs' Trophy

WILLIAM S. PALEY, President of the Columbia Broadcasting System, has been so struck by the useful service which amateur transmitters have rendered to the community, such as during the disastrous floods in America early this year, that he has presented a trophy to be awarded annually to the amateur adjudged to have performed, by means of radio, the most meritorious service to the community during the preceding twelve months. Seven sculptors have been invited to submit suitable designs for the trophy, which will be in the permanent custody of the American Radio Relay League. The annual winner will have his name engraved on it and will also receive a small replica. The first award, covering the year 1936, is expected to be made on March 15th next. Five famous men, headed by Admiral Grayson, have been selected to serve on the Board of Award.

Not many countries can boast of having a woman engineer on the staff of their broadcasting organisation. Here is Miss Klara Dalland in the control room of the Oslo station with Mr. Gythfeldt, the chief controlling engineer. Miss Dalland has just received an appointment at Norwegian broadcasting headquarters after serving for a period on the engineering staff of the Vädso station.

Wireless Aids for Aircraft

ALL South African main airports are soon to be equipped with the latest type of wireless direction-finding and blind-landing apparatus. Details of the new equipment, which includes the Lorenz apparatus were discussed at a recent meeting of the South African Radio Relay League. The decision to equip the airports in this manner has been taken as a result of extensive experimental work that has been carried out at the Cape Town Airport.

British Sound Recording Association

THIS society has now been firmly established, and all who are interested in home or professional recording are invited to obtain full particulars from the Hon. Secretary at 7, Ernest Close, Beckenham, Kent. The subscription is purely nominal, and for those who live too far away to be able to attend the regular meetings a scheme of associate membership has been arranged. The Association meets at 44, Valley Road, Shortlands, Kent, at 8.30 p.m. on alternate Thursdays.

A full programme of lectures, demonstrations, and visits to places of interest covering all phases of sound recording is being arranged for the winter months. At recent meetings lectures have been given by well-known experts on sound recording on discs and sound recording on films.

Australian S.W. Transmission

DURING December, Sydney VK2ME will transmit on 9,590 kc/s (31.28 metres) every Sunday at the following times, all G.M.T.: 6 a.m.—8 a.m., 10 a.m.—4 p.m.

During the same period Melbourne VK3ME will transmit on 9,510 kc/s (31.55 metres) daily from Monday to Saturday from 9 a.m. to noon (G.M.T.).

I.E.E. Wireless Section

THERE will be a special meeting to-day (December 4th) at 7 p.m., when a paper, illustrated by demonstrations, will be read by Messrs. E. A. Speight, Ph.D., and O. W. Gill on the Post Office Speaking Clock.

The Radio Society of Great Britain

THE amateur movement in this country is in a remarkably healthy state if one can judge by the state of the finances of the Radio Society of Great Britain. Subscriptions which total £2,270 are £306 higher than last year. The balance of income over expenditure is £315.

An Engineers' Meeting

DISAPPOINTMENT with the alleged inactivity of the Institute of Radio Engineers has prompted Mr. C. W. Watson and other radio engineers, stated to be members of the Institute, to call a meeting to discuss the matter.

The meeting will take place at the Bedford Room, Hotel Russell, London, at 4 p.m. on December 7th.

Anyone wishing to attend should communicate with Mr. Watson at 22, St. John Maddermarket, Norwich.

The Institute of Radio Engineers referred to has no connection with the well-known American Institute of the same name.

Sound Recording

PART II.

SUB-STANDARD FILMS: MECHANICAL RECORDING: GENERAL CONCLUSIONS

By S. R. EADE, A.M.I.E.E. (Of the Research Dept., B.T.H. Co., Rugby)

AFTER discussing methods of sound recording that are adaptable to home or amateur use, the author goes on to explore the possibilities of sound-on-film (sub-standard size) gramophone records and other specialised systems of mechanical recording

SOUND film of 16 mm. width is now well known and is capable of giving a satisfactory quality of reproduction. The reasons why it does not meet the home recording need can be summed up as expense and technical complexity of the apparatus and processing operation. It is, however, of great interest technically and is worth studying in some detail.

The major fields of usefulness of 16 mm. sound-on-film are educational, publicity, entertainment, where the expense of its full-sized brother is not justified, and, to a much less extent, home entertainment. This latter field will be much more fully developed when comprehensive libraries of films become generally available. Means for recording one's own talkies in this medium are at present, and likely to remain, outside the financial resources of the average amateur.

The great majority of 16 mm. sound films are made by optical reduction or re-recording processes from 35 mm. films. Two or three cameras are, however, available for direct sound and picture recording on 16 mm. One of these is of particular interest because the sound record is made by acoustic-photographic means without an intervening electrical link. The operator speaks directly into the camera, and so the range of sound pick-up is of course limited.

Any single-film system of this type

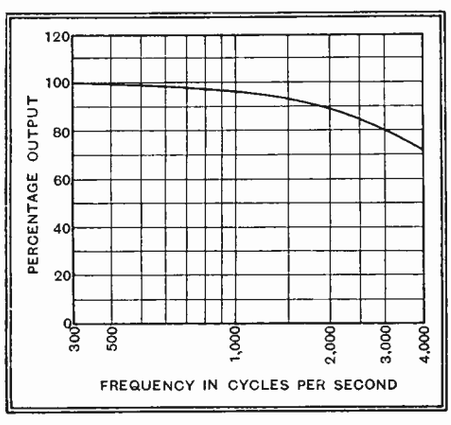

Fig. 7.—Attenuation due to finite slit width in 16 mm. recording.

suffers from the same difficulty as that mentioned for 35 mm. film. That is to say, the photographically fast emulsion required for obtaining the picture negative does not provide sufficient resolving power to obtain the required definition on the sound record.

It is standard practice to run 16 mm. sound films at the same frame frequency as 35 mm. prints, that is, twenty-four pictures per second. This fact allows direct optical reduction of the picture from 35 mm. negatives. Now, because the film width is 16 mm. compared with 35 mm. for its full-sized brother, and because a picture frame proportion of 3 to 4 is preserved, the linear speed of 16 mm. film is approx. $\frac{2}{5}$ that of 35 mm.

The attenuation which occurs at a frequency of 10,000 cycles per second on 35 mm. records, due to finite slit width and photographic considerations, will occur in equal measure at only 4,000 cycles per second on 16 mm. records. This attenuation is a serious problem and means that very accurate control is necessary to obtain satisfactory sound quality. For the same reason it is preferable to make a 16 mm. print by optical reduction of the sound track from a 35 mm. negative rather than to re-record or record the sound

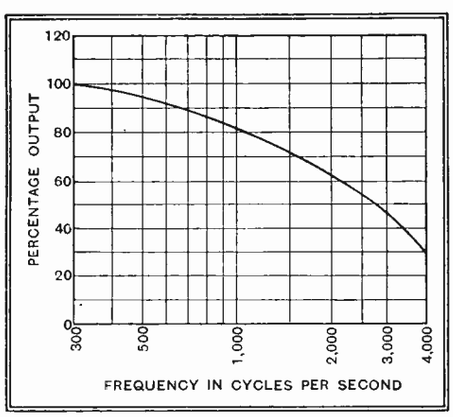

Fig. 8.—Losses due to lack of resolving power will increase inversely with the lower linear speed of 16 m.m. film.

directly on 16 mm. stock. This point will be further elucidated later in this article.

Volume range, on the other hand, is not so seriously curtailed, because a modulation depth of 0.060in. is maintained, compared with 0.075in. for 35 mm. variable area. A track of 0.060in. amplitude is obtained by utilising only one row of sprocket holes and placing the track where the second row would normally be on 16 mm. silent film. An increase in effective background noise is, however, inherent, and this causes a further slight decrease in volume range.

With regard to direct recording on 16 mm. film, if we consider a two-channel system (that is to say, separate cameras and films for sound and picture), the overall result to be expected can be computed from the figures we have quoted in the 35 mm. case. In the first place the apparatus must be as accurately made and operated as in the 35 mm. system, and the only difference will be that we use 16 mm. film at a speed of 36ft. per minute. If we assume a recording slit width of 0.0005in. as the lowest reasonable size, the attenuation due to this alone will be as shown in Fig. 7. Now the losses due to lack of resolving power in the emulsion at any frequency will be increased in-

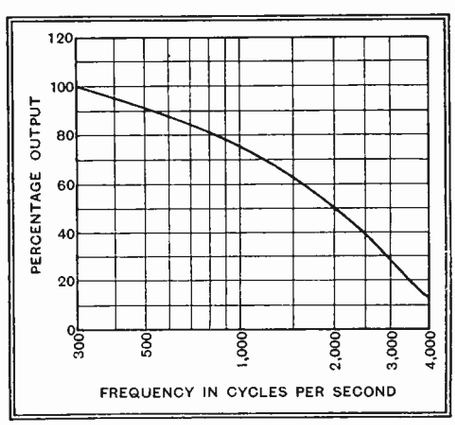

Fig. 9.—Overall high-note attenuation of the printed sub-standard film.

versely as the lowered linear speed, and will be as shown in Fig. 8.

If now we make a print by contact from the negative so obtained, a further loss will be introduced which will give a frequency characteristic for the final record approximately as shown in Fig. 9. Comparison should be made with Fig. 6 in last week's instalment, which relates to 35 mm. recording, to appreciate the losses involved. In addition the volume range will have been lowered by about 8 db., chiefly due to the effective noise level being increased.

Any method of re-recording in which a 35 mm. print is reproduced and the electrical output fed to a camera to record a 16 mm. negative will, of course, suffer from similar losses. It is often suggested that electrical compensation may be introduced to improve the frequency characteristic, but this is not a satisfactory solution, as it can only increase the track ampli-

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tude at the higher frequencies. The mean recording level must therefore be lowered, with a consequent proportional increase in noise ratio, and the harmonic content at the higher frequencies due to lack of resolving power causing valley fogging will be so great that the remedy will probably be more unpleasant than the disease.

With a re-recording process the camera will normally make a 16 mm. negative, and this must be contact-printed to form a 16 mm. positive. The process will introduce another loss in frequency characteristic.

Apparatus has been developed and is in commercial use which will print a 16 mm. track by continuous optical reduction from a 35 mm. sound negative. Machines of this type have required concentrated study and development over a long period owing to the mechanical difficulty of propelling two separate films at their correct relative speeds in the ratio of 5 to 2. The optical system between the two films is of asymmetrical type and forms a track image reduced in linear ratio of 5 to 2 but a transverse ratio of 70 to 65.

In this system of making a 16 mm. print there are no losses in the process due to finite slit width, and the printing losses are small compared with those obtaining with 16 mm. contact printing.

With the optical reduction method the processing conditions are such that small improvements can be made in rather unexpected places. In the first place it must be realised that the conditions obtaining for 16 mm. sound tracks are not the same as the optimum conditions for 35 mm.

In establishing optimum processing conditions in either case, the ultimate test must be an aural one, and the same sound frequencies apply in each case. The conditions affecting emulsion resolution are, however, different, owing to the lower linear speed.

Overall Characteristics

In general this means that the 16 mm. unmodulated print track density is kept lower than is normal for 35 mm. work. In the case of variable density recording, this results in an increased output of 8 db., and in the case of variable area tracks the output can be kept up proportionately to the 35 mm. case owing to non-proportional contrast introduced by the printer coefficient of the optical printer.

Summing up, we can say that with a 16 mm. print made by optical reduction a frequency characteristic similar to Fig. 10 is obtainable. Direct recording to 16 mm. or a re-recording process will give a slightly inferior result.

Signal-to-noise ratio will be rather worse than for 35 mm. work owing to the general lowering of the total signal output caused by the curtailed frequency characteristic. Volume range will be slightly lowered by the smaller track width and still more by the increased noise level, but this is partly counterbalanced by gains which can be made in the processing operation. Volume expansion methods can again be used to effect an improvement.

Turning to the question of mechanically recorded sound, the system with which we are most familiar is, of course, the conventional gramophone disc. This has a laterally modulated groove which traces a spiral when no sound is present, but traces the wave form of the recorded sound in the plane of the disc about the unmodulated spiral as axis. The discs

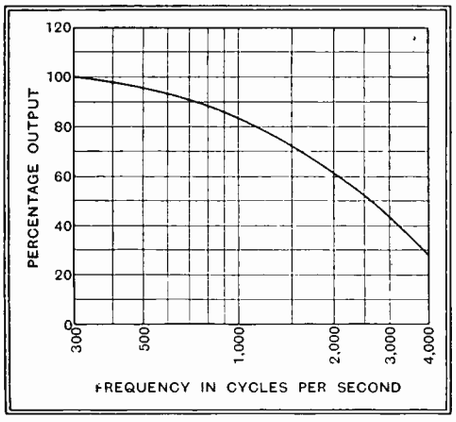

Fig. 10.—Approximate frequency characteristics that be obtained with optical reduction.

normally rotate at 78 RPM, and so for a 12in. diameter record the linear track speed progressively decreases from about 46in. per second on the outer diameter to 17in. per second on the inside.

The recording of a lateral-cut record is usually done with a chisel-shaped stylus having a flat front face with "vee"-shaped sides at an angle of 90°, tapering to a rounded base of approximately 0.002-in. radius. The groove is cut to a depth of from 0.002in. to 0.003in., and so the width of the track on the surface of the record is approximately 0.006 to 0.007in. It is usual to cut from 90 to 100 tracks to the inch, and so the available modulation amplitude is 0.002in. The maximum track amplitude, in conjunction with the inherent background noise or "scratch," determines the volume range available.

The original record is cut into soft wax, which is afterwards given a metal coating either by brushing on a conducting layer of graphite and then copper plating, or producing a metal layer directly by cathode sputtering. From this original "positive" is made a metal inverse, and from the latter the final commercial discs are pressed in one of a number of synthetic compounds.

As previously mentioned, a chisel-shaped stylus is used to cut the original wax, and this can be ground and maintained to fine limits. Such a stylus would, however, be prohibitively expensive and difficult to handle for reproducing, and so a round tapered needle with a rounded end is used. In order that the needle shall fit the groove as well as may be, it is normal practice to include a mild abrasive in the compounding of the disc material. After the first few turns this has something of the desired effect, but in itself gives rise to a considerable portion of the resulting background noise. The remainder of the ground noise is chiefly produced by small random irregularities in the disc material.

A second limiting feature in this connection is that the track made by the recording stylus is not of constant width measured transversely to the direction of travel of the stylus at any instant.

Thus the reproducing needle is not held firmly by both sides of the track at some points, but is partially free to weave from side to side. The effect is obviously more serious at higher frequencies, and is one of the limitations to the frequency range available from this type of record.

Standard of Quality

With regard to the standard of quality we may sum up by saying that it is usual to cut the frequency range sharply above about 4,000 cycles to maintain the signal-to-noise ratio of permissible value, and the volume range available is about 25 to 30 db.

It is interesting to remember that the original Edison phonograph used a vertically modulated or "hill-and-dale" track, but this was discarded for various reasons due to the difficulty of building the mechanical apparatus of those days with sufficient precision. The Western Electric Company have more recently resurrected the system, and with modern technique have shown that it will give results superior to the more conventional recording.

The advantages are considerably concerned with the fact that the "pinch effect" illustrated in Fig. 11 is now absent, and it is not necessary to include an abrasive in the record material. Thus

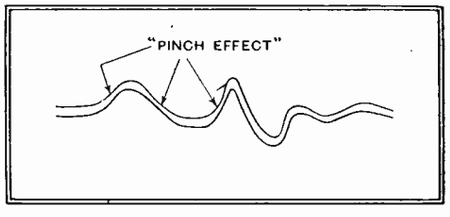

Fig. 11.—Illustrating the "pinch effect": the chisel-shaped cutter moves parallel to mean axis and not parallel to direction of track. This effect is avoided in "hill-and-dale" recording.

the background noise is reduced, with consequent increase in volume range and a permissible extension of the frequency range. It is stated that a volume range of 50 to 55 db. is available if the top frequency is limited to 5,000 cycles per second, while a range of 45 to 50 db. is available if the range is extended to 10,000 cycles.

It has been proposed to increase the volume range available from discs by using a combination of vertically and transversely modulated groove. If the vertical modulation is used for the sound recording in the normal way it is possible to modulate the vertical groove transversely at a low frequency to control the

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amplification of the reproducer. This low-frequency signal would be filtered and made to control the bias of one of the amplifying stages. The recorded sound could then be automatically contracted during the recording process and expanded on reproduction.

The Philips-Millar system of recording combines a mechanically recorded sound record with optical reproduction, and has the advantage over a purely photographic system of instant playback and over the purely mechanical system of improved quality of recording.

The record is cut by means of a diamond-pointed stylus into an opaque coating carried by a flexible transparent base similar to photographic film. The cutter works in "hill-and-dale" fashion—that is, at right angles to the plane of the record—and, owing to its shape, produces a bilateral form of variable area track. A soft layer of transparent material between the opaque top surface and the supporting base absorbs the depth of cut.

The method has the immediate advantage that a maximum contrast is available between the density of the recording layer and the transparency of the support. Providing the cut is clean, no high-frequency attenuation takes place due to an imperfect wave shape in the way that is inherent in a photographic method. The substance forming the opaque top layer may be in a finely divided form, which thus improves the definition and minimises background noise. Lastly, the record is immediately ready for reproduction.

Limitations of the System

The disadvantages that can be cited when considering the system from a general point of view are, first, that most of the advantages are lost if copies of the record are made by photographic means. Secondly, the design of a cutter is not quite so straightforward as with the more usual means for modulating a photographically recorded track; and lastly, the system suffers in the same way as the usual photographic methods when used as a long-playing reproducer. That is to say, owing to track size a large bulk of record is necessary for a playing time of, say, two or three hours. The author is not able to quote performance figures for this system.

For a long-playing reproducer a record track similar to that on a gramophone disc offers one great advantage in that its small track size allows a considerable playing time to be obtained from a given size of record.

For home recording and for many other purposes the simplicity of the system and the possibility of immediate playback are very attractive.

It cannot, of course, be claimed that the method offers the most perfect sound quality, but the results will be acceptable for many purposes.

For these and other reasons a considerable amount of research is being devoted to methods of mechanically recording sound on flexible base material in strip form. In this way it is possible to use a long endless loop of record stored on some form of endless re-spooling device and carrying a continuous helical track. A very long playing time with a minimum of easily handled material is thus available.

It is not possible to describe this system in detail at the present time, but it undoubtedly offers very great possibilities.

A well-known magnetic sound-recording apparatus makes use of a semi-permanent rearrangement of the molecular distribution in a suitable steel strip or wire when subjected to a magnetic field alternating at speech frequencies. Paper and other similar record carriers coated with suitable magnetic material are also used.

A DC field is usually applied at the same time as the speech frequency field to bring the working point to a suitable position on the hysteresis loop of the material and ground noise eliminating methods are possible by controlling this bias flux.

The method has the advantage of immediate "playback," but suffers from the bulk of the record material and the difficulty of storing completed records.

The author is not able to state actual performance figures, but the system is in commercial use, especially for re-broadcasting purposes.

Various attempts have been made to form sound images by electro-chemical action. Usually a stylus riding on a conducting record material applies a potential gradient determined by the speech frequencies to be recorded. Electro-chemical action with a suitable material in the record base then produces discoloration which provides a variable density form of image.

The resultant record is reproduced optically by reflecting light from its surface on to a photo-sensitive device.

No commercial system has been worked out and it would seem that the method has too many practical difficulties to allow a satisfactory result.

A summing-up of this survey in the light of home recording requirements would suggest that photographic methods are too expensive and require complicated apparatus operated with considerable technical skill to obtain good results.

Mechanical methods will give satisfactory results with comparatively simple equipment, although the sound quality possible with the apparatus obtainable by the amateur at the present time is some way short of that theoretically desirable.

The conventional gramophone disc does not permit sufficient playing time and is not satisfactorily capable of operation in conjunction with a 9.5 or 16 mm. movie camera to provide "home talkies."

The record cannot be immediately "played back," and requires some after-treatment if reasonable sound quality is to be obtained.

A mechanical recording system using a flexible base in strip form would seem to offer greatest possibilities, and if this can be combined with the necessary photographic picture requirements may provide a satisfactory solution.

Television Programmes

The principal items only of each day's programmes are given. The system to be used each day is given below the date. Transmission times are from 3-4 and 9-10 daily.

Vision	Sound
6.67 m. (45 Mc/s).	7.23 m. (41.5 Mc/s).

FRIDAY, DECEMBER 4th.
(Baird.)

3.5, Dress Parade. **3.20,** Film: "Australia—Harvest." **3.30,** Cartoons by H. S. Foxwell of "Teddy Tail" fame. **3.45,** Bob Wilton, comedian.

9.5, Dress Parade. **9.20,** British Movietone News. **9.30,** Repetition of 3.30 and 3.45 programmes.

SATURDAY, DECEMBER 5th.
(Baird.)

3.5, Starlight: Gillie Potter. **3.20,** British Movietone News. **3.30,** George Scott-Wood and his Six Swingers.

9.5, Starlight: "Hutch" (Leslie A. Hutchinson). **9.20,** Film: "Australia—Harvest." **9.30,** George Scott-Wood and his Six Swingers.

MONDAY, DECEMBER 7th.
(Marconi-E.M.I.)

3.5, Tex McLeod and his horse, "Arabia," spinning ropes and yarns. **3.20,** British Movietone News. **3.35,** Scenes from the Duchess Theatre production of "Murder in the Cathedral," with Robert Speaight as Thomas à Becket.

9.5, "Masks and Mimes," by H. D. C. Pepler, presented by Stephen Thomas. **9.25,** Film. **9.35,** "Cabaret Cartoon."

TUESDAY, DECEMBER 8th.
(Marconi-E.M.I.)

3.5, The Vic-Wells Ballet Company in "Façade." **3.30,** Film. **3.45,** Starlight: Sophie Tucker.

9.5, Demonstration by the Women's League of Health and Beauty. **9.20,** British Movietone News. **9.35,** The Vic-Wells Ballet Company in "Façade."

WEDNESDAY, DECEMBER 9th.
(Marconi-E.M.I.)

3.5, "Quarter-of-an-hour Meals," Moira Meighm will show what can be done with simple equipment in the preparation of good food. **3.20,** British Movietone News. **3.35,** Tenth Picture Page.

9.5, Repetition of 3.5 programme. **9.20,** Film. **9.35,** Eleventh Picture Page.

THURSDAY, DECEMBER 10th.
(Marconi-E.M.I.)

3.5, London Characters: Toni, the one-man band and Mike Stern, cheap-jack of Petticoat Lane. **3.15,** Film. **3.25,** Stage Scenery Design demonstrated by Peter Bax. **3.40,** Carroll Levis and some of his "discoveries"

9.5, Starlight: Ambrose with Evelyn Dall. **9.20,** British Movietone News. **9.35,** Ballet.

Wireless for Christmas

Next week's issue will contain suggestions and advice on the choice of wireless as Christmas presents, and will also contain special articles on ideas for entertainment during the festive season.

Listeners' Gu

Outstanding Broadcasts at Home and Abroad

HARRY PEPPER and (inset) John Watt, who have collaborated with Reginald Purdell in writing the fantastic story "Lovely Women and Ugly Men" which is to be broadcast on Wednesday and Thursday. John Watt takes the part of a journalist in this play as in "The Full Story.

WE are again to have breakfast-time broadcasts from an English station, but only for a short time. It may be, of course, that if the broadcasts are enthusiastically received the Corporation *may* reconsider their decision on early-morning transmissions.

During the period of the first test match between Australia and the M.C.C. at Brisbane the B.B.C. are co-operating with the Australian Broadcasting Commission in providing us with eye-witness accounts of each day's play. Alan Kippax, the Australian cricketer, will give a close-of-play commentary for the benefit of English listeners at 8.30 a.m. The first day's play will be commented upon to-day (Friday) and on each succeeding day, excluding Sunday, for as long as the match lasts. For the sake of those who are unable to listen at this hour a recorded version will be transmitted at 1 p.m. daily.

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COMIC OPERA

THE B.B.C.'s next contribution to the European Concerts arranged by the U.I.R. (Union Internationale de Radiodiffusion) is to consist of comic opera, representative of music from the British stage of the past two hundred years. It will include works by Arthur Sullivan, Edward German, Montague Phillips, C. Villiers Stanford, Alfred Reynolds and Dibdin. The soloists will be Muriel Lee Petty (soprano), Jan van der Gucht (tenor), Percy Heming (baritone) and Harold Williams (baritone), who will be supported by the B.B.C. Revue Chorus and Theatre Orchestra.

The concert will be broadcast Regionally from 7.30 to 8.45 on Tuesday, when it will also be taken by the members of the U.I.R. and Nationally on Friday, December 11th. Stanford Robinson is returning to London from his Continental tour to conduct this concert.

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AMERICAN ARTISTES

FAMOUS artistes of the American stage and screen will broadcast from a studio on Tuesday at 8 in the National programme while rehearsing for the gala performance which is to be given at the Coliseum in aid of the King George Memorial Fund on the following Thursday at midnight.

It is hoped to broadcast performances by some of the following: Sophie Tucker, who has organised this gala entertainment, Marlene Dietrich, Richard Barthlemess, June Clyde, Ann Harding, Paul Robeson, and Laura La Plante.

◇ ◇ ◇

MUSIC

SIR LANDON RONALD will on Saturday at 8 (Reg.) conduct Section D of the B.B.C. Orchestra in a programme which includes his own Birthday Overture, Sir Hubert Parry's "Lady Radnor's Suite for Strings," and Tchaikovsky's "Casse Noisette Suite." This programme was arranged for the summer, but owing to illness Sir Landon had to postpone it until he had sufficiently recovered.

Instrumental solos by members of the B.B.C. Orchestra will be given on Saturday at 6.45 (Nat.), the soloists being Terence Macdonagh (oboe), Richard Newton (bassoon), and Pat Whelan (saxophone).

Ethel Bartlett and her husband, Rae Robertson, will be heard in duets during a programme by the B.B.C. Orchestra (D) on Monday at 10.15 (Nat.).

The Sixth Symphony Concert will be relayed from the Queen's Hall at 8.15 and 9.25 on Wednesday (Nat.), when Sir Henry Wood will conduct the B.B.C. Symphony Orchestra, with Louis Krasner as solo violinist, who will give the first concert performance in England of the late Alban Berg's Violin Concerto. This work, which was only completed shortly before the composer's death last year, was first performed by Krasner at the Festival of the International Society for Contemporary Music at Barcelona last year, and profoundly impressed all those who heard it. Louis Krasner, at whose initiative the Concerto was written, also played the solo part when it was broadcast by the B.B.C. last summer.

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RUGGER AND SOCCER

THESE two sports will provide commentaries on four occasions during this week. On Saturday at 3.30 the National programme includes the third of the series, "Saturday Contrasts," during which F. N. S. Creek, the famous Corinthian, will describe part of the amateur soccer match between the Corinthians and the Royal Navy, from the Royal Naval Barracks ground at Chatham. From here listeners will be switched north to Wigan, where F. H. Pemberton will comment on the last part of the Rugby League match between Wigan and St. Helen's Recs (Recreations).

The Oxford and Cambridge rugger match at Twickenham on Tuesday will be commented upon by Captain H. B. T. Wakelam between 2.5 and 3.25

Details of the week's Television programmes will be found on p. 595.

ALBERT SANDLER and the Park Lane Hotel Orchestra which will be heard from the Park Lane Hotel on Sunday.

le for the Week

in the Regional programme. Another inter-Varsity match, this time the soccer battle between Oxford and Cambridge at the Arsenal Stadium, Highbury, comes into the Regional programme on Wednesday, when at 3.15 a running commentary on the second half will be given. F. N. S. Creek will again be the commentator.

ALAN KIPPAX, who will be heard at 8.30 each morning during the first Australian Test match.

BRITISH POLICY

AT the present time, with much talk on British foreign policy, it is opportune that a debate entitled "Limited or Unlimited Obligations: A Discussion on British Policy" should be broadcast. Those discussing the problem will be Sir Edward Grigg, Sir Norman Angell and Mr. Harold Nicolson, with Mr. H. Wickham Steed, who as former Foreign Editor and Editor of *The Times*, has exceptional knowledge of world affairs, in the chair. This will be radiated by the Regional transmitter at 9.20 on Saturday.

FOR THE SICK

JOHN CHEATLE is to present an original idea to listeners on Thursday at 8 (Reg.) and on the following Saturday (Nat.). It has been given the heading "For All Ills" and contains cures—to be taken neither internally nor externally—for minor ailments from sources of witchcraft, quackery, history, rustic tradition, and patent devices.

ANOTHER NEW OPERA

THIS time it is from the pen of Roger Quilter and bears the title "Julia." The heroine is the twenty-one-year-old widowed Countess of Clovelly, Julia, who has to make a choice between marrying one of two relatives of her late husband or lose her fortune. When she should meet these two suitors she runs off to a party at the Blue Boar Inn, where she meets David Wycombe, with whom she falls in love, and the romance progresses to a happy ending.

Only the first act is being relayed at 8.15 on Monday from Covent Garden, the first scene in which is Julia's boudoir and the second the Blue Boar Inn. Margaret Bannerman makes her début in light opera in the title-rôle and Henry Wendon plays opposite her as David Wycombe.

OPERA FROM ABROAD

THE week's programmes are marked by a scarcity of opera. Hans Pfitzner's "The Christmas Fairy" is Friday's only transmission of this kind and comes from Breslau at 7.15. On Sunday, from Radio-Paris, at 5.15, Paul Claudel's "Christophe Colomb" is being broadcast for the first time, wedded to music of Darius Milhaud, the most serious of the so-called "Group of Six" who form the select corps of contemporary French composers. Claudel is a distinguished diplomat and served his country as Ambassador to Japan and the United States.

Tuesday brings us a delightful and little-known opera from Frankfurt at 7.10. It is Nessler's "Der Trompeter von Säckingen," which was first produced in 1840 and swept Germany. On the same evening at 8, Rome relays from the Teatro Reale, Mascagni's "Nerone," conducted by the composer. Verdi's well-known "Falstaff" comes from Milan on Wednesday at 8.

SEPTUAGENARIAN

PAUL LINCKE, the well-known Berlin operatic composer, has just celebrated his seventieth birthday, and a special broadcast comes from Cologne on Sunday at 7, consisting of his works.

LEADING LADY and composer of the new opera "Julia," chatting at a recent reception of the British Music Drama Opera Company.

FINNISH

SUNDAY is the Finnish National Festival, and at 8.30 Warsaw is giving a Finnish concert with Finnish soloists. The concert will include works of Sibelius, Melartin, and Hannikainem.

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, DECEMBER 4th.

Nat., 7.20, Recital: Arthur Cranmer (baritone) and Samuel Dushkin (violin). 8, The White Coons. 10.10, "Autumn Violin," featuring Jeanne de Casalis.

Reg., 6, John Reynders and his Orchestra. ¶The B.B.C. Dance Orchestra. 8, British Ballet Music—B.B.C. Orchestra (D).

Abroad.

Vienna, 8, Contemporary Music.

SATURDAY, DECEMBER 5th.

Nat., 3.30, Saturday Contrasts—No. 3. 5.15, Jan Ralfini and his Dance Orchestra. 7.30, "In Town To-night." ¶Jack Hylton and the Boys. 9.20, Music Hall.

Reg., 4.15, The White Coons. 6, B.B.C. Military Band. 8, Sir Landon Ronald conducting the B.B.C. Orchestra (D). 10.25, Henry Hall's Hour.

Abroad.

Paris PTT, 8.30, Symphony Concert by the National Orchestra.

SUNDAY, DECEMBER 6th.

Nat., 6.30, "The Table Under the Tree." 7.15, Foreign Relay. 8, Salvation Army Service from Clapton Congress Hall. 9.45, B.B.C. Theatre Orchestra.

Reg., 5, Morris Motors Band. 6.30, Eighth Sunday Studio Orchestral Concert. 7.45, Service from Southwark Cathedral. ¶Albert Sandler and the Park Lane Hotel Orchestra.

Abroad.

Cologne, 7, Paul Lincke Evening—Operetta Music.

MONDAY, DECEMBER 7th.

Nat., 6.40, Pianoforte Recital—Stanislas de Niedzielski. 7.20, Music Shop. 9.35, "Mr. Faithful"—Lord Dunsany's new radio play.

Monday, December 7th (*cont.*)

Reg., 6, The Serge Krish Septet. 8.15, Roger Quilter's Opera, "Julia," from Covent Garden.

Abroad.

Leipzig, 7.10, Italo-Hungarian Evening from the Gewandhaus.

TUESDAY, DECEMBER 8th.

Nat., 6.25, B.B.C. Northern Orchestra. 8, American Stage and Screen Tribute to the King George National Memorial Fund.

Reg., 6, Friary Brewery Band. 7.30, Comic Opera. ¶Fred Hartley and his Novelty Quintet. 9.20, "Mr. Faithful."

Abroad.

Frankfurt, 7.10, "Der Trompeter von Säckingen," opera (Nessler).

WEDNESDAY, DECEMBER 9th.

Nat., 7.15, "Lovely Women and Ugly Men." 8.15 and 9.25, Symphony Concert from the Queen's Hall.

Reg., 6.40, The London Theatre. ¶George Scott-Wood and his Six Swingers. 9, The B.B.C. Theatre Orchestra and Anne Ziegler.

Abroad.

Paris PTT and Regionals. 8.30, National Orchestra and Dijon University Choir from Dijon.

THURSDAY, DECEMBER 10th.

Nat., 6.40, Carroll Levis and his Discoveries. ¶Van Phillips and his Two Orchestras. 9.20, Introduction to Shakespeare's "King Lear," to be broadcast on Sunday, December 13th.

Reg., 6, Worthing Municipal Orchestra. 8, "For All Ills." 8.30, "Lovely Women and Ugly Men."

Abroad.

Radio-Paris, 8.45, Weber Festival Concert.

UNBIASED

By FREE GRID

Do Women Lack Intelligence?

I WONDER if any of you who happen to be students of rodentology—or whatever this particular branch of Natural History is called—can assist me in a rather delicate matter relating to mice and women, between whom, as many of you may know, there exists an age-long enmity. The particular trouble which is plaguing me is unfortunately due to wireless and that is why it has been referred to me for solution.

Among my relatives I have a goodly store of maiden aunts of rather ancient vintage, the reason for this being that my grandfather lived in the good old mid-Victorian days when large families were considered the thing. This I know does not explain why they are still single, but the reason for this would probably be apparent to you were you to become acquainted with them. However, this is not what I wish to talk to you about and so there is no reason to become alarmed.

Now ladies of this type are usually possessed of what I may term the Sergeant-Major type of mentality, believing firmly in early Victorian virtues such as early rising and such-like horrors. It need hardly be said that to such people the early morning physical jerks broadcast by certain foreign stations round about 8 a.m. and such uncivilised hours of the day are a veritable God-send, and most of these good ladies are revelling in double-knee bends and other contortions beloved of the Sergeant-Major type of mind while you and I and other sane and sensible folk are still in our beds.

Remarkable Equine Sagacity

Unfortunately one of the most repellent of my aunts has been compelled to take to her bed, and is likely to remain there for some weeks, owing to her being kicked, quite justifiably, by an intelligent horse. Naturally wireless is one of her chief sources of amusement during the day, but unnaturally she wishes to listen in to these wretched morning programmes at an hour when none of the rest of the household is astir to switch the set on for her. Unfortunately her receiver cannot very well be transported to her bedside as it is built into a Victorian whatnot downstairs. By the way, in case there are any of my more modern readers who do not know what a whatnot is, I can only advise them to ask their grandparents as I cannot, of course, occupy the valuable space of this journal by giving a dissertation on Victorian ethnology.

Needless to say it was decided that I, as usual, should be the one to hold the baby, and I was duly summoned to the Presence. Naturally I immediately suggested the purchase of a new receiver, but all the thanks I got for my pains was a severe lecture on the evils of extravagance and the painting of a mental picture of what would be my eventual lot if I persisted in my spendthrift habits. The upshot of the matter was that I agreed to lend her—or to loan her as I believe is the correct modern expression—a loud speaker and endeavour to construct a suitable arrangement for her to switch on the set in the morning.

Since the set was a battery-operated one I was unable to extend the LT leads to her bedroom on account of the question of voltage drop and I was therefore eventually forced to do the best I could with an alarm clock and a mousetrap of the breakback type. I arranged that by the aid of a piece of string connecting the alarm key of the clock with the mouse-

Duly summoned to the Presence.

trap, the latter should close the LT circuit with a firm contact at the appointed hour. The mousetrap was, of course, installed downstairs next to the set, and it was so arranged that when the string was wound up by the revolving key it fired off the trap. It would, of course, have been just as simple to arrange for my aunt to pull the string when she woke up, but I have never been one to miss the opportunity of exploiting the resources of science, and since the alarm clock was in use in any case, I thought it might as well do two jobs instead of one.

Now I flatter myself that this arrangement was absolutely foolproof, but this does not mean to say that it was proof against the appalling lack of technical instinct which seems to be every woman's birthright. It had not been working many nights when I received an S.O.S. to the effect that the receiver would persist in waking up my aunt with ribald songs from America at about 2 a.m. It seemed obvious to me, of course, that there must be some defect in the alarm clock which caused the set to be switched on in the small hours of the morning, and since the wavelength to which the receiver was pretuned was also that of an American station the mystery was fully explained.

I was, however, greatly disconcerted when my aunt told me that it was nothing to do with the alarm clock, which was behaving itself in a perfectly respectable manner. I made a thorough examination and could only report that I found nothing wrong. Nevertheless the trouble continued, and it was purely by chance that I found that the whole cause of it was that the fool of a nurse who set the trap every night had thought it necessary to stick a piece of cheese on it. I need hardly insult your intelligence by explaining what it was that had fired off the trap, although, of course, there were never any dead mice to be found as silent evidence since a modern mouse is naturally far too sophisticated to be caught out when extracting cheese from a trap.

Unfortunately the withdrawal of the cheese did not cure the trouble, and it seems obvious to me that mice must still be the cause of it although I, frankly, fail to see the reason why. This is the reason, of course, why I want any of you who may be students of mouse psychology to give me the benefit of your studies. As it is things are getting a little desperate, for I have been compelled to discard the mousetrap switch and get up at an unearthly hour every morning and hurry along to my aunt's house to switch on her set, and I don't mind telling you that the strain is beginning to tell on my health as I am none too robust.

Auf Wiedersehen

AS I am just about to cross over to the Continent on a mission of some danger connected with the forthcoming Christmas festivities in our village I will take this opportunity of wishing you all a happy Christmas, as it is by no means certain that I shall succeed in returning safely. I have, however, made special arrangements to transmit to you a few facts concerning my doings in the back of beyond. I am, as a matter of fact, bound for Iceland's greasy mountains and other delectable spots where the poet tells us that Father Christmas is accustomed to reside, and, quite frankly, between you and me, I am by no means looking forward to my mission, as I have got a very nasty cough. If, therefore, any of you ladies happen to have an old red flannel chest protector which you don't want I should be very glad to have the loan of it. I am off on Monday.

New Apparatus Reviewed

Recent Products of the Manufacturers

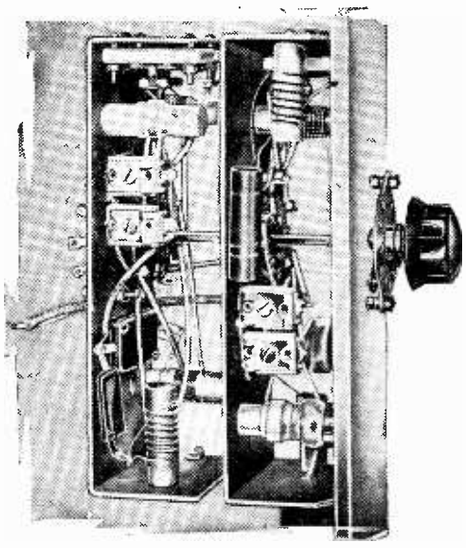
C.A.C. ALL-WAVE SUPERHET COIL UNITS

IN order to simplify the work of building an all-wave receiver the City Accumulator Co., Ltd., 18-20, Norman's Buildings, Central Street, London, E.C.1, are marketing as a separate unit the coil assembly used in their Austin all-wave sets.

Actually the coil unit is made in sections, each containing separate coils for each waveband, multi-point switch and padding condensers. There is one section for the signal frequency circuit and one for the oscillator. They are assembled on small aluminium panels and each is secured to the main chassis by two nuts.

It is designed for use with a triode-hexode valve, a 0.0005 mfd. gang condenser and an IF of 456 kc/s. With this size tuning condenser the wavebands covered on each of the four ranges were found to be 9.9 to 27.5 metres, 22.8 to 72 metres, 200 to 550 metres, and 780 to 1,875 metres respectively.

One great advantage of using a unit of this type is that the initial lining up of the set is simplified, for the coil units are tested and the various padding condensers adjusted before despatch. With half the adjustment already made it becomes a relatively easy matter to line up the IF amplifier, and then



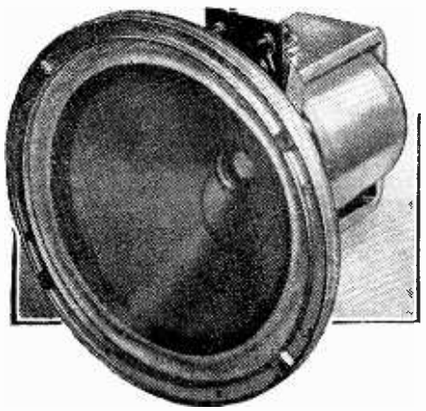
All-wave coil assembly made by C.A.C and now available as a separate unit.

a few final adjustments to the various padding condensers can be tried to compensate for minor differences in stray capacities.

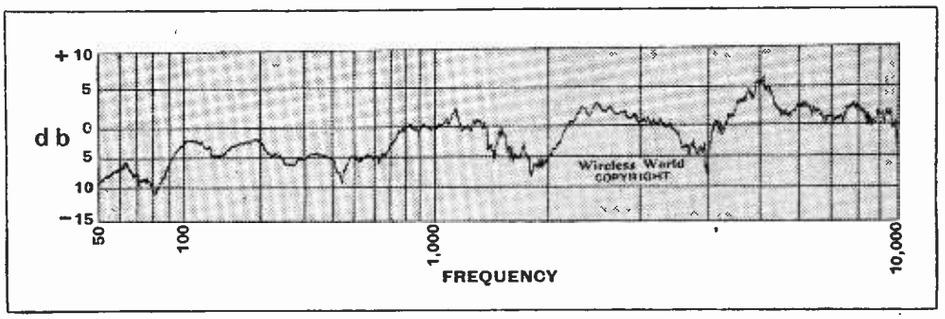
The coils fitted are quite efficient, and excellent results were obtained from a receiver embodying these coils. All the worth-while short-wave stations were tuned in without difficulty despite the size of the tuning condensers, though a good slow-motion drive is essential. The C.A.C. drive fitted to the test receiver was found to be very good indeed as it has a very large scale and is quite free from slip and backlash.

With only one signal circuit before the frequency changer a little interference from second channel signals was occasionally encountered on the short waves, but it was not serious. As the coil sections are each entirely self-contained it would be quite practicable to add an RF stage and another coil section, and the improvements so effected would be well worth while on the short waves though it is not really necessary for the ordinary broadcast bands.

It is a well-designed unit and the coil assembly, which includes two sections as illustrated, costs 52s. 6d.



A recent addition to the Hartley Turner range of loud speakers in which the "Duode" principle of voice coil construction has been adopted.



Axial response curve of Hartley Turner "Duode" loud speaker on irregular baffle (area approx. 22 sq. ft.), microphone distance 4 ft., power input 1 watt.

HARTLEY TURNER "DUODE"

THE application of the "Duode" principle of construction to the Hartley Turner loud speaker has still further improved the qualities of that instrument. For those who may not be familiar with the "Duode" principle, it is sufficient to state that the speech coil is wound on a light aluminium former which vibrates and becomes the active element at high frequencies by virtue of the eddy currents induced in it. Reference to the response curve shows that the output in the extreme top from just above 5,000 cycles to 10,000 cycles is flat within 2½ db. But the improvement in high-frequency response is not the only advantage which the "Duode" system has to offer, and at lower frequencies there is a marked increase in the damping control which is of special advantage in the reproduction of transients.

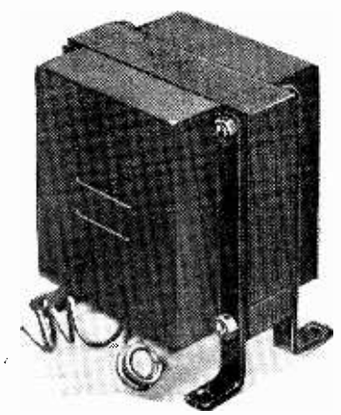
This increased damping is probably also responsible for a reduction in the 5,000-cycle peak which was prominent in the original design and which now is not more than 5 db. in height. There is also a reduction in the dip below 2,000 cycles, and in every way the curve of output against frequency has been appreciably smoothed.

The new design exhibits all the excellent qualities in the bass, and absence of modulation of high frequencies by low, which helped to establish the reputation of the first unit. It will be noticed, however, that the response below 100 cycles shows a new dip. This was found to be due to "belling" of the periphery of the diaphragm when supplied with a sustained input of 80 cycles. In the steady state not more than 500 milliwatts is necessary to maintain this "break-up" of the diaphragm, but under actual receiving conditions in which the applied frequencies are continually varying no trouble from this effect was to be observed.

The price for DC excitation is £6 and for AC £7 5s., and an output transformer can be supplied to suit any type of output stage at an extra cost of £1.

KINGSWAY ELECTRICAL SMOOTHING CHOKE

KINGSWAY ELECTRICAL, LTD., of 3-9, Dane Street, High Holborn, London, W.C.1, have submitted for test a choke designed for use in *The Wireless World* Negative Feed-back Amplifier. It is of the shrouded type, and measurements showed it to have a DC resistance of 190 ohms with



Smoothing Choke for the Negative Feed-back Amplifier.

an inductance of 18 H., when carrying 109 mA. DC. It is consequently a suitable component for this amplifier and it can be confidently recommended. It is priced at 10s.

BROADCAST BREVITIES

NEWS FROM PORTLAND PLACE

INFORMAL INTERVIEWS can more readily be obtained by the Austrian Broadcasting Company by the use of this unobtrusive microphone which resembles an ashtray and is here shown in the centre of the table. Americans have for a long time made great use of diminutive microphones and transmitters and the one illustrated is of American origin.

The Dying Charter

ALTHOUGH the B.B.C. Charter expires at the end of the year, the Corporation officials go about their business with cold-blooded stoicism.

No sign is there at Broadcasting House that the minutes are ticking relentlessly on—no marking of calendars, no cutting of notches on sticks, no Omar Khayyám-like eating and being merry . . . . .

Programme building goes on as usual: the New Year is already charted, and many programmes have already been devised to fill the first four months of 1937.

Poetry Crusade

EARLY in the New Year the B.B.C. hopes to run a poetry crusade.

Whatever our reactions to broadcast poetry—and there are hundreds of varying opinions on the subject—there is no gainsaying the fact that if poetry were a more solid and regular feature of the transmissions it would form a link between the musical programmes and the "spoken word" as represented by the talks and news bulletins.

An Outstanding Broadcast

The trouble with broadcast poetry in the past has been the lugubrious manner of its presentation. A brilliant exception was the reading of Tennyson's "Enoch Arden" a few weeks ago by Henry Ainley, with musical interpolations on the piano by Sir Hamilton Harty. In the hands of these two masters the long poem became a vivid recreation of life, utterly dissociated from the musty, Victorian drawing-room tradition which we moderns apply indiscriminately to all poetry having a semblance of rhyme and metre. The broadcast was a pleasant variant on the stereotyped Sunday evening Symphony concert, and more of its kind might be attempted.

"The Poet Explains"

As a start we are to have two experimental poetry programmes in January, sponsored by an English poet of international reputation, and these are to be followed up by a series of six talks, each lasting an hour, entitled "The Poet Explains," to be given from 10 to 11 p.m. during February.

Portland Place will pay very careful attention to the "listener reaction" in this case, and if the response is encouraging, who knows what may follow?

Director of Poetry ?

Is it too much to expect that a Director of Poetry may be appointed? Every other type of programme has its Director, but poetry is relegated to the care of the same official who handles talks on gardening, economics and food marketing schemes.

The choice of a worthy official might be difficult, but it need not be assumed that poetry is incompatible with bureaucracy. Several eminent poets of to-day are permanent officials in Government service.

Let the B.B.C. have the courage to appoint a Director of Poetry and the whole world will take notice.

A Television Christmas

MR. GERALD COCK and his production staff at Alexandra Palace are now collecting the ingredients for the special Christmas fare which is to be offered to the fortunate owners of television receivers throughout the week beginning December 21st. Although it is still too early to discuss the Christmas television programmes in detail, televiewers may rest assured that an effort will be made to present as many all-star features as possible. Most of the artists engaged will be celebrities from sound broadcasting, as well as from the stage and films.

"Picture Page" on Christmas Day

On Christmas afternoon it is hoped to present a special edition of "Picture Page," Cecil Madden's television magazine, in which interesting personalities from all walks of life—onion sellers, street performers, explorers, "people in the news," and other picturesque characters—face the television camera to relate their experiences.

There will also be a bumper programme between 9 and 10 on Christmas evening.

Christmas, 1936, will go down in history as the first Television Christmas, and everything will be done to make it a memorable one.

"The Run of the Play"

A NEW kind of commentary is to be tried at Twickenham on Boxing Day, when listeners will participate in the thrills of the second half of the rugger match between the Harlequins and Richmond. An attempt will be made to project "the run of the play." The broadcast will open with a description of what has gone before, with comments on the form of the various players and on Rugby in general. Gradually the commentator will work up to a description of the match after half-time.

All of which goes to show that the "O.B." Department has not gone stale. New outside features are difficult to get nowadays, practically every source of entertainment having been tapped at one time or another. The fact that Mr. de Lotbinière and his staff are now seeking new methods of presentation is encouragingly significant.

New Station for the West

A SITE near Plymouth has at last been found for the high-power station which is to put Somerset, Devon and Cornwall on terms of broadcasting equality with Wales.

For many months the B.B.C.'s mobile transmitting and receiving vans have ranged the West Country in search of a site which would provide not only the necessary height above sea level but freedom from geological drawbacks.

Watchet for Wales

Assuming that the B.B.C. Charter is renewed and that the Government gives specific permission for the construction of the station, it is hoped that preliminary work on the site will begin in the late spring.

The new station will probably be completed by May, 1938, when Watchet will go "all-Welsh" in spirit, if not in language, and Plymouth (headquarters at Bristol) will have no further scruples about catering exclusively for its own listeners.

A FIRST-RATE AERIAL.—This photograph, taken during Comdr. Attilio Gatti's recent expedition to the Belgian Congo, shows that there is at least one thing done better in the wilds than in civilisation. A native boy, making his own ladder with vines and fibres as he goes up the tree, hoists an aerial for the McMichael "Colonial" receiver which kept the party in touch with the world.

RANDOM RADIATIONS

By "DIALLIST"

Our Radio Trade

WHAT a big business we do in radio nowadays is shown by the October import and export returns, the latest available. Our exports and re-exports of wireless goods totalled just under £200,000 for the month and showed a favourable balance of over £30,000. Pretty good, you think? Well, so it is; though the position is not quite so satisfactory when you come to look into the figures in detail. For instance, the favourable balance on transmitting gear was a little under £30,000. It follows that on receiving equipment of all kinds we were just about all square in pounds, shillings and pence as regards exports and imports. But not in *numbers*: we exported 7,000 receiving sets in round figures and imported 9,000; exported 214,000 valves and imported 260,000. So we were down to the extent of 2,000 receivers and 46,000 valves. But the most perturbing item is "parts and accessories." Here our exports were to the value of £51,427 and our imports to the value of £101,101. Why it should be necessary to spend this colossal sum (we spent more in September) on foreign radio components is rather difficult to understand.

[N.B.C. Photo.

TRAIN TO TRAIN. While speeding at 90 m.p.h. in the American streamlined train "Comet" a conversation by means of short-wave links arranged by the N.B.C. was conducted with a passenger travelling in a German streamlined train. Both trains were specially equipped by the respective authorities to carry out the experiment.

When Valves Were Repaired

VALVES, I admit, are still dearer than they might be, but prices to-day are as nothing compared with what they were a dozen years ago, when a simple *bright-filament* triode cost 15s. or 17s. 6d., and dull emitters such as the DER, the DEV, and the DEQ could not be had under £2 10s. each. In those days valves were much more apt than they now are to expire through the burning-out of the filament. Some genius invented a process whereby blown-up filaments could be replaced, and for a time quite a business was done by certain firms in valve repairs. A hole about the size of a shilling was made in the bulb (I have forgotten, if ever I knew, how this was done; if you've ever tried to open a valve you know from experience what an implosion is!) and through this the old filament was extracted and a new one put into its place. I had several valves refilamented in this way and they worked pretty well, though if one took their curves, as was one's wont in those days, they were apt to be strangely different from those of a new valve.

Radiotelegram

A WEEK or two ago I mentioned that telegrams sent by wireless were originally known as Marconigrams and later as Radiograms. The later word has now come to designate a combined wireless receiver and gramophone, and I wondered what was now the correct term for a wireless telegram. A correspondent who used to be a ship's wireless operator writes to say that he recollects the term Radiotelegram. I've verified this from the Post Office, and there is no doubt that radiotelegram is the official word in the British Empire to-day. I believe, though, that radiogram is still used in the United States, where the radio set-*cum*-gramophone all in one cabinet is much less frequently seen than it is here. Will some American reader please tell me whether I am right? If so, what word do Americans use for the instrument that we call a radiogram?

A Queer Fault

THE other day I came across a fault in a big radiogram which took quite a bit of tracking down. The instrument, which is of the highest quality, developed a most offensive form of noisiness. It began with mild cracklings which soon became so violent that they assailed the ears like a machine-gun barrage. Clearly a partial "dis"—but where? It was traced eventually to the milliammeter which acts as a tuning indicator. This is placed in the plate circuit of the second IF valve and carries all the HT current of that valve. Its windings had given way under the strain, and apparently the broken ends were vibrating, making an intermittent contact. One thing that surprised me was that in a set otherwise so good throughout a small, cheap milliammeter should have been used for this purpose. Any component which carries the whole plate current of a valve in a mains set has a good deal to put up with and should be soundly constructed. As the replacement cost 4s., it can't have been a very high-grade milliammeter!

The Aerial Question

A RECENT note of mine on the folly of spoiling the performance of good sets by working them off poor indoor aerials was misunderstood by one or two readers, who took it, for some reason or other, that I was attacking portable sets. Of course I wasn't. I was having a dig at those who buy receivers designed for use with an efficient external aerial and then handicap them by using them with very inefficient collectors, or even (as in the instance I mentioned) with none at all. The portable set is in quite a different category. It is specially designed to give good results from its own small built-in frame, and as a rule it is a very satisfactory piece of apparatus, particularly for those who cannot erect aerials, whether indoor or outdoor, of respectable height and length. No, I've nothing at all against the portable; in fact, I use one quite a lot. But necessarily it has its limitations owing to the small size and the minute effective height of its collector. You wouldn't, for example, regard a portable as the ideal receiver for long-distance work.

Ant-proof Insulation

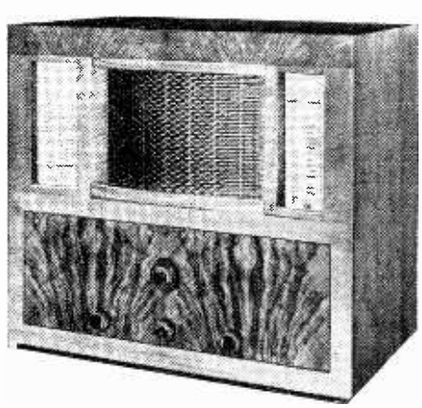
BRITISH wireless manufacturers have in the past been accused of neglecting the overseas market, but there are now signs that the peculiar problems affecting the design of sets for difficult climatic conditions are at last being taken more seriously.

For instance, it would appear that, in certain tropical countries, insulating material is liable to be eaten away by white ants. The Ekco firm, now busily engaged in developing the export side of its business, wants to study the matter at first hand, but the trouble is that white ants imported for the purpose do not seem to thrive in our English climate. Ekco is therefore searching for a strain of termites that, while remaining true to type, will retain their normally insatiable appetites long enough for the laboratory staff to find what kinds of insulating material are unpalatable to them.

NEW H.M.V. BATTERY ALL-WAVE RECEIVER

THE Model 166 just released is a four-valve battery superheterodyne with an undistorted power output of 1¼ watts and provision for short-wave reception. There are three wave-ranges covering 18-50, 195-580 and 840-2,000 metres, the medium waveband occupying a vertical scale at the left of the cabinet and the long and short wavebands a corresponding scale on the right. Between the two is situated the permanent-magnet moving-coil loud speaker behind a curved bronze-mesh grille.

The first valve in the circuit is an X21 frequency-changer preceded on medium and long waves by a band-pass filter. It is followed by a VS24 IF amplifier and a HD22 second detector, which also provides the AVC supply. The final valve is a QP21 double pentode, and the total HT consumption is rated at 7 mA.

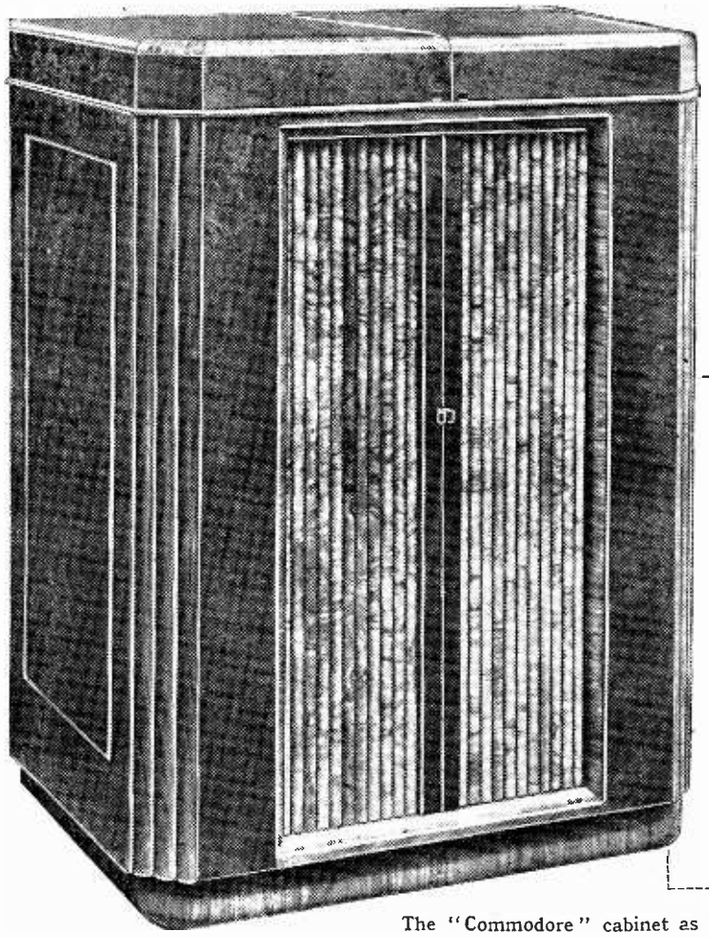


An attractive cabinet design has been adopted for the new H.M.V. Model 166 all-wave battery receiver.

There is provision for a gramophone pick-up, and the price of the instrument, complete with batteries, is 13 guineas.

Anson "Cor

A RADIO-GRAMOPHONE WITH A LAVISH SPECIFICATION



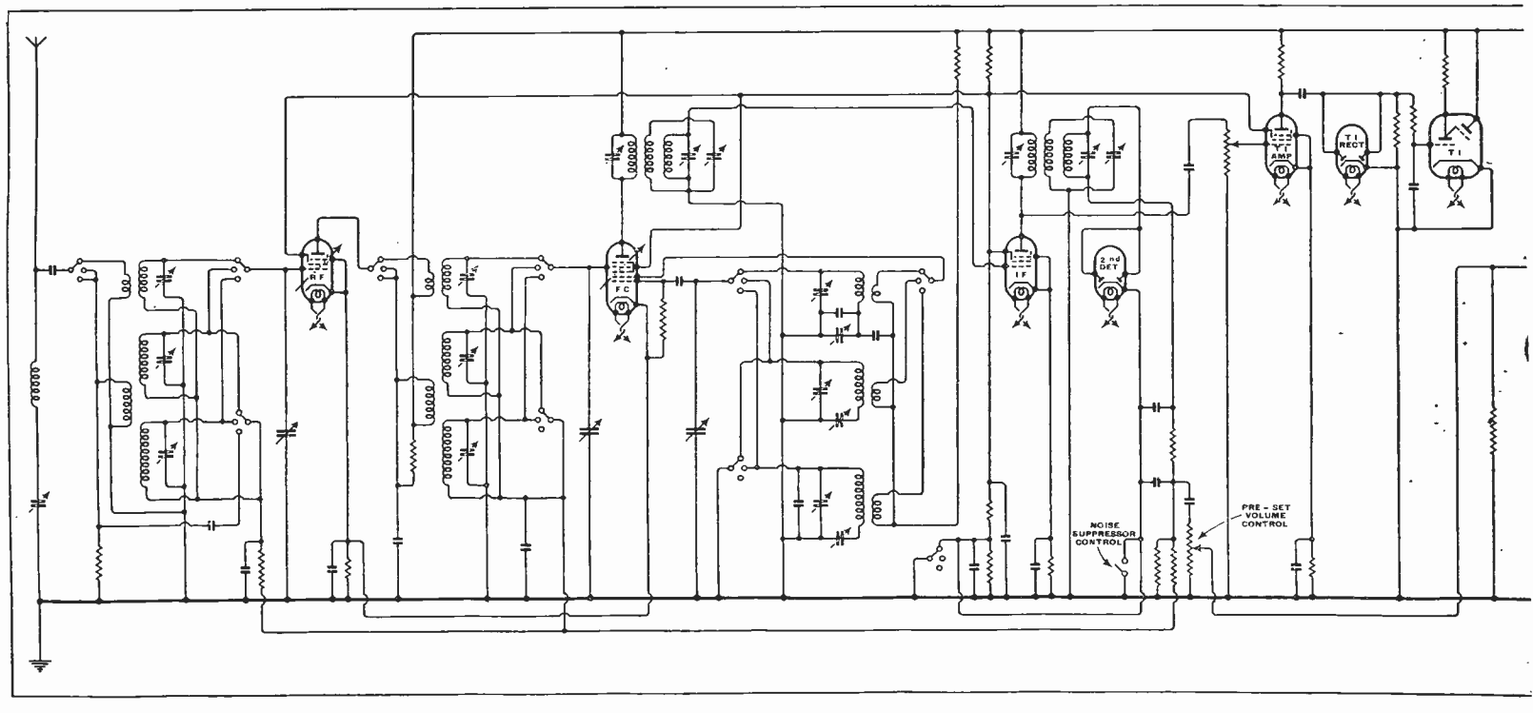
The "Commodore" cabinet as it appears when closed.

FEATURES.—*Type.*—*Radio-gramophone for AC mains with automatic record-changer.* ***Waveranges.*—***(1) 14-52 metres. (2) 175-565 metres. (3) 930-2,250 metres.* ***Circuit.—(Receiver)*** *Var.-mu pentode RF amplifier.—heptode frequency-changer—var.-mu pentode IF amplifier—double-diode second detector—triode AF amplifier—var.-mu pentode TI amplifier—double-diode TI rectifier—cathode-ray tuning indicator valve. Full-wave valve rectifier.* ***(Amplifier)*** *Triode first stage (all frequencies)—push-pull triode output valves (low frequencies)—triode first amplifier—triode output valve (high frequencies).—Two full-wave valve rectifiers. Westinghouse metal oxide rectifier for loud speaker fields.* ***Controls.—****(1) Tuning. (2) Volume. (3) Waverange. (4) Noise suppression. (5) Bass tone control. (6) Middle tone control. (7) Top tone control. (8) Manual or auto record-changer switch. (9) Record rejection switch. (10) Master switch (radio, gram. and on-off).* ***Price.****—165 guineas* ***Makers.—*** *Henry Anson Ltd., Harlequin Avenue, Great West Road, Brentford.*

IN spite of the many points of technical interest in the circuit of this luxurious instrument, it is the record-changer unit which first focuses and holds our attention. This remarkable piece of mechanism is capable of giving five and a half hours of continuous entertainment from a single loading of records, for it plays both sides of each of thirty-three records before passing them to a rejection chamber at the side of the cabinet. Throughout this process the discs are handled with far greater care than they are likely to receive in the normal course of hand loading. A detailed description of all the processes involved and the many ingenious contrivances incorporated in the design would run into many pages, and it is here possible to touch only on a few of the salient features of the design.

Separate motors are used for the turntable and for driving the record-changing mechanism. The latter motor is reversible and is controlled by a relay. The first motion is to lift the records in the magazine until the top record in the pile engages with a traversing arm. This breaks a low potential electrical contact

Circuit diagram of electrical equipment. A stanc special power amplifier in which high and

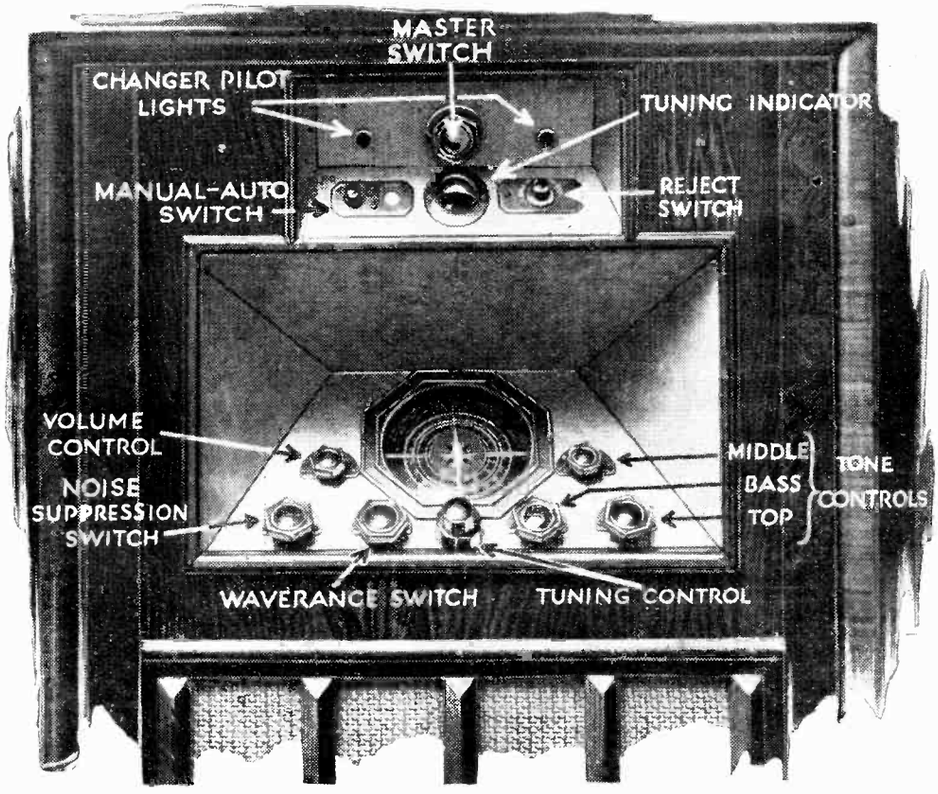


nodore"

between the arm and the vertical spindle upon which the records in the magazine are centred. The act of breaking this contact actuates the relay and reverses the motor, thus putting into operation the mechanism for loading the turntable. The turntable mechanism is hinged and is lowered out of harm's way when the record is in process of being turned over. Incidentally, by moving a lever it is possible to arrange for records to be played on one side only, and there is also provision for manual operation if this is desired.

A great deal of thought has been given to the method of feeding the pick-up needle into the first groove of the record. Gravity plays no part in this process, and it is probably for this reason that the instrument has proved eminently successful for use on board ship. The mechanism is well supplied with safety devices and it is virtually impossible to cause damage either to records or the mechanism itself through negligence. For instance, if one forgets to empty the rejection chamber and a record falls into a position where it might be damaged by the turntable mechanism as it is lowered, the first contact with the record opens a switch concealed in the push-rod which takes the weight of the turntable motor and instantly brings the mechanism to a standstill. Also a switch concealed in the hinge of the side door of the cabinet automatically switches off the current if the record-changer should be working when one attempts to remove played records from the rejection chamber. Pilot lights on the control panel show the progress and completion of each record-changing cycle.

Starting with a record-changer of this calibre any radio-gramophone must be built up on a rather different scale from the ordinary product if incongruity is to be avoided. In this, in our opinion, the designers have been entirely successful.

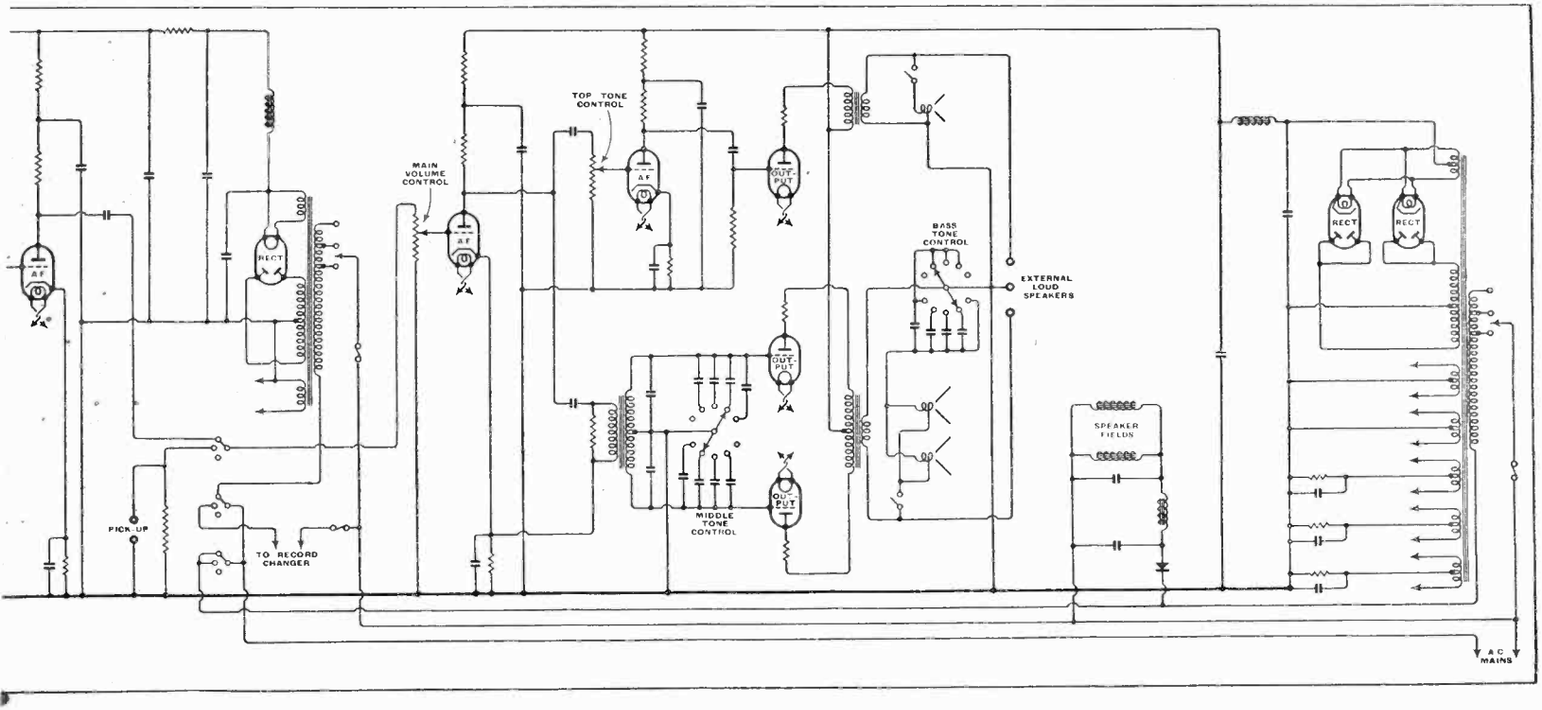


All principal controls for the operation of the record-changer and wireless receiver are concentrated on two adjacent panels.

The design throughout is on thoroughly sound engineering lines, and there has been no compromise with cost of production in effecting any simplification which might adversely affect either the efficiency or reliability of operation.

The cabinet is of the very highest quality and measures 3ft. 10in. high, 2ft. 10in. wide and 2ft. 2in. deep. It is solidly constructed and weighs approximately one hundredweight. Thus, quite apart from anything else, it is admirably suited

-wave chassis has been adapted for use with a quencies are amplified through separate channels.



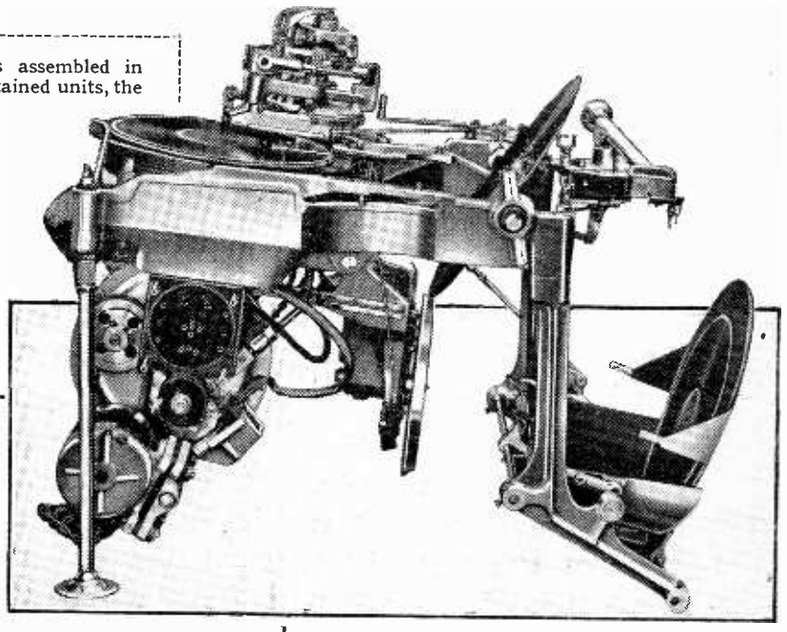
Anson "Commodore"—

to its function as a baffle for the three loud speakers, which can be supplied with at least 12 watts from the amplifying equipment. For radio reception an American-type chassis has been adopted and each receiver is rebuilt and suitably modified at the audio-frequency end to work into the separate power amplifier.

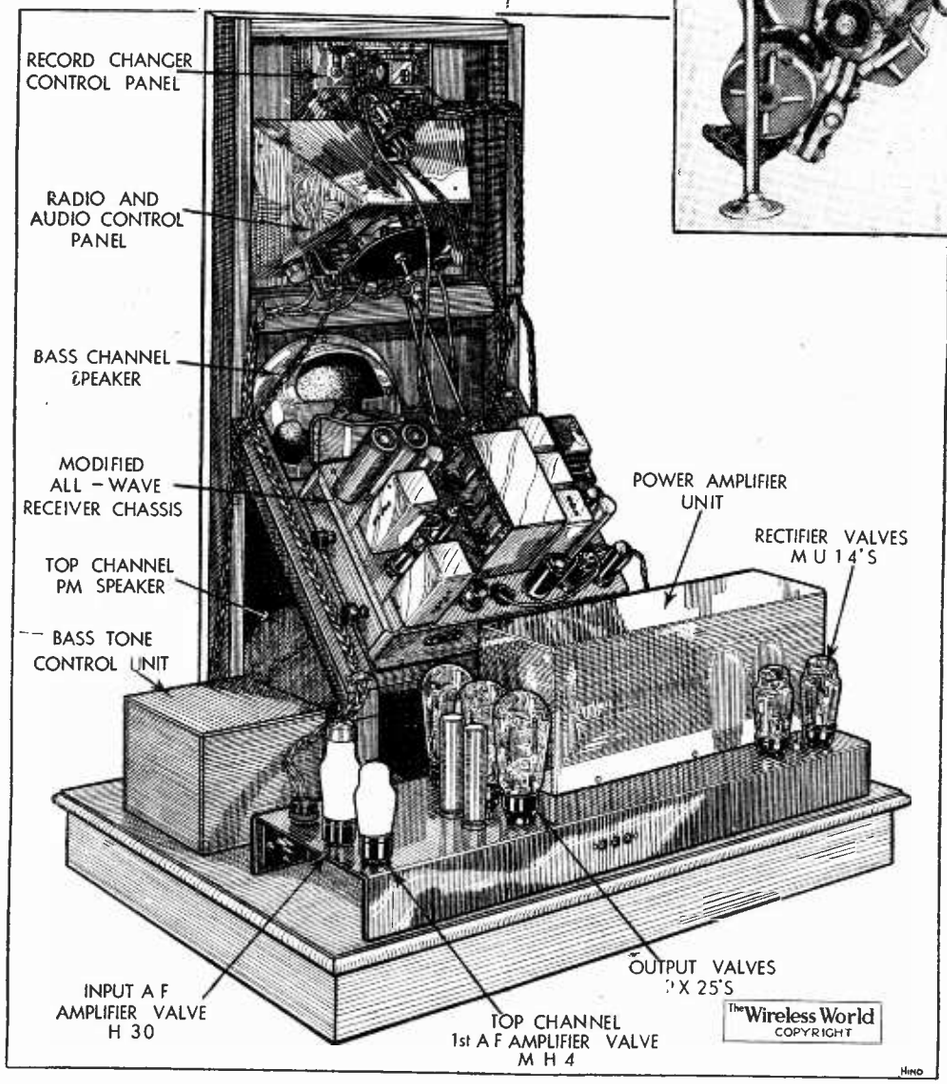
The input to this amplifier, whether from radio or gramophone, passes first to a triode which amplifies all frequencies and acts as a buffer between the input circuit and the frequency discriminating circuits which follow. The output from this first stage is "bifurcated"—to use the makers' own term—by parallel resistance-capacity couplings in which the values have been suitably chosen to effect a separation between high and low frequencies. The coupling passing the lower frequencies feeds into a high-impedance transformer supplying two PX25 valves in push-pull. The output valve for the high-frequency section is a single PX25, since the energy contained in this band is considerably lower than that found in the lower half of the frequency scale. Resistance-capacity coupling is employed throughout this channel, and an additional stage has been added to ensure that there shall be no deficiency in this important section of the sound spectrum. A single small diameter permanent-magnet moving-coil loud speaker is used for the high notes, and two large-diameter energised units in parallel give the radiating area necessary for adequate reproduction of the extreme bass.

There are no fewer than three independent tone controls. The first, which controls the bass response, consists of a pad of condensers connected in series with the speech coils of the two larger moving-coil units. The middle frequencies are controlled by shunt condensers across the secondary of the push-pull intervalve transformer, and the high-note tone control consists of a volume control potentiometer in the input circuit to the high-frequency channel.

The introduction of a control for the middle register is most useful, as, due to the sensitiveness of the ear in this region, the extreme high- and low-frequency response is apt to be masked at low volume levels. With a tone control in the middle register a much better aural perspective is maintained when the instrument is turned down and is merely serving the purpose of providing a musical background.



The gear is assembled in two self-contained units, the record-changer (right) and the radio and audio amplifying equipment (below).



Quality to Choice

In assessing the quality of reproduction it is necessary to bear in mind that the makers have not attempted to give a "straight-line response" or to impose in any way their own ideas of what constitutes good quality. This is an instrument in which there is full scope for self-expression on the part of the listener. The reserve of power and range of control in the three sub-divisions of the musical scale is sufficient to provide an endless variety of effects—if necessary even to the point of caricature. The double basses, for instance, can be brought forward from their usually obscure place at the back of the orchestra to the status of solo instruments grouped round the conductor's rostrum; or the brass can be given an "edge" which will penetrate any amount of overlaying by other instruments. However, if one requires the usual compromise in the balance of tone the settings of the tone controls which give this result are soon discovered. If the top control at first seems a little critical in achieving a true top response without a certain hard brilliance, there can be no doubt about the smoothness of the two lower controls. It is, perhaps, in gramophone reproduction that the fine bass response is best appreciated, and there can be no doubt that

Anson "Commodore"—

the content of any record will be enlarged and enriched when played through on this equipment.

The radio receiver gives a performance which is fully in keeping with the scope and quality of the remainder of the instrument. All the range that one can possibly use is there, and adjacent station selectivity is possible in all cases with the exception of the locals, where not more than one channel is lost on either side of the normal setting of the station. The reception of American broadcasting on the short-wave range calls for no more skill or concentration than is necessary in operating the set on the medium-wave band.

Apart from the omission of the final AF stages, the only important alteration to the chassis as originally designed is in the provision of a separate amplifier and rectifier for operating the cathode-ray tuning indicator. The radio chassis has its own power supply unit, and the set is completely cold when the gramophone records section is in operation—an important point in view of the length of performance of which this side of the apparatus is capable. A third rectifier of the metal-oxide type supplies the field current for the two energised speakers.

The whole of the amplifying and receiving equipment, together with the unified control panel, is assembled in a framework which can be withdrawn from the cabinet as a single unit. At the back there are sockets for connecting external loud-speaker units and also sockets for remote electrical control of the record-changer unit. The latter is effected through a subsidiary low-voltage relay system.

The price is not within the reach of everyone, but those who can afford to indulge themselves will have the satisfaction of possessing an instrument which can have few rivals in the completeness of its electrical specification, and the ingenuity of its record-changing mechanism.

DISTANT RECEPTION NOTES

YOU may have noticed that Prague No. 1 is not much of a signal just now even after dark. The reason is that its usual 120 kilowatts have been reduced temporarily to a mere 5. Prague No. 2, on 259.2 metres, is out of action altogether at the moment. I have not heard the reason for these goings-on, but I suppose that extensive alterations must be taking place in both the Prague transmitters.

If Prague is silent, or nearly so, Lwow has found a new voice, for the 50 kilowatt transmitter is now at work on 377.4 metres. The wavelength is shared with Barcelona EAJ1, but when this is silent the Polish station comes in well. The old Lwow transmitter was rated at 16 kilowatts. In pre-Lucerne days it worked on 385 metres, and three years ago it used to come in strongly. Then it suffered badly from heterodyne troubles towards the end of the Prague Plan. Under the Lucerne Plan the 16-kilowatt station was usually rather a "chancy" station, coming through well at times, but being often unreceivable.

The French North-African zone is to have a new station, and a high-powered one at that. Morocco already has its 20-kilowatt, Rabat and Algiers its 12-kilowatt transmitter. Tunis is to have one of 100 kilowatts. It may be some time before the station is ready, for the plans have still to be passed.

I have seen it stated that Radio Lyons, the privately owned French station which works on 215.4 metres, has just increased its power from 5 to 25 kilowatts. But the increase took place months ago, and for a long while now this station has been strongly received. I may be unlucky, but I seldom find the programmes of Radio Lyons sufficiently attractive to induce me to listen to it for very long.

Some time ago I mentioned that a station intended to work on a wavelength in the neighbourhood of 300 metres was under construction at Singapore. I now hear that the work is so well advanced that the station may be testing almost at once. The power is, I believe, 20 kilowatts. Singapore time is 7 hours ahead of our own. As closing down time will probably not be later than 11 p.m. local time, the only chance of hearing the station will be on a mid-winter afternoon shortly before 4 o'clock.

Transatlantic reception has been pretty good of late, and more than once I have picked up U.S.A. stations before midnight. This is possible, of course, only when an American station happens to fit into the gap left by some European station that has closed down. One such gap may be found just above Radio Normandie when Moravska-Ostrava and Kuldiga have finished for the night. When conditions are good WPG on 272.6 metres occupies it and may be heard soon after 11 o'clock.

There is no question that many of the late night heterodynes that mystify some listeners are of transatlantic origin. If you find a whistle where there was none earlier in the evening and make a note of the dial reading you are almost certain to find an American station just above or just below it when you go back to it after the European station has signed off.

Nor am I sure that it is U.S.A. stations alone that cause surprise heterodynes in Europe. The South American stations have been coming in so strongly from a comparatively early hour onwards that some of them may also be "guilty." So far, though, I have not succeeded in catching any of them in the act.

D. EXER.

Wireless Servicing Manual. By W. T. Cocking. Second edition, 231 pages + x, 85 illustrations. Published by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 5s. 4d. post free.

THE second edition of this well-known book has been extended by the inclusion of much extra material. All the matter of the first edition is included, but an additional 18 pages of new information have been added, thus increasing the scope of the book and keeping it thoroughly up to date.

The new material includes chapters on short and ultra-short wave apparatus and on the connection of extension loud speakers and other subsidiary apparatus. The appendices have also been revised and now include wire tables, the newest American colour codes, as well as the latest valve base connections.

Going Down

A "RUN" ON THE ULTRA-SHORT WAVELENGTHS

By "CATHODE RAY"

IN the great wavelength share-out at Washington in 1927 there was a keen scramble for long and medium waves. Quite a lot of room was at that time still left among the short waves, but it was rapidly being used up, and the whole lot was, therefore, apportioned to the various interests. But when it came to waves below 13 metres nobody displayed any enthusiasm, so two bands were thrown to the amateurs and the rest were left unclassified.

It was the custom on such occasions to hand out to amateurs a few wavebands for which nobody else saw any utility. With regard to these ultra-short wavebands, the general impression was that they were no good; or, alternatively, if good, there were so many of them that nobody needed to worry about being crowded out.

It is true that even if one leaves out of account the almost unlimited "micro-waves" below 1 metre, the number of "channels" of any standard width is enormous when compared with the total of those provided by the longer waves.

From 10 metres to 20,000 metres there is room for 3,331 channels each 9 kc/s wide. From 1 metre to 10 metres there is room for 30,000. It also seems to be true, despite many surprises in the way of long-distance reception, that the majority of these are restricted to local ranges, and that there is, therefore, no objection to working a large number of transmitters on the same wavelength.

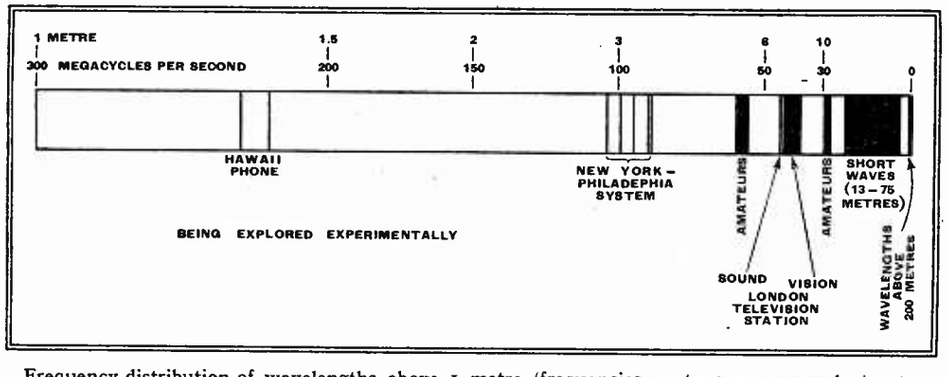
But so rapid has been the discovery of the value of these wavelengths for many purposes that already there are not enough of them to satisfy everybody concerned.

What are all these uses for the ultra-shorts that seem to have been quite suddenly discovered? Television everybody knows about, of course. Besides having forced itself into a prominent place in the public eye (sorry, that was really quite unintentional!) by sheer weight of publicity, it has also forced itself into a prominent place in the elbow-room problem by not "playing fair." While radio telegraph authorities look askance at broadcasters for occupying bands as wide as 9 kilocycles per station, television goes and annexes bands of about 5,000 kilocycles each! Such wholesale appropriation naturally puts a different face on the matter. If ultra-short waves had no other use than for television, there would still be cause for counting them rather anxiously to see if there were enough. But what may not be so well known is that the same would apply if there were no television at all!

Once again, what *are* all these applications for space in the ultra-shorts? I have mentioned amateurs; they have two bands approximately 10-10.7 and 5-5.35 metres, and have justified use of them by demonstrating their utility and by public service on such occasions as when communications broke down during the American floods of 1936.

The features that make ultra-short waves so useful for this sort of work are being recognised by many besides amateurs. Engineers engaged on large structures such as bridges or pylons use "transceivers" to give instructions to or receive reports from men up aloft. Prospectors, explorers, and surveyors use them to keep scattered parties in communication. In America, the land of gigantic trains, there is a real need for communication between driver and guard, and it has to be a link that does not snap like that between two trucks somewhere along the train. So ultra-short wave sets are used. In France they are used in shunting yards and at the port of Rouen. The fighting services use them to co-ordinate their increasingly mobile forces. Police can spread a wide and fast-moving net over the criminal by means of a fleet of cars in continuous two-way touch with headquarters.

The advantages of ultra-short waves for this sort of thing are that a small portable aerial is able to radiate efficiently; that, except for motor ignition, there is hardly any interference; and that the simple, compact, but highly sensitive super-regenerative receiver is most effective on these waves, and is immune to a useful degree from what interference there is. And, of course, there is the advantage for them that the longer waves are all booked up.



Frequency distribution of wavelengths above 1 metre (frequencies up to 300 megacycles/sec.). Note the wide band occupied by one television station compared with all bands above 200 metres.

Post Office Telephone Links

There are fixed communications, too. Instead of extending the telephone system across the channels around our islands by means of cables, which are expensive to lay, and expensive to maintain where ships' anchors and tides drag at them, our Post Office now puts up quite simple ultra-short wave stations which can work unattended. There are twelve "lines" to Ireland between 4 and 6 metres; and a number of others elsewhere, including a span of no less than eighty-five miles between Dorset and the Channel Isles. This, by the way, is 73 per cent. longer than the "optical" range that used to be considered the maximum, at any rate for reliable service. There is—or was until the present acute misunderstanding arose between the two termini—a link between Barcelona and Majorca, 120 miles, with only 10-watt transmitters, working unattended on 4.5 and 5 metres. In America there is one of these telephone links at Cape Cod working on about the same wavelength, and they are used farther afield still, in Hawaii. A different sort of ultra-short wave link is the one across New York harbour, which enables a transmitter on an island to be controlled from the shore.

The ease with which ultra-short waves can be directed is applied in certain blind landing systems for aircraft, now being installed at most public aerodromes, and in the same class there are direction-finding beacons.

Going Down—

Broadcasting authorities, already insufferably overcrowded elsewhere, have not left the ultra-short waves unconsidered. There are certain difficulties arising out of their position as a public service, but the establishment of regular television may tend to reduce these. High-fidelity enthusiasts hope that if broadcasting is done on these waves it will be allowed considerably more than 9 kilocycles per channel, so that selectivity and quality need not be mutually destructive; and broadcasters are considering the advantages of being able to cover "dead spots" with a number of comparatively cheap relay stations working if necessary on a common wavelength. The American station W8XH on 7.3 metres has already made a favourable impression.

Long years ago the B.B.C. pioneered short-wave outside broadcast links where telephone lines were impracticable; for example, in broadcasting the Boat Race, and the first Old Vic relay. Ultra-short waves are now used quite a lot in America for this sort of thing, *e.g.*, interviewing pedestrians, and giving running commentaries on golf matches.

The idea—which is fast becoming illusory—that there is unlimited band-width between 1 and 10 metres has attracted other claims by wide-band systems besides those of television. Armstrong (of super-regenerative and other fame) has demonstrated a system of frequency-modulation depending on an expansion of band-width in order to improve the signal/noise ratio. Double-modulation systems are coming into use, whereby instead of the carrier wave being modulated direct with the phone or morse signals it is modulated by a number of *radio-frequency* waves, each of which is in turn modulated by the audio-frequency signals, which can be separated by means of suitable tuning circuits after the first detector in the receiver. Besides leading to economies, this multiplex system gives some degree of secrecy.

Further Television Requirements

Between New York and Philadelphia there is a multiplex system—two pictures, two automatic typewriters, and one telegraph, in each direction simultaneously—relayed by two unattended stations *en route*, the whole working on six wavelengths close to 3 metres.

Then there will have to be some means of "S.B.-ing" television, and linking up the transmitters with outside broadcasts. Cables for carrying the necessary wide-frequency band are enormously expensive and may never be generally available. It looks as if radio links will be used, and of course they must be at least as wide-band as the television broadcasts themselves.

Some, at least, of these systems that seek a place in the ultra-short waves because of their wide band requirements will have to go below 1 metre into what is generally known as the "microwave" region. The cross-channel circuit from Lympne to St. Inglevert on 17 cms. has had few neighbours in wavelength during the several years since it was installed; but this solitary state may not last much longer. Apart from the enormous width of the frequency band available, these waves offer certain exclusive possibilities. Experimental systems of radio-directed navigation in Germany with 10 cm. waves have shown that a beam only one-tenth of a degree is practicable. This is done with parabolic reflectors just like a beam of light.

Then there have been experiments—French this time, I believe—with a view to locating obstructions such as icebergs. The transmitter and receiver are mounted on opposite sides of the ship, and any exceptional reflections that would be caused by something in front are investigated by calculating angles and so forth, according to simple surveying principles.

Time would fail me to tell of other present and projected applications of ultra-short waves—airport and aircraft signalling, fire-fighting (both urban and forest), geophysics, film production, radio-meteorography, therapeutics—all are queuing up. The wide open spaces will soon be built-up areas.

PRINCIPAL BROADCASTING STATIONS

There being no important changes in our usual monthly lists, these pages have not been included in this issue.

WHERE THE PUBLIC CAN SEE TELEVISION DEMONSTRATIONS

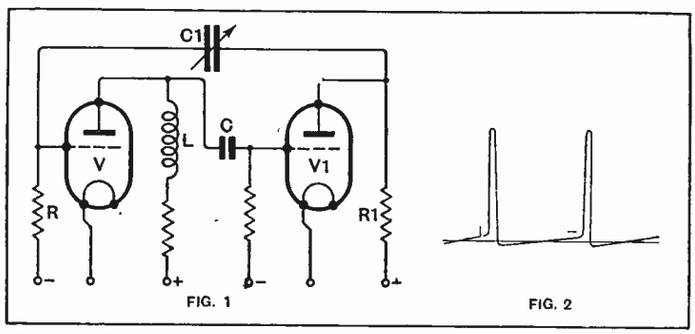
Place.	Particulars.
Science Museum, South Kensington.	Free.
Waterloo Station.	Free to railway ticket holders (Southern).
Army & Navy Stores, Ltd., 105, Victoria St., S.W.1.	Free.
John Barker & Co., Ltd., High St., Kensington, W.8.	Demonstrations shortly
Barries Radio (London) Ltd., 91, Ruislip Rd., Greenford, Middx.	Free at 9 p.m.
Bensteds, 22, Hill Street, Richmond.	Free at 3 p.m. and at 9 p.m. by appointment.
Bentalls, Kingston-on-Thames ...	Demonstrations shortly.
Electrico (Croydon) Ltd., 97, George St., Croydon, and 30 Market Square, Bromley.	Free from 3–4 p.m. and from 9–10 p.m. by appointment.
A. W. Gamage, Ltd., Holborn, E.C.1.	Free.
General Electric Co., Magnet House, Kingsway, W.C.2.	Free.
Gramophone Co., Ltd., 98–108, Clerkenwell Rd., E.C.1.	By arrangement with their local H.M.V. dealer, readers of THE WIRELESS WORLD can have free demonstrations.
Hampton & Sons, Ltd., Pall Mall East, S.W.1.	Free from 3–4 p.m.
Harrods Ltd., Brompton Rd., S.W.1.	Free.
Hendon Motor Co., 48, Vivian Ave., Hendon Central, N.W.4 (not far from Hendon Central Underground).	Demonstrations daily from 3–4 p.m., and by appointment only from 9–10 p.m.
A. Imhof, Ltd., 112, New Oxford St., W.C.1.	Free.
H. Jenks, Ltd., 54, Ebury St., S.W.1.	Free.
Murdoch, Murdoch & Co., 463, Oxford St., W.1.	Free, by invitation.
E. Rogers & Sons, Ltd., 56, 58 & 64, High St., Weybridge.	Free.
Royal Arsenal Co-operative Society, Ltd., various branches in S. London.	Free.
Selfridge & Co., Ltd., Oxford St., W.1.	Free. Appointments have to be booked.
The Teleradio Co., 157, Fore St., N.18.	Free. Names have to be left in advance at various branches of the Teleradio Company.
Thomas Wallis & Co., Ltd., Holborn Circus, E.C.1.	Free.
Wm. Whiteley, Queen's Rd., Bayswater, W.2.	Free.

Recent Inventions

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

IMPULSE GENERATORS

THE two valves V, V1 are mutually cross-coupled, to form the so-called multi-vibrator circuit (Fig. 1). The anode of V is coupled through the condenser C to the grid of V1, whilst the anode of the latter is similarly coupled through the condenser C1 to the grid of the first valve. A circuit of this kind produces oscillations



Circuit of multi-vibrator is shown in Fig. 1, while Fig. 2 indicates the form of wave generated.

which are very rich in harmonics, the frequency and wave-form of the fundamental being largely determined by the values of the coupling condensers and resistances.

According to the invention an inductance coil L is included in the anode circuit of the valve V for the purpose of increasing the frequency, and reducing the width of the impulses generated by the valve-combination, so that they take the form shown in Fig. 2.

Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. Application date February 25th, 1935. No. 452583.

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SUPPRESSING LOCAL INTERFERENCE

ONE method of cutting-out local interference consists in using an auxiliary valve, which is normally quiescent, but which is "triggered" by the impact of a strong interfering impulse, so as to produce a biasing-voltage which paralyses, say, one of the IF circuits and so prevents either the signal or the interference from reaching the loud speaker. If the duration of cut-out is sufficiently short, there is no apparent discontinuity in the received programme, though the impulse of static is effectively removed. It is found, however, that the sudden interruption of the carrier wave affects the operation of the rectifier valve and gives rise to a "click" in the loud speaker.

In order to prevent this residual effect, the carrier wave is first removed in the early stages of the receiver (or the signal may be transmitted with the carrier-wave suppressed) and the "interruption" necessary to eliminate local "static" is then effected at a point in the receiver preceding that at which the carrier wave is again restored. This secures the desired result without giving rise to undesirable noises in the speaker.

N. V. Philips Gloeilampenfabrieken. Convention date (Germany) May 14th, 1935. No. 452107.

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DIRECTION-FINDERS

ALTHOUGH the point of minimum or "zero" signal-strength is more sharply defined than that of maximum signal-strength, there are times, for instance on an aeroplane in flight, when, owing to the prevailing noise, it is necessary to employ the less sensitive method.

In order to do so, and at the same time secure a high degree of sensitivity, the receiving aerial—or its line of maximum response—is caused to rotate through a small but fixed angle. Any departure from the true bearing-line then becomes obvious unless the axis of rotation is truly in line with the distant transmitter. In the latter case, the superposed rotation will produce no variation in the strength of the received signal.

Telefunken Ges. fur Drahtlose Telegraphie m.b.H. Convention date (Germany) January 27th, 1934. No. 450484.

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VARIABLE-MU VALVES

ONE well-known way of securing a variable-mu effect is to wind the control grid of a valve in an uneven spiral, so that the spacing between successive turns gradually increases. This, however, leads to undesirable results when the control grid is followed by other grids, as in a pentode or other multi-grid valve, because the subsequent grids, being wound evenly, are "clogged" by the irregularities in the electron stream introduced by the first grid.

According to the invention, as applied to a variable-mu pentode, the control grid and the suppressor grid are both wound with the same degree of unevenness; whilst the intervening or screening grid is wound with a uniform spiral, as usual.

N. V. Philips Gloeilampenfabrieken. Convention date (Holland) December 12th, 1934. No. 452541.

TUNING INDICATORS

A CARRIAGE runs on wheels along a grooved track so as to move a pointer along an indicator scale marked with wavelengths or stations. In order to allow of fine and coarse adjustment, the drive is applied to the carriage through either a large or small wheel which makes frictional contact with the surface of the track. Normally the tuning is "fine," but by pressing a release knob, the first driving-wheel is disengaged, and the second wheel is brought into action to move the pointer rapidly over the scale.

The General Electric Co., Ltd., S. G. Hunter, and W. H. Peters. Application date March 5th, 1935. No. 453140.

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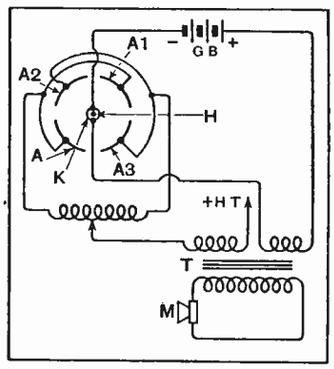
MODULATING SYSTEMS

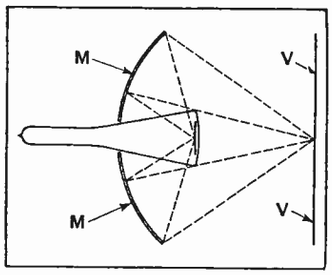
IN a magnetron valve the passage of the electrons from filament to anode is controlled by a strong magnetic field applied from a coil wound outside the bulb. This type of valve is particularly suitable for short-wave working, but when used for transmission is subject to certain limitations which tend to reduce its efficiency as a modulator.

In order to remedy this, the signalling voltage is applied simultaneously to the anodes and to a control grid. As shown in the figure, the magnetron is of the split-anode type, the two pairs of anodes A, A1 and A2, A3 respectively, being interconnected. Modulating signals from the microphone M are applied across the transformer T to two windings, one of which varies the voltage on the two pairs of anodes, whilst the other varies, in opposite phase, the biasing voltage on a grid H. The latter takes the form of a straight wire placed inside the helically wound cathode K.



Method of applying modulation to a magnetron generator.

Telefunken Ges. fur drahtlose Telegraphie m.b.h. Convention date (Germany) November 30th, 1934. No. 452960.



Method of projecting the image in a cathode-ray tube.

TELEVISION RECEIVERS

ONE drawback of the cathode-ray tube when used as a television receiver lies in the fact that the size of the picture is, necessarily, restricted by the overall size of the glass bulb in which the fluorescent screen is mounted. The inventors set themselves to solve this problem by using a reflecting mirror, instead of the more usual magnifying lens.

As shown in the figure, the mirror M is mounted at the back of the cathode-ray tube, which projects through an aperture in its centre. A relatively small tube may be used in this way to give a clear final picture, say, 12 or 18 inches square. The dotted lines show how the light from one particular scanning spot is reflected from all points on the mirror back to a single point on the viewing screen V. Because the fluorescent light is picked up from a wide angle, there is a very little loss. In addition, the back of the fluorescent screen may be made opaque, to prevent any loss in that direction.

Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett, and R. Cadzow. Application date January 16th, 1935. No. 452148.

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CATHODE-RAY TUBE

THE electron stream is focused by two tubular electrodes which are mounted coaxially, end to end, inside the glass bulb, and are maintained at different positive potentials relative to the cathode. A diaphragm with a central aperture is mounted between the ends of the two tubes.

The arrangement is such that of the two electron-optical lenses so formed, the "collecting" lens is predominant if the diaphragm is connected to the electrode carrying the higher positive potential, whilst the "dispersing" lens prevails if the diaphragm is connected to the lower-potential electrode. The diameter of the centre hole in the diaphragm determines the effective "aperture" of the electron lens-system. The use of the two lenses allows a sharper and smaller image-point to be formed on the fluorescent screen of the tube.

Radio Akt. D. S. Loewe. Convention date (Germany) December 9th, 1933. No. 453223.

MISCELLANEOUS ADVERTISEMENTS

NOTICES

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ADVERTISEMENTS for these columns are accepted up to **FIRST POST on MONDAY MORNING** (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or on **SATURDAY MORNING** at the Branch Offices, 19, Hertford Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26B, Renfield Street, Glasgow, C.2.

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All letters relating to advertisements should quote the number which is printed at the end of each advertisement and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

NEW RECEIVERS AND AMPLIFIERS

A

A

DEGALLIER'S, Ltd., the Firm for Reliable Short Wave Radio (1937), have on show in London the largest selection of fully guaranteed brand new all-wave receivers; callers invited to handle all at their leisure without obligation to purchase; all S.W. receivers guaranteed to get stations on the low bands, including the Americas, etc. Hours of business, 11 a.m.-7 p.m., Saturdays 9 p.m. Early closing day Mondays. All goods cash with order or c.o.d.; handsomely illustrated catalogues available; send large stamped addressed envelope with all enquiries.

WE Guarantee to Receive the American Transmissions at full programme strength after 3 p.m. daily; those interested welcomed without obligation.

6/6 Each.—Valves for American receivers, all guaranteed, each a first, no seconds or throw-outs; for every known set, from 1927-37; metal, metal glass, glass counterparts and glass; in ordering, just state type and number; we have it, even up to the latest 6L6; all post paid; line cords for all Midgets, 4/6.

£3/10/- wave, 7X, 10X6, A.C./D.C., 200-250 volts, carriage 1/4.—5-valve Midget, T.R.F., medium and long

£8.—"Challenger" Table Grand Model 6-valve superhet, "Mono-vision" tuning control, A.C. 200-250 volts, 3 bands 18-55, 190-550, 800-2,000 metres, 3½ watts output, tone control, delayed A.V.C.; carriage 4/6; (16½×16×8).

£9.—"Challenger" Table Model 6-valve superhet, 3 bands, 16-52, 190-550, 900-2,000 metres, A.V.C. tone control, P.U. terminals (17×13×9), A.C./D.C., 200-250 volts; carriage 4/-; also available in A.C., same price.

13 Guineas.—The new Challenger 8 (type 800) table model De Luxe, 22×18×12 high fidelity 8-valve superhet, A.C., 200-250 volts, wave-band coverage 11-2,050 metres, simplified centralised tuning, super Vernier, slow-fast tuning self-contained control panel, perfect tone quality at low volume, new type 10-inch M.C. speaker, from a whisper to 8 watts pure undistorted tone, no overloading at full volume, oscillator fundamental without use of harmonics, persistent oscillator of highest output, isolating filters eliminate oscillation and motor-boating, fully delayed A.V.C. bias, absolute minimum of noise and sensitivity control for noise suppression, A.V.C. re-enforced capacitators prevent drift, pre-aged intermediate frequency transformers, I.F. barrier, discs, anchor coil leads, plug in loud-speaker, also provision for external speaker, moisture sealed out by tropical zone impregnation, self healing electrolytic condensers, one complete chassis of dreadnought construction, moderate voltages assure full valve life, economical to operate (consumption 65 watts), long life eliminates repairs, correct valve selection, no compromise, no hum, full weight transformers, true push-pull, stabilised high tension supply, stabilised biases, ceramic coil insulation, fully loaded plate coils give maximum gain, pre-balanced coil assembly, matched sets of individual coils, no taps, sealed insulation, thin laminations of special silico steel, 7 K.C. selectivity, fractional microvolt sensitivity, shielded switching, permits high gain, positive silver-plated contacts, eliminates switch noises, audio frequency range 30-8,000 cycles, diode detec-

(This advertisement continued in third column.)

HT

"A head to contrive, and a hand to execute."

HOBBIES

Of the hobbies that men enjoy, there are two above all that we cater for: one is, working with tools; the other, listening to music.

How happy is the man who enjoys both; For, first, he can get hours of pleasure in building up a Hartley-Turner S12A kit set, and then go on to enjoy really lifelike music from it.

Bear in mind that the kit set is identical with the receiver that we ourselves use in our most expensive short-range radio-gramophones. We call it a "short-range" set because the simple circuit is designed to deal with the full frequency response of the best B.B.C. transmissions. It will actually bring in (on a good aerial) 50 stations or more; but we do not guarantee freedom from interference in difficult conditions: the set is really meant for local station work.

TECHNICAL DATA

CIRCUIT: Band-pass filter, set to 20 kc/s band-width; H.F. pentode with amplified A.V.C.; R.F. transformer with reaction detector—used as 1st A.F. valve on gramophone work; intermediate A.F. valve with volume control; special HARTLEY-TURNER A.F. coupling unit; power stage with two 25 watt valves in push-pull; HARTLEY-TURNER output transformer; mains unit of generous design, exceptionally well smoothed, for 50 cycles A.C., 200-250 V.

PERFORMANCE: A.F. side flat to 13 kc/s: R.F. circuits cut at 10 kc/s on medium waves and 8 kc/s on long waves: up to 14 watts undistorted output.

CONSTRUCTION: steel chassis, box form, 3in. deep, 14in. wide, 13 3/16in. back to front; 9¼in. overall height with valves. Components above and below deck, all wiring below. Tuning scale with station names and wave-length calibration. Four controls: tuning, wave switch, reaction, volume **plus** mains switch.

PRICE: complete with valves, blue prints, full instructions and sundries **£19 15 0**

To those readers who wish detailed information before deciding to purchase, we are prepared to forward the print and instructions, for 3s. 6d., this to be credited on purchase of the kit.

HT

HARTLEY TURNER RADIO LTD.

THORNBURY ROAD, ISLEWORTH, MIDDLESEX.

Telephone: HOUnslow 4488

NUMBERED ADDRESSES

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes: in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

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Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged: on transactions over £10 and under £50, the fee is 2/6; over £50, 5/-. All deposit matters are dealt with at Dorset House, Stamford Street, London, S.E.1, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post. When sending remittances direct to an advertiser, stamp for return should also be included for use in the event of the application proving unsuccessful.

NEW RECEIVERS AND AMPLIFIERS

(This advertisement continued from first column.)

tion, prizmatone high fidelity R.F. preselector stages on all bands, carriage, 6/-; for experimenters, less cabinet deduct 15/-; if public address Rola 12in. G.12 supplied in place of standard speaker, add £2.

£17/17/- 6 inches, width 24 inches, depth 12½ inches, chassis as incorporated in 800 model but incorporating the G.12 high fidelity 12in. speaker; carriage and crate 10/-.—Challenger 8 Console 800C., height 3 feet

29 Guineas.—"Challenger 800 R.G." radiogram with automatic record changer; measurements, height 2 feet 8 inches, width 3 feet, depth 21 inches; this also incorporates the G.12 and tweeter; carriage and crate 15/-.

NOTE.—The Challenger 800 is available for A.C./D.C. 200-250 volts, employing 11 valves, at an additional cost of 20/- on each model.

CHALLENGER Model 381, with refinements over the 800 series, 8 valve, 13-2,060 metres, Polychromatic dial scale, improved vision master, beam power output valve, 10 watts undistorted, band spread Magna dials and second-hand, magic eye tuning, full range, tone control, automatic band indicator, high image frequency suppression, hair line selectivity, ultra sensitivity; the price will be: table model, 14 guineas; or in chassis form for the experimenter, chassis, dials and speaker, £13/18; the 381 is available in A.C. only; we would point out that this receiver does not in any way replace the 800 model.

£16.—Challenger 12 A.C./D.C. 200-250 volts, 4 bands 11-2,050 metres, the first time that D.C. users have been able to get 10 watts undistorted from their speaker, which is a large 12in. K. type Rola, triple parallel rectification, push-pull parallel four pentode output, carriage and crate 7/6; chassis, valves and speaker alone, £15.

£37/10/- and speaker, 6 bands, 4½-2,400 metres, A.C., 100-250 volts; this receiver has many improvements over the 1936 model; carriage paid; available in various console cabinets.—V.T.18 Midwest 18 valve chassis, valves

£50.—Midwest Royale 24-valve chassis, valves and three speakers, carriage paid.

£50.—Challenger "Model 5240" 24-valve superhet, twin chassis, valve and "2" Public address speaker, with 60 watts undistorted output, sensitivity ¼ microvolt absolute, tuned H.F stages on all bands, 3 I.F. stages, the last one being used for selectivity only, frequency response at the speakers within 2db over whole range, wave band coverage 5-2,050 metres in 5 bands, Magic-eye tuning, variable selectivity, receiver chassis heavily shielded and chromium plated, Centro-Master automatic control unit, dual rectifier, signal channel separate from A.V.C. system, linear diode detection, separate rectifier to provide A.V.C. voltage, radio frequency pre-amplifier stages eliminate repeat points and whistles, and provide maximum signal to noise ratio, beam power output valves, polychromatic dial scale, prizmatone high fidelity, uni-control 2-speed free-wheeling tuning, band spread Magna dial and second-hand, automatic band indicator, automatic interstation noise suppression, separate bass boosting amplifier, automatic frequency control, iron core I.F. transformers, code interference filters, automatic volume control, beat frequency oscillator; carriage 18/-; also available in various gramophone and console cabinets.

DEGALLIER'S, Ltd., 18, Connaught St., Marble Arch, London, W.2. Paddington 2745. [3349

"Radio Data Charts," A Series of Abacs Post free 4/10

No. 15

Notes on an interesting new H.F. Low Impedance Feeder

This feeder has been designed for conveying H.F. currents to or from half-wave dipole aerials in which the feed is taken at the centre of the acrial. Under these conditions the radiation resistance as referred to the centre of the acrial is theoretically 73 ohms in free space and slightly greater in practice. This feeder has been designed for short-wave reception or low power transmission, with particular reference to the television frequencies.

Catalogue No. 319, 65ft. on bobbin, 6/9.

In practice it has been found to subscribe towards the production of a particularly clear picture remarkably free from usual interference, even when it has been found necessary to lead down via a lift shaft. In these early days we are reluctant to be over-enthusiastic, but we have taken the opportunity of testing this feeder in practice, against installations using known coaxial systems, and so far there is no evidence that the coaxial is in any way superior; in fact there is a distinct tendency the other way. The difference in price, and ease of installation, make its trial worth while every time. It is sold on reels, 65ft. 6/9, or in longer lengths at 3½d. per yard, subject to special order.

SPECIFICATION: Surge impedance 75 ohms, i.e. exactly matching a dipole. Loss on db. per 100ft. at 45 m.c. = 1.4; 14 m.c. = 0.8; 7 m.c. = 0.6. Two enamelled copper conductors, each 0.018in. dia. Spacing between centres, 0.035in. Covering "Telconax" laid up to a final elliptical section, 0.11in. × 0.15in. Weight per 100ft., 0.85 lbs.; breaking strain 20 lbs., conductors breaking first. Owing to the absence of fibrous worming there is no moisture absorption, and due to the fact that "Telconax" has high resistance to the action of ultra-violet light, long exposure to hot, dry or moist climatic conditions are unlikely to increase attenuation losses.

For transmission purposes, capable of carrying 1.5 amp., H.F., and when supplying a half-wave dipole at 60% efficiency from the transmitter may be used for final stage power inputs not exceeding 200 watts.

Those interested in anti-interference all-wave reception should write for our free book on the "Eliminoise" system. Other literature includes "Wireless Without Crackling," free; "Interference Suppression" manual, post free, 1s. 2d.

RECEIVERS AND AMPLIFIERS, CLEARANCE, SURPLUS, ETC.

HENRY'S.

1936 Regentone 6-valve Superhet., thermometer tuning, unused and boxed; list price £11/11, A.C. model £5/10, Universal A.C./D.C. £5/15.

1936 Regentone 5-valve Consolette, thermometer tuning, unused and boxed; list price £10/10, A.C. model £4/15, Universal A.C./D.C. £5.

1936 Regentone Battery Set, list £7/10/6, var.Mu., S.G., det. and pentode output, P.M. speaker, thermometer tuning, unused and boxed; £3.

HENRY'S, 72, Wellington Av., London, N.15. Stamford Hill 2907. [3247

HYAMS RADIO.

KOLSTER BRANDES Class B Band Pass 4-valve Sets, with B.V.A. valves and batteries; list price £10/10, special offer, £4/5.

KOLSTER BRANDES Straight 3 Receiver, 8in. moving coil speakers, with B.V.A. valves and batteries; complete £2/15.

HYAMS RADIO, 23, Lisle St., Leicester Sq., W.C. Gerrard 2969. [3357

THE Sensational Offer of the Season.

KING OF THE AIR 6-valve All-wave Superhet. Chassis. 6 latest metal valves, 9-valve performance, Jensen dynamic M.C. speaker, new magic dial, floodlit (station names), transformer tapped from 100-250 volts, pick-up tappings, 5 watts output, 3 wavebands 14-52, 180-560, 950-2,100 metres, tone control, A.V.C. (for A.C. mains only), chassis packed in sealed cartons; price £8/10 (carriage paid) anywhere; cash with order or c.o.d.—Morris's, 89, Tottenham Court Rd., London. Museum 4910. [3358

75/- for Brand New 9-guineas Table Grand, 193- model, guaranteed, A.C., moving coil speaker, magnificent walnut modernistic cabinet; send for list of similar bargains.—Kay, 1, Old Church Lane, N.W.9. Col. 8266. [0535

BATTERIES & CHARGING PLANT

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OVER 100 Ferranti and Weston Meters in Stock; S.A.E. for list.—R. P. R. Radio, 112, Pentonville Rd., London. [3341

PYE Universal Tester, £5; Ferranti VT1 valve tester, £4.—Cosmic Radio Services, Ltd., 23, Water St., Liverpool. [3346

UNIVERSAL Avo Meter new condition, cost £12/12, for sale; £8/10, or nearest offer.—L. H. W., 106, Upland Rd., Sutton Surrey. [3360

FERRANTI and Weston.—Thermals, 0-120 milliamperes, 25/-; 0-2½ amperes, 15/-; M.C.s, 0-1 milliamperes, 20/-; 0-5, 0-20 milliamperes, 15/-; 0-50, 0-150, 0-200 milliamperes, 12/-.—Box 84, c/o *The Wireless World*. [3296

SIGNAL Generator, all wave, Readrite, 15-3,000 metres, magnificent instrument in beautiful carrying case, brand new, guaranteed, £6/6; output meter, Readrite, 0-100, for same or separate, £2/2; instruments you will be proud to own; cash with order or c.o.d., on appro. if desired.—Kay, 1, Old Church Lane, N.W.9. Col. 8266. [0540

NEW COMPONENTS

ALL Standard Makes, wholesale only; write for lists.—Leonard Heys, 36, Henry St., Blackpool. [0528

"WIRELESS World" Transverse Current Microphones, in parts; original model 8/6, improved 10/-, complete.

A. HINDERLICH, 2, Bridge Rd., London, N.W.10. [3276

"WIRELESS WORLD" Specification Microphone Transformer; 8/6.—Sussex Chargers, 40, Western Rd., Hove. [3340

ARMSTRONG 6-Valve SUPERHETERODYNE RADIOGRAM

Chassis with

ROLA F.6 SPEAKER

THIS new chassis is designed to give a good all round performance with 3½ watts output on both radio and gramophone. Short wave-band is arranged to cover both the English and American amateur bands as well as the usual short wave broadcast. All the best English components are used throughout and the circuit incorporates the latest improvements such as three wavebands with band-pass input, full range volume and tone controls working on both radio and gramophone, large full vision scale with station names marked on all wavebands, etc.

The price includes radiogram chassis complete with 6 British valves and 8" Rola moving coil speaker, matched to the chassis, mains leads, pilot lamps and everything ready for immediate use. Packing and carriage free.

7 days' trial, carriage paid.

ARMSTRONG 12 months' guarantee.

Price

£7.10.0

Ready to switch on.

ARMSTRONG MANUFACTURING CO.
100, KING'S ROAD, CAMDEN TOWN, N.W.1.
'Phone: GULliver 3105.

SEASONABLE BARGAINS

ARMCHAIR RADIO CONTROL.—Modula high res-compression, Volume Control, 12ft. twin flex and valve adaptor, **1/6.**

SPEAKERS, 6in. R.V.A., new. Moving Coil. Half price, **7/6.**

CRYSTAL SETS for crystal-pure reception. Desk type, full B.B.C. range, **7/6.** Headphones, **2/9** and **4/6.**

7/6

HOME RECORDING

Great Fun. Lasting Interest.

Cost is low. New **MIVOICE** acoustic sets, complete outfits in carton de luxe, **21/-.** No. 2 Mivoice, **12/6.** Junior, **7/6. ELECTRIC** recording Turntables, **25/-.** Cutter needles, sapphire, **3/6.** Diamond, **7/6.** Blank discs, **4/-** doz.

PUBLIC ADDRESS.—We can supply from stock a range of Portable and Fixed D.C. and A.C. Amplifiers for Dance Band, P.A. and Talkies, from 3 watts to 100 watts, at bargain prices. All new 1936 models.

LIGHT AND RAY CELLS.—Selenium Raycraft, **21/-**; Kingston, **15/-.** Raycraft outfit with relay and amplifier, **45/-. Photo-cells,** for Sound-on-Film, Television and Ray Work, B.T.P., **15/-**; R.C.A., **25/-**; G.E.C., **25/-** to **£3 10s.** Beck Angle Prisms, mounted in carrier, **5/6.** Micrometer adjusters for lens, **1/-.** Eyepieces with prism and lenses for photo-cell inspection, **12/6.** Five-guinea X-ray valves, new, **10/-** only.

MIRRORS,—5½in. dia., Helio or Television, **1/6.** Parabolic Concave, 10in., **20/-**; 20in., **25/-**; 24in., **30/-.** Carr. fwd. Neon Lamps, **2/6** and **3/-** each, with holder. Miniature Neons, **2/6.**

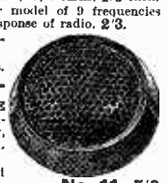
SHORT-WAVE 2-pin coils. 2, 3, 4 turns, **1/-** each; 5, 6 turns, **1/6** each.

MULTI-FREQUENCY TEST RECORD.—A new model of 9 frequencies 25/8,000, for use with gramo., test frequency response of radio, **2/3.**

HEAR YOUR VOICE on your radio set loud-speaker.

5/- BUTTON MICROPHONES for all purposes. Usually sold at 3/6. Our price has always been **1/-.** We have supplied thousands.

A NEW PRACTICAL HOME MICROPHONE for broadcasting at home. It is a general-purpose, robust mike, with solid bakelite body, back terminals, front metal grille. **No. 11.** New design, finely finished, **5/6.**



No. 11, 5/6

No. 11A. Special in solid brass body, unequalled at the price on speech and music, **7/6.**

FLOOR STANDS, 26in., **12/6**; 37in., **15/-**; 48in., **18/6.**

CABLE AND WIRE.—Screened metal sheath a necessity. Lead covered single, 3/.029, **7/-** 50 yds.; 7/.029 ditto, **12/-** per 50 yds. L.C. Twin, 1/.064, **12/-** per 50 yd. coil; L.C. Twin, 1/.044, **16/-** per 50 yd. coil. Plain V.I.R. lighting, 1/.044, **5/3** per 100 yds. 27/40 Litz for H.F. coils, **1/-** per doz. yds. Heavy Mains, Flex, per doz. yds., post 6d Twin lighting Flex, **2/-** per. doz. yds., post 4d. Insulated Earth Cable, **1/6** doz. yds., post 4d. Lead-in Cable, rubber-covered, **2/-** doz. yds., post 4d. Red and Black Flex, **1/6** per doz. yds., post 3d.

Come to us for Dynamos, Motors, Meters, Mikes, Testers, Recording Gear and Convertors, Switchgear and Soundheads.

Send for Electrical-Scientific Illustrated List "W." Post Free.

ELECTRADIX RADIOS

218, Upper Thames Street, E.C.4

Phone: Central 4611

COMPONENTS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

RADIO CLEARANCE,

63, High Holborn, W.C.1. Holborn 4631.

LISSEN 4-valve A.C. Band Pass Receiver, a splendid job, fitted in handsome walnut cabinet, complete with energised moving-coil speaker, connection for pick-up, listed 9 guineas, sent out aerial-tested by our own engineers; 70/-.

8-VALVE A.C. Mains Superhet. Receiver, by well-known manufacturer, incorporating many refinements, visual tuning, illuminated colour coded volume control, local distance, switch, etc., fitted in handsome bird's eye maple cabinet, size 16in. wide, 12in. deep and 23in. high, comprising the following valves: AC/VP1, FC4, AC/VP1, AC/VP1, AC/HLDD, V914, AC2 Pen., IW3, pre H.F. stage, 2 I.F. stages, full A.V.C., etc., limited quantity; £7/15.

EXCLUSIVE British Rights Held by Us for Constructrad Short Wave Kits; all kits supplied valves free, 5 interchangeable coils, covering a range from 15-600 metres; complete set, not a converter.

1-VALVE Battery Kit; 29/6.

2-VALVE Battery Kit; 32/6.

1-VALVE AC/DC Kit; 37/6.

3-VALVE AC/DC Kit; 50/-.

EVER-READY 5-valve Battery Superhet., an up-to-the-minute modern receiver, fitted 5 valves (ring), etc., A.V.C., provision for extension speaker and pick-up, latest square type dial calibrated in metres and station names, listed 14 guineas; last few to clear, £5/10, carriage paid.

LISSEN Battery Band Pass 3, a handsome receiver in walnut cabinet, of upright design, complete with valves as follows. Var. Mu screen grid, detector, Pentode output; sent out aerial-tested and guaranteed; 57/6.

BRYCE Mains Transformers and Chokes, standard for the season, best made, British and guaranteed.

250-0-250, 80 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 4 amp.; 8/6.

350-0-350, 120 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 4 amp.; 10/6.

350-0-350, 150 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 4 amp., 2-0-2 volts, 2 amp.; 12/6.

500-0-500, 150 m.a., 2-0-2 volts, 2.5 amp., 2-0-2 volts, 6 amp., 2-2 volts, 2 amp., 2-0-2 volts, 2 amp.; 17/6.

H.T.8 Transformer, 250 volts, 60 m.a., 2-0-2 volts, 4 amp.; 8/6.

DITTO with H.T Metal Rectifier; 17/6.

ALL Transformers are Fully Shrouded.

BRYCE Mains Chokes.

40 m.a., 30 hys., 300 ohms; 4/6.

60 m.a., 40 hys., 300 ohms; 6/-.

150 m.a., 40 hys., 200 ohms; 10/6.

250 m.a., 15 hys., 200 ohms; 21/-.

60 m.a., 80 hys., 200 ohms for speaker replacement, etc.; 6/-.

SPECIAL Clearance Choke, 250 m.a., 12 hys., 100 ohms, heavy duty type, interleaved windings, etc., cannot be repeated; 1/-.

TRIAD American Valves, highest quality, all types, 5/6, as follows:-

01A, 24A, 27, 30, 1, 37, 38, 39, 41, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 6F7, 2A3, 5Z3, 12A7, 6A7, 6C6, 6D6, 12Z3, 25Z5.

ALL These Valves Cy a 90-day Guarantee and Free Replacement, proved that the filament or heater is intact, and the glass not broken when returned to us.

AMERICAN 5-6-7-pin Valve Holder, chassis type; 6d.

LISSEN 126 Superhet Assembly, comprising 3-gang coil unit, fully screened, 2 Band Pass coils, 1 oscillator), 2 I.F. transformers, fully screened, 1 only 3-gang semi-screened condenser with drive; 8/11.

CENTRALAB Volume Control, with switch, 5,000, 10,000, 25,000, 500; 2/6 each.

LISSEN All-wave Coil complete with circuit, switching, etc., sent out in matched pairs, covering 2 short bands, 1 medium and 1 long; 8/-.

DITTO Single Coils; 4.

LISSEN 126 K/Cs. Iron Cored Oscillator Coils, screened; 1/-.

ONE Dozen Peak Metal Cased Condensers, paper type, all useful sizes, 0.1 plus 0.0001, 0.1, 0.2; 2/6 a dozen.

8 Mfd., 500-volt work, 550-volt surge, heavy duty electrolytic condenser, well known manufacturer; 2/11.

8 Mfd. and 4 mfd. Electrolytics, 450-volt working, 500-volt peak; 2/6.

8+8 Cardboard, wire e. electrolytics, 450-volt working, 500 surge, by well-known manufacturer; 3/6.

50 Mfd. 12-volt Working Condensers, well-known manufacture; 1/-.

(This advertisement continued on next page.)