THE

WIRELESS ENGINEER

AND

EXPERIMENTAL WIRELESS

NUMBER 111 VOLUME IX DECEMBER 1932

A JOURNAL OF
RADIO RESEARCH
AND
PROGRESS

2/6
NET

PUBLISHED BY
ILIFFE & SONS LTD.
DORSET HOUSE TUDOR STREET LONDON E.C.4

"The Wireless World"

The weekly journal which keeps its readers thoroughly in touch with all that is happening in wireless. It covers every wireless interest and appeals to every wireless amateur.

It is in every sense a wireless newspaper, for it records and reviews prevailing theory and current practice in design, and also gives, week by week, broadcasting and other general news for every one interested in wireless broadcasting and reception.

Special features are: Theoretical Articles discussing new principles: Detailed Technical Reviews of Commercial Radio Receivers: Designs for Experimental Receivers specially prepared to illustrate the practical application of new principles in valves, components, or circuit arrangements.

"The Wireless World" now appears in greatly enlarged form, and while retaining all the well-known features, each issue also contains the

Complete
FOREIGN PROGRAMMES
For the Whole Week
(with full details)

The
Wireless
World

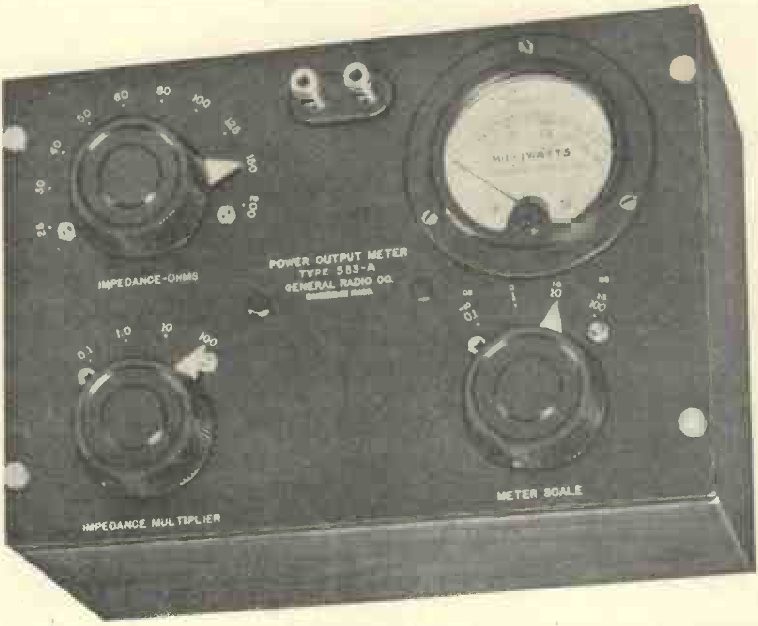
EVERY FRIDAY 4d

Subscriptions:
Home and Canada, £1.1.8, other Countries
Abroad, £1.3 10 per annum, post free.

ILIFFE & SONS LIMITED DORSET HOUSE TUDOR STREET LONDON E.C.4

CLAUDE LYONS, LTD

Head Offices: 76 OLDHALL STREET, LIVERPOOL
London Offices: 40 BUCKINGHAM GATE, S.W. 1



Output-Power Meter, Range 2.5 to 20,000ω

The Output-Power Meter, generally more shortly designated "Output-Meter," is an essential in the Radio-Engineering Laboratory. We were the first to introduce same to the British Manufacturer. In the Radio Field its chief use is to measure the power output of a receiver. In conjunction with a calibrated Standard-Signal Generator, the output of which is known in Micro-volts, and by setting the Output-Power Meter always to 50 milliwatts, it is naturally possible to ascertain a power-ratio for the Receiver as a whole, thus determining accurately its "sensitivity."

Because it is necessary, for accurate measurements, that the impedance of the Meter and that of the output of the Receiver should be equal, Power-Meters have been constructed of various characteristic impedances. Thus at first we offered only the GR Type 486, impedance 4,000 ohms. Later on we introduced the 483-A, -B and -C, of 4,000, 8,000 and 20,000 Ohms Impedance. Frequently the range purchased by the manufacturer was a compromise as regards impedance matching. On other occasions a number of such Meters were purchased, so as to accommodate receivers of differing output-impedance.

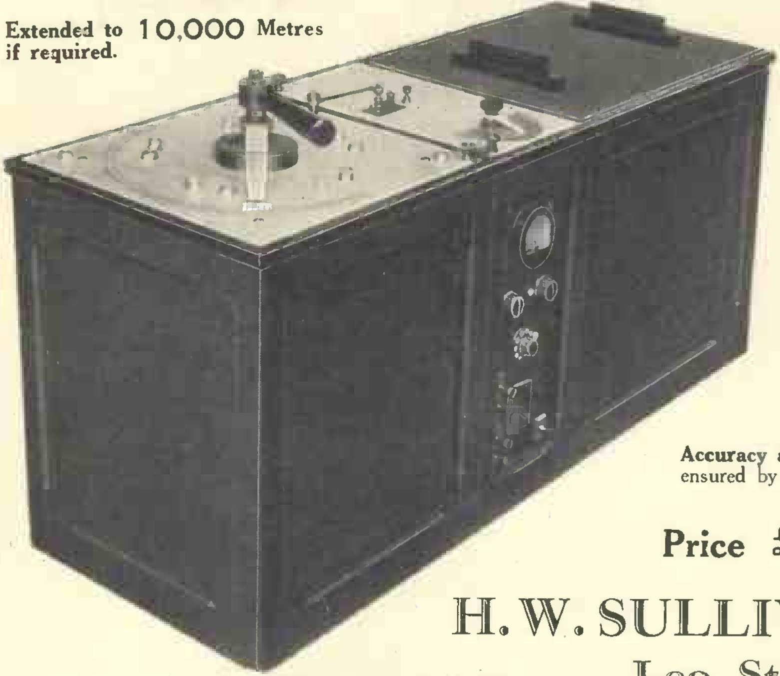
By the introduction of our new GR Model 583-A Output-Power Meter, all these problems are solved, for the instrument may be employed across any source over the very wide impedance range of from 2.5 Ohms to 20,000 Ohms. At the same time the instrument will also measure the impedance of any source, within the above range, to which it is connected.

The secret of this unusual instrument is the fact that it is a combination of four distinct parts. Firstly, there is a variable-ratio transformer having virtually zero losses: this feeds into a loss-adjusting network: thence, into a meter-multiplier calibrated both in voltage and power ratios: thence, into the rectifier-type milliwatt-meter. Thus meter gives, by selecting the appropriate step of its multiplier setting, full-scale readings of 0-5, 0-50, 0-500 and 0-5,000 milliwatts respectively. The meter gives, additionally, direct readings in decibels.

This instrument is also of great service when taking measurements on Oscillators, Amplifiers and Transformers. It is compact, light in weight and low in price, and described in our new Catalogue "G."

SULLIVAN-GRIFFITHS DYNATRON WAVEMETER

Extended to 10,000 Metres if required.



30-2000 METRES

Continuously Variable

Accuracy,	**1 part in 10,000**
Stability,	**1 part in 100,000**

Patented stable thermal compensated coils.

Patented dual range variable condenser of high stability and straight line frequency law.

Calibration independent of valve replacement.

Accuracy and simplicity of interpolation ensured by **linear frequency law.**

Price £182 or £130.

H. W. SULLIVAN, LTD.,
Leo St., London, S.E.15.

GET THIS NEW BOOK

it tells you all about - - -

- RADIO POWER UNITS—and how to build them.
- NOTES ON A.C. POWER UNITS.
- OPERATING RECEIVERS ON D.C. MAINS.
- ABOUT T.C.C. ELECTROLYTIC CONDENSERS.
- ELIMINATION OF INTERFERENCE.
- FOUR T.C.C. POWER UNITS with full constructional details.
- ROTATING RESISTANCE CALCULATOR.

With details of 4 Power Units—with a Chapter on D.C. Apparatus—and a Rotary Resistance Calculator and other really ***useful*** informative data this book should be in the hands of every electric light user.

COUPON

To Publicity Dept., The Telegraph Condenser Co., Ltd.,
Wales Farm Road, N. Acton, London, W.3.

Please send me a copy of your book " The Design and Construction of Radio Power Units," for which I enclose six penny stamps to cover cost of postage.

Name ....

Address ....

E.W.12/32

....

Please write in Block Letters.

ASK YOUR DEALER

If you have any difficulty in obtaining a copy of this book, fill in the coupon and post to us with six penny stamps. We will send you a copy by return.

T.C.C.

ALL-BRITISH

CONDENSERS

1676

A3

The
WIRELESS ENGINEER
and EXPERIMENTAL WIRELESS

A Journal of Radio Research & Progress

Editor
HUGH S. POCOCK

Technical Editor
Prof. G. W. O. HOWE D.Sc., M.I.E.E.

VOL. IX No. 111

DECEMBER 1932

CONTENTS

EDITORIAL 665

THE EXISTENCE OF MORE THAN ONE IONISED LAYER IN THE UPPER ATMOSPHERE. By Geoffrey Builder, B.Sc. 667

FURTHER NOTE UPON THE PENTODE WITH CAPACITIVE COUPLING By L. G. A. Sims, Ph.D., A.M.I.E.E. 673

INTERFERENCE By E. T. Glas 680

CORRESPONDENCE 685

SOME RECENT PATENTS 687

GENERAL INDEX TO ARTICLES, AUTHORS AND ABSTRACTS IN VOLUME IX, JANUARY-DECEMBER, 1932.

Published Monthly on the first of each month
SUBSCRIPTIONS Home and Abroad : One Year, 32/-, 6 Months, 16/-. Single Copies, 2/8 post free

Editorial Offices
116-117 FLEET STREET, LONDON, E.C.4 Telephone: City 9472 (5 lines)

Advertising and Publishing Offices
DORSET HOUSE, TUDOR STREET, LONDON, E.C. 4
Telegrams: "Experiwyr Fleet London" Telephone: City 2846 (17 lines)

Branch Offices

COVENTRY	BIRMINGHAM	MANCHESTER	GLASGOW
19 Hertford Street	Guildhall Bldgs., Navigation St., 2	260 Deansgate	26B Renfield Street, C.2
Telegrams: "Cyclist, Coventry"	Telegrams: "Autopress, Birmingham"	Telegrams: "Iliffe, Manchester"	Telegrams: "Iliffe, Glasgow"
Telephone: 5210 Coventry	Telephone: Midland 2970 (3 lines)	Telephone: Blackfriars 4412 (4 lines)	Telephone: Central 4857

The Editor invites the submission of articles with a view to publication. Contributions which are not exclusive should be so described when submitted. MSS. should be addressed to the Editor, "The Wireless Engineer and Experimental Wireless," Dorset House, Tudor Street, London, E.C.4. Especial care should be taken as to the legibility of MSS. including mathematical work.

ALL YOUR RESISTANCE PROBLEMS SOLVED

• ACCURACY

The Dubilier Metallized Resistance is permanently accurate in value and is absolutely stable in operation.

• LOW COST

The Dubilier Metallized Resistance costs only 1/- per watt. It is British throughout and its dependability is worthy of the Dubilier reputation.

• LONG LIFE

The Dubilier Metallized Resistance will last indefinitely. It is immensely strong mechanically and is capable of standing a heavy overload.

SUITABILITY FOR ALL PURPOSES

No matter whether you require a resistance for use in a radio Receiver, mains rectifier, filter or amplifier—on any occasion when Resistances are required you cannot do better than buy Dubilier Metallized Resistances.

1 Watt **1/-** 2 Watts **2/-** 3 Watts **3/-**

DUBILIER METALLIZED RESISTANCES

DUBILIER CONDENSER CO. (1925) Ltd.
Ducon Works, Victoria Road, North Acton, London, W.3

JOURNAL OF SCIENTIFIC INSTRUMENTS

produced by the Institute of Physics with the co-operation of the National Physical Laboratory. The English journal devoted to scientific instruments, their principles, construction and use. Essential to designers, makers and users.

CONTENTS OF THE NOVEMBER NUMBER.

SCIENTIFIC INSTRUMENTS AND AERONAUTICS. By H. E. Wimperis, C.B.E., M.A.
The Principles and Practice of the Gravity Gradiometer. Part I. By E. Lancaster-Jones, B.A.
A Self-Rectifying Demountable X-Ray Tube of High Power By C. E. Eddy, D.Sc., F.Inst.P.
New Instrument:
  Calipers for Fruit.
Laboratory and Workshop Notes:
  An Illuminating Device for Use in Experiments with Filtered Ultra-Violet Light. By Julius Grant, Ph.D., F.I.C.
  The Sputtering and Manipulation of Replica Gratings. By L. G. Wilson, B.Sc.
Eighteenth Physics in Industry Lecture.
  Correspondence, Review, Catalogues, Notes and Comments, Institute Notes.

The subscription rate for a yearly volume is £1 10s. net (post free) payable in advance. Separate parts 2s. 8d. (post free). Subscriptions should be sent to the publishers

CAMBRIDGE UNIVERSITY PRESS
Fetter Lane, London, E.C.4 - - - England

RADIO DATA CHARTS

A SERIES OF ABACS

providing most of the essential Data required in Receiver Design.

By R. T. BEATTY, M.A., B.E., D.Sc.
(1930)

"Radio Data Charts" provide designers of wireless apparatus with a ready and convenient means of solving problems without having recourse to complicated formulæ and mathematics.

By the use of the charts it is possible to tackle all the more familiar problems in radio receiver design; including, for example, finding the relationship between inductance capacity and frequency, and working out the design of high frequency transformers. All keen amateurs will appreciate this helpful book.

(39 *CHARTS and more than* 50 *Diagrams.*)

Price 4/6 net. By post 4/10

From all leading booksellers or direct from the publishers.

Published from the Offices of "THE WIRELESS WORLD," W.E.II.
Dorset House, Tudor Street, London, E.C.4.

THE
WIRELESS
ENGINEER
AND
EXPERIMENTAL WIRELESS

VOL. IX. DECEMBER, 1932. No. 111

Editorial.

Valve Data Diagrams.

IN June, 1931, we described a valve triangle, that is, a diagram, each point of which is at the intersection of three lines drawn from the three corners of an equilateral triangle to meet the opposite sides. The points where these lines meet the opposite sides enable one to read off the three principal characteristics of the valve, *viz.*, the amplification factor, the internal resistance and the mutual conductance. Such a diagram has the advantage of giving one a more comprehensive idea of the properties of a number of valves of various types than could possibly be obtained by means of tabulated data. The particular form of diagram described had, however, several disadvantages; interpolation was difficult because of the radial divergence of the three sets of co-ordinates, and the points tended to become crowded towards certain parts of the triangle. An improvement was introduced by Klingelhöffer and Walther* who described a modified valve triangle in which the crowding of the points was avoided by using logarithmic scales and interpolation was made easier by using parallel co-ordinates; the three sets of co-ordinates cut each other at an angle of 60 degrees, that is to say, they were parallel to the three sides instead of radiating from the corners of the triangle.

A further inprovement has now been devised† which not only allows the three characteristics mentioned above to be read off with great ease and with accurate interpolation, but also gives a fourth characteristic, *viz.*, that which Barkhausen called the "Güte" or quality index of a valve and which is equal to the product of the mutual conductance and the amplification factor.

As will be seen from the figures, the diagram consists of two rectangular co-ordinate systems, one of which is at an angle of 45 degrees to the other. All the four scales are logarithmic. Any valve is represented by a single point; from the vertical and horizontal scales its resistance and quality index and from the sloping scales its mutual conductance and amplification factor can be read off.

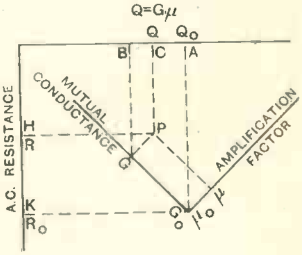


Fig. 1.

In the original diagram the right-hand sloping scale gave the "Durchgriff" which is

---

* See *Telefunken-Zeitung*, No. 59, 1931, p. 59.

† *Zilitinkewitch.*—Radio (Ukraine), Nov. 1931 and Technika Radio i Slabogo Toka (Russian), Jan., 1932; also *Gundlach.* Elektrische Nachrichten-Technik (German), Sept., 1932.

the reciprocal of the amplication factor, but we have modified it so as to read the more familiar amplification factor μ directly. At the bottom corresponding to a "Durchgriff" D of 0.1 per cent., we have $\mu = 1{,}000$ and at the top $D = 40$ per cent., and $\mu = 2.5$. The scale of mutual conductance G runs from 0.3 to 8.0 mA per volt. All the valves of three German makers were found to lie within these ranges, but there are now screen grid valves with amplification factors greater than 1,000 and to accommodate them the diagram would have to be extended to the left.

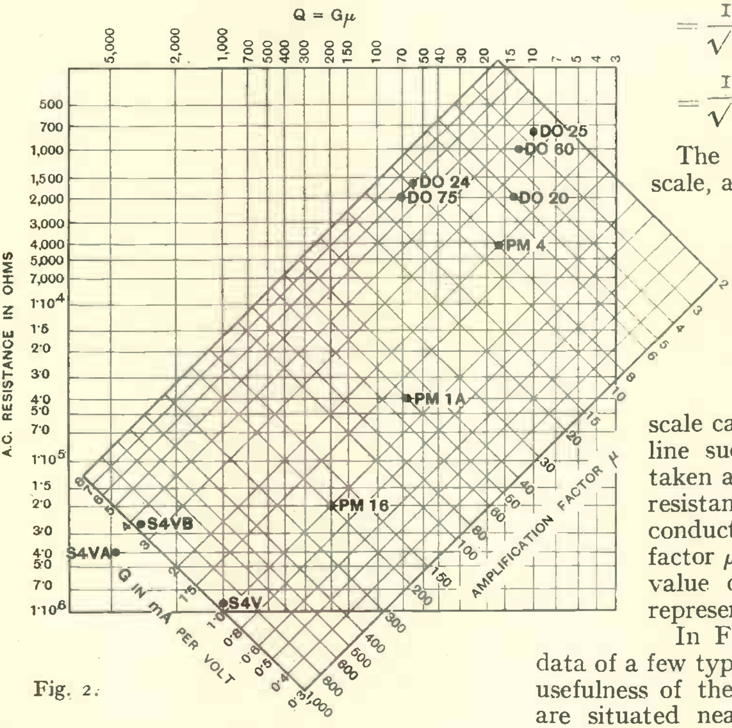


Fig. 2.

The A.C. resistances cover a very wide range, *viz.*, from about 500 ohms to a megohm, while the quality index varies between 3 and 3,000.

So far as the sloping co-ordinates are concerned, the diagram is an ordinary logarithmic one on which G and μ for each valve are plotted. It is not so obvious that the same points will give the values of R and Q on suitable logarithmic scales on the vertical and horizontal lines, but that this is so can be readily proved.

Let the vertical through the point $G_0\mu_0$ meet the horizontal scale at the point A, and that through any other point P, corresponding to a valve with values G and μ, at the point C. Then

$$AC = AB - BC$$

$$= \frac{1}{\sqrt{2}}[(\log G - \log G_0) - (\log \mu_0 - \log \mu)]$$

$$= \frac{1}{\sqrt{2}}[\log G + \log \mu) - (\log G_0 + \log \mu_0)]$$

$$= \frac{1}{\sqrt{2}}(\log G\mu - \log G_0\mu_0)$$

$$= \frac{1}{\sqrt{2}}(\log Q - \log Q_0)$$

The $1/\sqrt{2}$ is merely a matter of scale, and the formula shows that, if the point A is taken as Q_0, the value of Q corresponding to any point P will be represented by the point C on an appropriate logarithmic scale.

Similarly it can be shown that a logarithmic scale can be plotted on the vertical line such that, if the point K is taken as the value R_0 of the A.C. resistance of a valve with mutual conductance G_0 and amplification factor μ_0, the point H will give the value of R for any other valve represented by the point P.

In Fig. 2 we have plotted the data of a few typical valves to illustrate the usefulness of the diagram. Output valves are situated near the upper corner and screen grid valves near the bottom left hand of the diagram. The S4VA has an amplification factor of 1,500, and is thus somewhat outside the $G - \mu$ co-ordinates, but these could easily be extended further to the left to include such valves. G. W. O. H.

Since writing this note we have discovered that a diagram very similar in principle was described by Dr. R. T. Beatty in the *Wireless World* of July 17th, 1929, and used by him to plot the data of about 100 British valves. In Dr. Beatty's diagram R and G were plotted on the same axes as in Fig. 2 but in the reverse directions, μ was plotted on the horizontal scale, while Q, which is little used in this country, was not given. Dr. Beatty's diagram illustrates the great utility of this type of diagram for plotting the data of a large number of valves in a manner that lends itself to easy classification.

The Existence of More Than One Ionised Layer in the Upper Atmosphere.*

By Geoffrey Builder, B.Sc.

(King's College, University of London.)

Introduction.

IN a recent editorial[1] in *The Wireless Engineer*, reference has been made to the problem of the number of ionised layers in the upper atmosphere. It was pointed out that the work of Goubau and Zenneck,[2] on 533 metres, can be interpreted in terms of reflections from a single ionised layer at a height of about 100 kms. Even though this is true it affords no criterion of the number of ionised layers which do actually exist. As will be shown, it is to be expected that these waves would always be reflected at about this height. Since there has now accumulated a large amount of evidence indicating the existence of more than one ionised layer in the upper atmosphere capable of reflecting wireless waves it seems worth while to review the data available from wireless experiments.

Experimental Methods.

There are two important wireless methods of investigating the electrical structure of the upper atmosphere. The " frequency-change" method is due to Appleton and Barnett[3] and has been extensively and successfully used by Appleton and others. A small continuous change is made in the frequency of an unmodulated continuous wave transmitter and the signal amplitude at the receiving station is photographically recorded using an Einthoven galvanometer or other suitable instrument. If two sets of waves are being received simultaneously the equivalent path difference P' between them is determined by the number of interference maxima and minima through which the received signal intensity passes as the change in the transmitter frequency is made. It may be shown[4] that

$$P' = c\delta n/\delta f$$

where

c = the velocity of electromagnetic waves in free space.

δf = the number of cycles per second by which the transmitter frequency is changed.

δn = the number of interference fringes due to the frequency change δf.

and the equivalent path of the wave is given by

$$c\int(1/U)ds$$

where ds is an element of the path and U is the group velocity of the waves at any point.

A typical record obtained by the method is shown in Fig. 1. The mean wavelength was 107 metres and the frequency change 6.30 kc. per sec. The number of interference fringes is 10.7 and therefore the equivalent path difference between the interfering waves was 509 kms. Since the distance between transmitter and receiver was 5 kms., and one of the interfering waves was the direct " ground wave," it is readily calculated that the equivalent height of reflection for the " atmospheric wave " was 257 kms.

The " group-retardation " or " pulse " or " echo " method of Breit and Tuve,[5,6] has been very widely used, with many modifications and improvements. A short pulse of radio-frequency energy is sent out from the transmitter and the nature of the signal at the receiving station is investigated by means of a high-speed recorder such as the cathode-ray or bifilar oscillograph. If there is a multiplicity of paths between the transmitter and the receiver, and if the pulse is

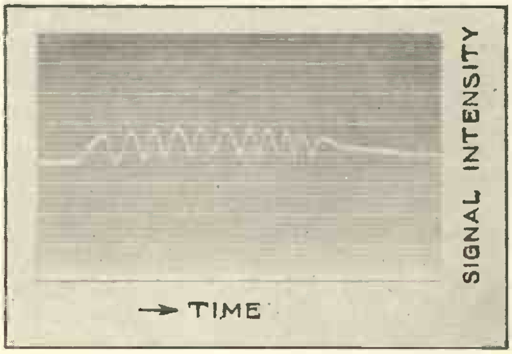


Fig. 1.—*A simple fringe pattern obtained by the frequency change method. Frequency change* 6.30 *kc/s and equivalent path difference* 509 *kms.*

---

* MS. received by the Editor, March, 1932.

sufficiently short, a signal corresponding to each of the paths is received separately. The time differences between the arrival of the various signals is measured directly from the oscillograms and the equivalent path differences and the equivalent heights may then be calculated. In practice, a uniform sequence of pulses is transmitted with sufficient spacing between them to ensure that the received signals, corresponding to each pulse sent, do not overlap in time. Recent workers have used pulses as short as 1×10^{-4} sec. in duration, sent at a rate of about fifty per second. A typical simple record obtained in this way is reproduced in Fig. 2. The recording instrument was a Duddell oscillograph and a time-base for measurement is given by an oscillation of 1,100 cycles/sec. The pulses marked G are those due to the direct ground signal and are followed by echoes F_1 and F_2 which are first and second reflections from an equivalent height of 254 kms. The distance between transmitter and receiver was 5 kms. and the wavelength 90 metres.

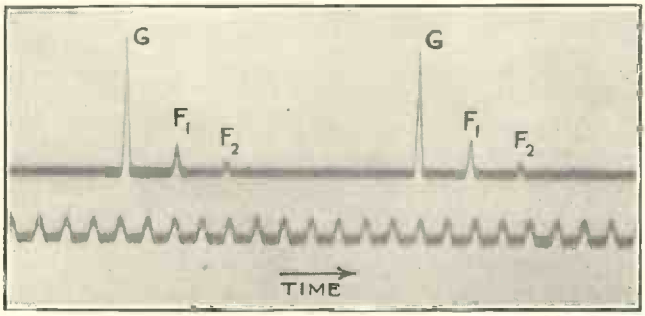


Fig 2.—*First and second reflections from an equivalent height of 254 kms., as recorded by the echo method. Time base oscillator frequency* 1,100 *c/s.*

Equivalence of the Two Methods.

These two methods, as well as others of less importance, have been compared theoretically by Appleton[7] and Schelleng[8] who showed that the quantities measured by the two methods are generally equivalent. Experiments being carried out by the author indicate the validity of this conclusion. A comparison of their relative advantages for investigating the upper atmosphere has been made by Appleton and Builder[9] who pointed out that the echo pattern is much the simpler to interpret if there is a multiplicity of paths, but that the frequency change method was much more sensitive in the detection of weak signals when a square law detector was used. The use of a linear detector, working at very high levels, for the echo observations, has since shown that the methods are essentially the same in this respect.

The Existence of One Ionised Layer.

The existence in the upper atmosphere of an ionised layer capable of reflecting wireless waves was first directly demonstrated by Appleton and Barnett[3] in 1925, using the frequency change method. Confirmation by the pulse experiments of Breit and Tuve[6] followed shortly afterwards. Appleton and Barnett, using a wavelength of 400 m., measured heights of the reflecting layer varying from 90 kms. in the daytime to 115 kms. at night, while Breit and Tuve found heights ranging from 80 to 200 kms. for 70 m. waves. The latter measurements have, however, not been confirmed, and later Breit, Tuve, and Dahl,[10] with improved pulse transmissions on 75 metres, observed that the heights of reflection measured from successive echoes were sometimes approximately in the ratio 1 : 2 : 4, and interpreted the results in terms of multiple reflections at a single layer although the relative intensities and the relative delays of the echoes are scarcely compatible with the explanation. Kenrick and Jen[11] obtained equivalent heights of the reflecting layer for 67 metre waves of 250 kms. in the daytime to 350 kms. at night. These values, together with those of Hollingworth[12] on 14,350 metres, Appleton and Barnett[13] on 400 metres and Heising[14] on 57 and 111 metres were employed to obtain a curve relating equivalent height and wavelength, and it was shown that the result was not incompatible, qualitatively, with the curve calculated on the assumption of a single reflecting layer.

Quantitatively, agreement was not good and the greater range of measurements now available indicate that the agreement of the shape of the experimental and calculated curves was fortuitous. Further, the single layer theory does not account for the observed relation of attenuation to wavelength, as has been pointed out by Heising,[14] Eckersley,[15] and others. To explain the marked superiority of the shorter waves for long-distance communication it is necessary to assume a distinct attenuating region below the reflecting layer at which reflection of the short waves occurs.

TWO IONISED LAYERS.

Frequency Change Measurements.

In 1927 Appleton[16] demonstrated the existence of two distinct regions of ionisation at heights of about 100 and 200 kms. Using the frequency-change method many of the records showed subsidiary fringes superimposed on the main ones. At a wavelength of 1,000 metres, it was always found that these subsidiaries could be accounted for in terms of multiple reflections between the ground and a single ionised layer (the Kennelly-Heaviside or *E* layer) at a height of about 100 kms. With 400 metre waves similar results were usually obtained, but in some records taken in the early morning the subsidiary fringes could not be explained in this way. A careful examination showed that the ratio of the number of primary to subsidiary fringes was not that to be expected on the assumption of multiple reflections from a single layer. Moreover, in the period just before sunrise, the primary fringes disappeared on some occasions, the subsidiary then becoming the main fringes. In these cases the primary fringes suddenly returned at about 40 minutes before sunrise at the ground, while the subsidiaries gradually weakened and disappeared.

The difficulty of interpreting such records in terms of a single reflecting layer led Appleton to postulate a second ionised layer (*F* layer) at a height of about 200 kms. and considerably richer in ionisation than the lower layer. On this basis, the subsidiary fringes are due to the radiation partly or completely penetrating the lower layer and being reflected at the upper one. The sudden return to reflection at the *E* layer, at about 40 minutes before ground sunrise, agrees well with the time of sunrise at the height of this layer. Another feature of the records which is similarly explained is that the equivalent height of *F* layer, deduced from the subsidiary fringes, began to decrease at about 80 minutes before sunrise.

Further evidence pointing to the correctness of this hypothesis was obtained by Appleton and Ratcliffe[17] in simultaneous observations at a number of stations receiving signals from the same transmitter. Simultaneous reflections from different layers at different receiving stations were observed at wavelengths of 400 and 212 metres, and it was found that the *E* and *F* layer heights did not differ greatly for these two wavelengths. Appleton and Green[18] found that only during part of the daytime is the ionisation of *E* layer great enough to reflect 100 metre waves. Fig. 3, from their paper, shows the variation of equivalent height of the reflecting layer throughout the day measured on this wavelength. The discontinuities in the curve indicate definitely the distinct nature of the two layers, especially when it is remembered that for the greater part of the night and throughout the day 400 metre waves are reflected at a height of about 100 kms.

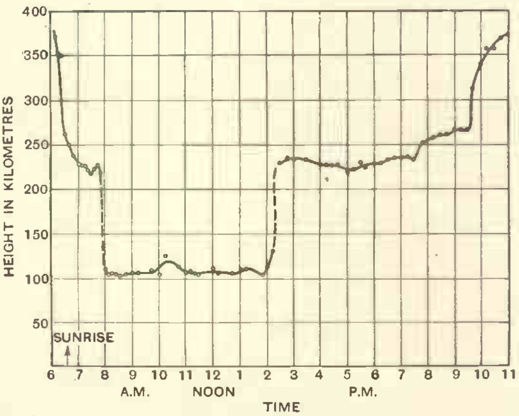


Fig. 3.—*The variation of equivalent height of reflection of* 100 *m. waves on October* 21, 1928. (*After Appleton & Green.*)

The frequency-change measurements therefore indicate that (*a*) 1,000 metre waves are always reflected at *E* layer at an equivalent height of about 90 kms., (*b*) 400 metre waves are reflected at E layer at an equivalent height of 90 kms. in the daytime to 115 kms. at night, except for short periods before sunrise when recombination in *E* layer has proceeded so far as to permit its penetration by these waves so that reflection may occur at *F* layer at about 200 kms., (*c*) the behaviour of 200 metre waves is very similar except for such differences as might have been expected: slightly greater equivalent heights for both layers and a greater tendency to penetrate the lower layer, and (*d*) at 100 metres penetration of the lower layer occurs for the greater part of the day. Equivalent heights on this wavelength are about 105 and 230 kms. in the daytime to more than 360 kms. at night.

Group-retardation Measurements.

Appleton[19] has interpreted the results of Breit, Tuve, and Dahl, already referred to, as confirming the hypothesis of two reflecting layers. The three echoes received indicated equivalent heights of 105, 235 and 470 kms., the departure from the ratio 1 : 2 : 4 being outside the limits of experimental error. If the three echoes are multiple reflections from a single layer it is to be noted that the third reflection is consistently absent, and that in the published records the first echo is frequently weaker than the second. These difficulties disappear at once if the echoes are interpreted as a single reflection from *E* layer and first and second reflections from *F* layer. The heights of the two layers so obtained are in good agreement with the daytime frequency-change measurements made on 100 metres.

In 1930 Gilliland,[20] using 74 metres, concluded that the down-coming signals during the day were due to two layers at equivalent heights of 119 and 235 kms. Appleton and Builder[21] have published successive echo records showing the penetration of the lower layer by 80 metre waves in the sunset period. Similar records for 90 metres, in Fig. 4, taken at 9, 10 and 11 o'clock G.M.T., show the gradual change over of reflection at *F* layer to reflection at *E* layer as the ionisation of *E* layer increases. The non-occurrence of multiple echoes in these records is due partly to the use of a square law detector and partly to attenuation, probably occurring in *E* layer.

Schafer and Goodall[22], using 185 and 97 metres simultaneously, provided further striking evidence in favour of the two-layer theory. Curves of equivalent height against time showed, for the longer waves, a sudden change over of reflection from the upper to the lower layer, while the shorter waves continued to be reflected by the upper layer. Further, it was shown that waves just short enough to penetrate the lower layer suffered considerable group retardation so that the equivalent height of *F* layer measured on this wavelength was appreciably increased. This effect has previously been discussed by Appleton and Ratcliffe[23] and by Appleton,[24] and is further illustrated in Fig. 5, in which the variation of the equivalent height of the reflecting layer for 80 metre waves and the intensity of the *F* layer reflections are plotted against time. Until 1620 G.M.T. reflection from *E* layer occurred, but the waves then penetrated this layer and were reflected at *F*. The *F* echoes were at first weaker and indicated greater equivalent heights than later when the *E* layer ionisation had further decreased. The reverse process then occurs when *E* layer ionisation again increases sufficiently to reflect. The inverse correlation of *F* layer height and echo intensity is very marked in this as in many other similar records.

More recently further observations by Gilliland, Kenrick and Norton,[25] Ranzi,[26] and others have added an abundance of evidence in favour of the hypothesis of a second re-

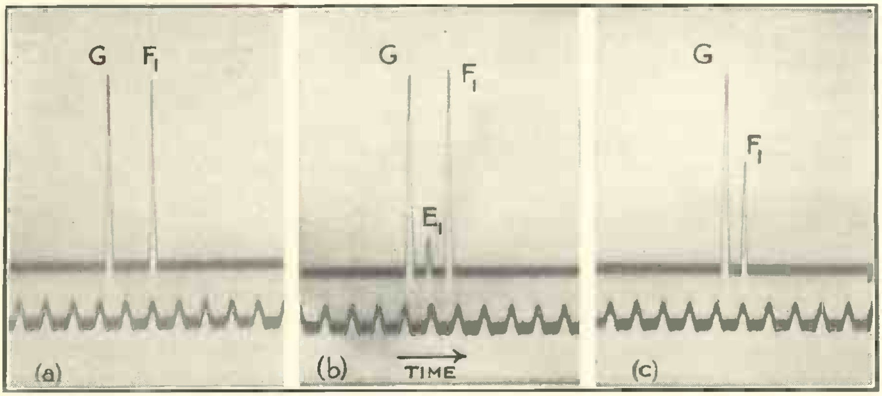


Fig. 4.—*Successive echo records showing a change over of reflection from F layer to E layer and illustrating the distinct nature of the two layers.*

flecting layer. It is to be noted that there is no definite evidence of reflections from heights intermediate between those given for the *E* and *F* layers except those of Goubau and Zenneck[2] to which we now turn. From what has been said, the failure to observe echoes from *F* region is not surprising in view of the wavelength used in the experiments and the results are in this respect compatible with the simple two-layer theory. It is to be noted, however, that while the frequency change measurements gave values of 90 to 115 kms. for 400 metres, Goubau and Zenneck measured equivalent heights up to 140 kms. for 533 metres. The echoes from which these higher values were calculated were usually accompanied by others giving the more usual heights of 90 to 100 kms. The authors show that for the most part the equivalent heights may be divided into two groups at about 95 and 135 kms. Such a grouping does not suggest either a continuous layer of ionisation extending upwards from 90 kms. or that the double and complex echoes are due to undulations in the layer as suggested by the authors. It is therefore necessary to consider whether these complex echoes, which generally occurred in the early morning hours, indicate a stratification of *E* layer or whether there is any other probable explanation.

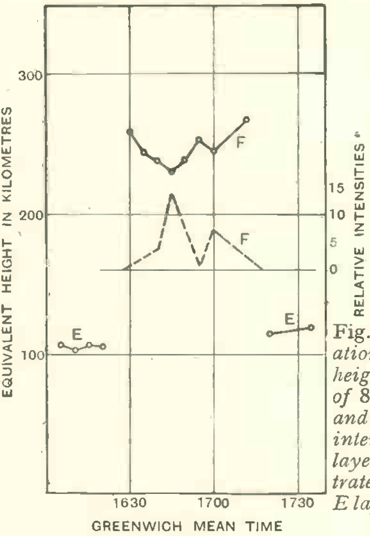


Fig. 5.—*The variation of equivalent height of reflection of 80 metre waves and the variation of intensity of the F layer echoes, illustrates the effect of E layer on F layer echoes.*

Are there more than Two Ionised Layers or are these Layers Horizontally Stratified?

Eckersley[15] considers that the available data suggests horizontal stratification of the *F* layer, the maxima of ionisation being about 10^5 electrons per cc. at 100 kms. (*E* layer) and 3×10^5 and 9×10^5 at 180 and 250–350 kms. respectively (*F* layer). The variation of equivalent height with wavelength does not appear to require such stratification, and the variation of equivalent height of the *F* layer for a given wavelength is scarcely compatible with such a hypothesis since the equivalent height increases smoothly as recombination proceeds until such time as the ionisation is no longer sufficient to cause reflection of the waves being used. There is no sudden jump to a higher stratum such as occurs in the case of penetration of *E* layer and more evidence is necessary before further complication of the layer structure need be postulated. The results of Goubau and Zenneck may at first appear to support a similar hypothesis for the *E* layer unless their own explanation of complex echoes due to scattering at an undulatory layer is accepted. Appleton and Builder[9] have obtained double echoes from the *F* layer on 80 metres under somewhat similar conditions but consider that they may be the two magneto-ionic components due to splitting of the original signal into two polarised components having different group velocities in an ionised medium in the earth's magnetic field.[*] The occurrence of such splitting at times when the waves may be supposed to penetrate far into the ionised layer, the gradual increase from zero of the time interval between the components as such penetration occurs, and the different electron densities required for the reflection of the components, are all in accord with the explanation. Fig. 6 shows an echo record which is typical of such splitting of the *F* echo. Under other conditions echo patterns like that of Fig. 7 are frequently obtained owing to multiple splitting. Transitions between these two types are also observed, the two main components both showing signs of complexity but remaining distinct. If the explanation advanced is correct it accounts for such complex echoes without the need to assume further complexity in the layers themselves.

There is another type of echo pattern which at first sight might seem to suggest

---

[*] Since this paper was written this hypothesis has been confirmed. A full account will be available shortly.

the existence of more than two layers but may be very simply explained on the two-layer theory. When the wavelength being employed is such that partial penetration of the *E* layer occurs and echoes are received simultaneously from the *E* and *F* layers, it is to be expected, by analogy with multiple reflections from a single layer, that echoes will also occur due to successive reflections from the two layers. Echoes are in fact observed corresponding to an equivalent height equal to the sum of the equivalent heights of the *E* and *F* layers, as measured from the corresponding echoes on the same record. There is also some evidence that reflection from the top of the *E* layer may occur. Echoes are occasionally observed corresponding to an equivalent height approximately equal to twice the equivalent height of the *F* layer less the equivalent height of the *E* layer and may possibly be due to such reflections since they seem to occur only when the critical penetration wavelength for the lower layer is being used.*

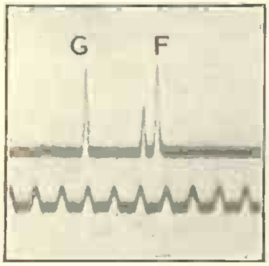


Fig. 6.—*Splitting of the F-layer echo into two components of different retardation.*

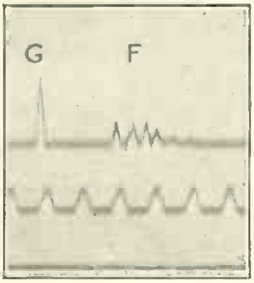


Fig. 7.—*A complex F-layer echo which may be due to magneto-ionic dispersion.*

At present it does not appear essential to postulate more than two layers or stratification of these two layers to explain the experimental data, nor does it appear to be necessary, for observations such as those described here, to assume an undulatory nature for the two layers, but further detailed evidence is required on these points. The occurrence of further strata is not incompatible with the generally assumed mechanism of the ionisation of the layers. Moreover, by the methods described, a layer of ionisation would not be detected if it was above another layer more intensely ionised.

Summary.

The chief wireless methods of investigating the electrical structure of the upper atmosphere are briefly described and compared. It is shown that the results obtained by both methods support the hypothesis of the existence of at least two layers of ionisation capable of reflecting wireless waves. The possibility of the occurrence of other strata of ionisation is also briefly discussed and it is concluded that the measurements available do not require the existence of more than two simple layers of ionisation for their explanation.

I am indebted to Professor Appleton and Mr. A. L. Green, and to the Royal Society for permission to reproduce the diagram of Fig. 3.

REFERENCES.

[1] Editorial, *Wireless Engineer*, VIII, 463 (1931).

[2] G. Goubau and J. Zenneck, *Zeit. f. Hochf-tech.* 37, 207 (1931).

[3] E. V. Appleton and M. A. F. Barnett, *Proc. Roy. Soc.*, A. 109, 621 (1925), and *Nature*, March, 1925.

[4] E. V. Appleton, *Proc. Roy. Soc.*, A. 126, 542 (1930).

[5] G. Breit and M. A. Tuve, *Nature*, 116,357 (1925), and *Terr. Mag.*, 30, 15 (1925).

[6] G. Breit and M. A. Tuve, *Phys. Rev.*, 28, 568 (1926).

[7] E. V. Appleton, *Proc. Phys. Soc.*, 41, 43 (1928.)

[8] J. C. Schelleng, *Proc. I. R. E.*, 16, 1471 (1928).

[9] E. V. Appleton and G. Builder, *Proc. Phys. Soc.*, 44, 76 (1932).

[10] G. Breit, M. A. Tuve and O. Dahl, *Proc. I. R. E.*, 16, 1236 (1928).

[11] G. W. Kenrick and C. K. Jen, *Proc. I. R. E.*, 17, 710 (1929).

[12] J. Hollingworth, *Jour. I. E. E.*, 64, 579 (1926).

[13] E. V. Appleton and M. A. F. Barnett, *Proc. Roy. Soc.*, A. 109, 621 (1925).

[14] R. A. Heising, *Proc. I. R. E.*, 16, 75 (1928).

[15] T. L. Eckersley, *Proc. Roy. Soc.*, A. 132, 83 (1931).

[16] E. V. Appleton, *Nature*, Sept. 3, 1927, and *Proc. Roy. Soc.*, A. 126, 542 (1930).

[17] E. V. Appleton and J. A. Ratcliffe, *Proc. Roy. Soc.*, A. 128, 133 (1930).

[18] E. V. Appleton and A. L. Green, *Proc. Roy. Soc.*, A. 128, 159 (1930).

[19] E. V. Appleton, *Nature*, March 23, 1929.

[20] T. R. Gilliland, *Bur. Stds. Jour. of Res.*, 5, 1057 (1930).

[21] E. V. Appleton and G. Builder, *Nature*, June 27, 1931.

[22] J. P. Schafer and W. M. Goodall, *Proc. I. R. E.*, 19, 1434 (1931).

[23] E. V. Appleton and J. A. Ratcliffe, *loc. cit.*, p. 155.

[24] E. V. Appleton, *Proc. Phys. Soc.*, 42, 321 (1930).

[25] T. R. Gilliland, G. W. Kenrick and K. A. Norton, *Proc. I. R. E.*, 20, 286 (1932), and *Bur. Stds. Jour. Res.*, Vol. 7, 1931.

[26] I. Ranzi, *Nuovo Cimento*, 8, 258 (1931).

---

* The fuller investigation of the magneto-ionic effect indicates that simultaneous reflection from the two layers is partly due to the greater electron density required to reflect the left-handed polarised component, which may penetrate the lower layer and be reflected at the upper, while the right-handed component is reflected by the lower layer. Successive reflections at the two layers are therefore not observed as frequently as might be expected from the frequent occurrence of simultaneous echoes from the two layers.

Further Note upon the Pentode with Capacitive Coupling.*

By L. G. A. Sims, Ph.D., A.M.I.E.E.

IN a recent paper† the Author showed that the load-matching conditions which apply particularly in an output stage employing a pentode enable the output coupling capacity to improve materially the low-frequency power response of the stage. The preliminary analysis of the case given in the paper was intended mainly to establish the existence of this effect and a further contribution containing detailed extensions was promised.

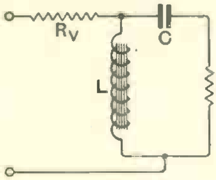


Fig. 1.

Let Fig. 1 represent the equivalent circuit of a valve coupled to a resistance load by means of an inductance L and condenser C, the symbols R_v and R relating to the operating resistance of the valve and to the load respectively.

It was shown that, per volt available in the anode circuit, the volts V developed across the load R were given by

$$V = \frac{\omega LR}{\left[\left(RR_v + \frac{L}{C}\right)^2 + \left\{\omega L(R + R_v) - \frac{R_v}{\omega C}\right\}^2\right]^{\frac{1}{2}}} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where $\omega = 2\pi \times$ frequency.

Treating ω as the independent variable in order to examine the behaviour of V with change of frequency, and treating all other quantities as constants, the equation

$$\frac{dV}{d\omega} = 0 \quad \ldots \quad \ldots \quad (2)$$

leads to a condition of maximum voltage and therefore of maximum power in R when ω has the special value‡

$$\omega = \left[\frac{1}{C\left(L - \frac{R^2C}{2}\right) - \frac{L^2}{2R_v^2}}\right]^{\frac{1}{2}} \quad \ldots \quad (3)$$

In the Author's previous paper this equation was examined in order to see whether real values of ω could be expected in practice, that is, whether a peak in the power response curve could be expected. It was found that, with the load-matching conditions usually employed, such a peak could only be expected with pentode valves because the peak occurs only when, among other conditions, the load resistance is less than that of the valve—a characteristic of the pentode but not of the triode output stage.

If typical values of L, R and R_v be inserted in equation (3) and ω be evaluated for different values of C, it is found that ω approaches infinity for two different values of C. In Fig. 2 are plotted three curves which illustrate this effect, relating to different constant values of R_v.

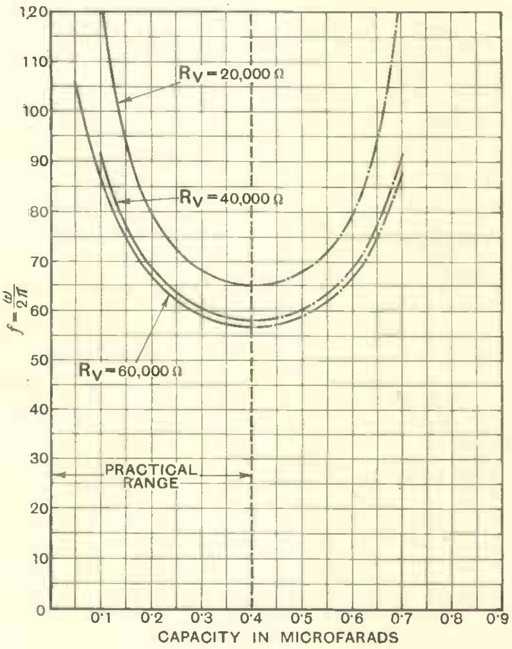


Fig. 2.—*Curves plotted from equation* (3). $L = 40$ *henrys*, $R = 10,000$ *ohms.*

In order to interpret these curves it is

---

* MS. received by the Editor, June, 1932.

† *See* "Capacitive Output Coupling," Sims, *Wireless Engineer and Experimental Wireless*, June, 1932.

‡ *Ibid.*, page 315.

necessary to examine them with reference to Table I (which gives figures from which the curve of Fig. 2 relating to $R_v = 60{,}000$ ohms was calculated) and with reference to experimental results taken with circuit constants approximating closely to those assumed in calculation. Fig. 3 shows a series of such experimental results taken with an Osram type PT 240 pentode whose rated internal resistance is 55,000 ohms. The output inductance, measured in the circuit with the load disconnected but with the steady valve current flowing, was 40 henrys, and the load was a non-inductive resistance of 10,000 ohms. These values correspond closely to those assumed in the calculation of Table I, namely $L = 40$ henrys, $R_v = 60{,}000$ ohms, $R = 10{,}000$ ohms. The experimental curves were taken with a constant input of 1.6 volts R.M.S. to the grid of the pentode at a large number of frequencies between 45 and 6,000 cycles per second, the circuit diagram being as shown in Fig. 4. It is seen that the frequency and hence the pulsatance ω at which the power peak occurs, falls continuously as the coupling condenser is increased from 0.05 microfarad to a value between 0.3 and 0.4 microfarad, the peak vanishing for values of

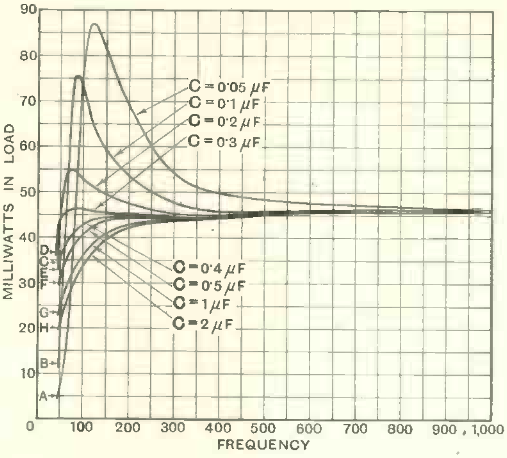


Fig. 3.—*Experimental power response curves of Pentode PT240. Choke-condenser coupled to resistance load of* 10,000 *ohms.* $R_v \doteqdot 55{,}000$ *ohms,* $L \doteqdot 40$ *henrys, under operating conditions. Input to grid* = 1.6 *v. R.M.S.*

TABLE I.

CALCULATION OF ω FROM EQUATION (3).

$L = 40$ hys. $R_v = 60{,}000\ \Omega$. $R = 10{,}000\ \Omega$. C variable.

C in μF.	$\frac{R^2C^2}{2}$	$\frac{L^2}{2R_v^2}$	$\frac{R^2C^2}{2} + \frac{L^2}{2R_v^2}$	LC	$LC - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2}$	$\frac{1}{LC - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2}}$	$\omega = \frac{1}{\sqrt{LC - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2}}}$	$f = \frac{\omega}{2\pi}$
0.05	$\frac{0.125}{10^6}$	$\frac{0.222}{10^6}$	0.347×10^{-6}	2×10^{-6}	1.653×10^{-6}	6.04×10^5	729	116
0.1	$\frac{0.5}{10^6}$	,,	0.722×10^{-6}	4×10^{-6}	3.278×10^{-6}	3.05×10^5	553	88.2
0.2	$\frac{2.0}{10^6}$	,,	2.222×10^{-6}	8×10^{-6}	5.778×10^{-6}	1.73×10^5	417	66.4
0.3	$\frac{4.5}{10^6}$	,,	4.722×10^{-6}	12×10^{-6}	7.278×10^{-6}	1.375×10^5	371	59
0.4	$\frac{8}{10^6}$	,,	8.222×10^{-6}	16×10^{-6}	7.778×10^{-6}	1.285×10^5	358	57
0.5	$\frac{12.5}{10^6}$	,,	12.722×10^{-6}	20×10^{-6}	7.278×10^{-6}	1.375×10^5	371	59
0.6	$\frac{18}{10^6}$	,,	18.222×10^{-6}	24×10^{-6}	5.778×10^{-6}	1.73×10^5	417	66.4
0.7	$\frac{24.5}{10^6}$	,,	24.722×10^{-6}	28×10^{-6}	3.278×10^{-6}	3.05×10^5	553	88.2
0.8	$\frac{32.0}{10^6}$	,,	32.222×10^{-6}	32×10^{-6}	Negative	Negative	Imaginary	Imag.
0.9	$\frac{40.5}{10^6}$	,,	40.722×10^{-6}	36×10^{-6}	Negative	Negative	Imaginary	Imag.

capacity greater than this. If reference be made to Fig. 2 it will be seen that the experimental results agree fairly closely with the theoretical prediction given by the first half of the curve relating to $R_v = 60{,}000$ ohms. This curve shows that no peak is to be expected for lower frequencies than about 57 cycles per second, and that a capacity of about 0.4 microfarad is then needed.

For larger values than 0.4 microfarad the theoretical and experimental curves no longer agree, as the former appear to indicate a further range of frequencies over which a power peak will occur with further increase of capacity, whilst the latter show that, in fact, the power response curve degenerates with increasing C to the form characteristic of plain transformer coupling, that is, the low-frequency response falls away.

Case of "Level Compensation."

It follows, therefore, that only the first halves of the curves shown in Fig. 2 have practical value. At the same time, it is made clear that an important practical case arises at what may be called the critical or transition point of these curves, namely, the point of minimum frequency. Here the capacity becomes such as to maintain uniform response over the widest possible range of frequencies (see Fig. 3). This, then, gives the condition for what may be termed "level compensation."

Referring to the figures in Table I, it is seen that this condition arises when the denominator of the expression for ω, defining ω for maximum power, has its greatest value. From this we may determine an expression for the capacity which yields level compensation in a given pentode output circuit. Writing for the denominator expression of (3)

$$m = LC - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2} \quad .. \quad (4)$$

we may differentiate m with respect to C and equate to zero to determine conditions for a maximum.

Thus $$\frac{dm}{dC} = L - \frac{2CR^2}{2} \quad .. \quad (5)$$

Equating to zero gives

$$L = CR^2$$

Whence, if C' be written to denote a special value of C applying to this case

$$C' = \frac{L}{R^2} \quad .. \quad .. \quad (6)$$

Inserting the values $L = 40$ henrys, $R = 10{,}000$ ohms into (6) and converting to microfarads gives $C' = 0.4$ microfarad, which agrees satisfactorily with Figs. 2 and 3 and Table I and confirms that (6) gives a maximum value of m and a minimum value of ω.

The value of capacity for level compensation is shown by (6) to be independent of R_v, a result which is also demonstrated by the curves of Fig. 2.

But although this is so, the lowest frequency of uniform response is a function of R_v (see Fig. 2). Clearly, by substituting from (6) in (3) this frequency can be determined. The substitution yields

$$\omega' = \frac{1}{\left[\frac{L^2}{R^2} - \frac{L}{2} - \frac{L^2}{2R_v^2}\right]^{\frac{1}{2}}}$$

where ω' represents the special value of ω associated with C'.

Then

$$\omega' = \frac{\sqrt{2} \,.\, RR_v}{L(R_v^2 - R^2)^{\frac{1}{2}}} \quad .. \quad (7)$$

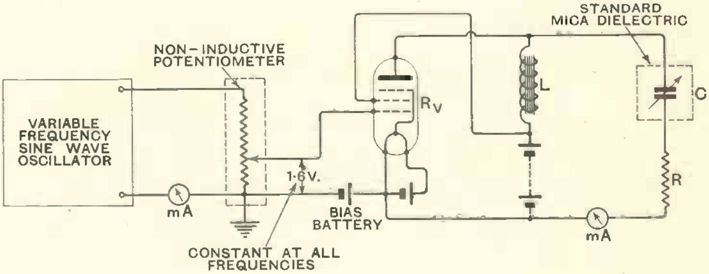


Fig. 4.

whence by writing $f' = \frac{\omega'}{2\pi}$ we have

$$f' = \frac{0.225 \, RR_v}{L \,.\, (R_v^2 - R^2)^{\frac{1}{2}}} \quad .. \quad (8)$$

Substituting in (8) the values $R_v = 60{,}000$ ohms, $R = 10{,}000$ ohms, $L = 40$ henrys, as used in Table I, gives $f' = 57$ cycles per second for the lowest frequency of uniform response. This agrees exactly with the figures calculated from equation (3) in Table I and is confirmed to a reasonable degree of approximation by the experimental curves. Thus equations (6) and (8) may be used to determine the coupling capacity and lowest frequency of uniform response.

Throughout the above reasoning a load resistance of 10,000 ohms has been employed and a transformation ratio of unity assumed at the inductance. Inevitably the varying frequency under which the output stage works in practice must complicate the theory when the true nature of the load is a complex impedance, as is the case with a loud speaker; nor could full allowance be made for this. But at the very low frequencies concerned throughout the analysis the load certainly tends to become predominantly ohmic in character,* which makes its treatment as a resistance a reasonable approximation. Since the ratio of transformation, if not unity, appears in the equations merely as a constant multiplying the actual values of resistance and capacity in the secondary circuit, it does not affect the general conclusions reached. If, for example, the ratio of primary turns to secondary turns be k, and the actual load resistance and coupling capacity be R_2 and C_2, the substitutions

$$R = k^2 R_2, \quad C = \frac{C_2}{k^2}$$

throughout the solutions will allow for all ratios of transformation.

With pentode valves, except when used with low-resistance moving-coil speakers, the value of k is usually close to unity, and the properties of the auto-transformer of low ratio then reduce the effective series impedances of the transformer windings to values which are negligible at low frequencies, so justifying their omission from the analysis. On the other hand, the magnetising current at the lowest frequencies is by no means negligible and is taken into account in equation (1).

Capacity for Maximum Power at a Particular Frequency.

If equation (1) be differentiated with respect to C (ω being taken as constant) a solution may be derived which gives the value of C required for over-compensation of the bass response at a chosen frequency, so enabling the low-frequency response of an imperfect reproducer to be augmented. Thus, whereas the analysis has so far aimed at adjusting the characteristics of the output stage to equal, as far as possible, those of a supposed perfect reproducer, the present analysis will aim at improving the response of the complete stage, including the reproducer.

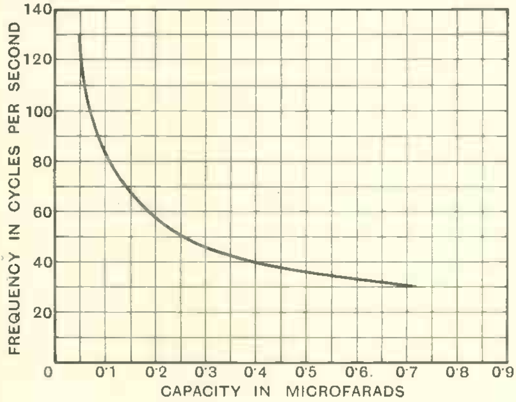


Fig. 5.

Expanding the denominator of (1) and writing

$$\beta = RR_v$$

$$\delta = \omega LR$$

$$\epsilon = \omega L(R_v + R)$$

we have

$$V = \frac{\delta}{\left[\beta^2 + 2\frac{\beta L}{C} + \frac{L^2}{C^2} + \epsilon^2 - 2\frac{\epsilon R_v}{\omega C} + \frac{R_v^{\,2}}{\omega^2 C^2}\right]^{\frac{1}{2}}} \qquad \ldots \quad \ldots \quad (9)$$

Differentiating and writing (D) for the denominator expression when this recurs unchanged from (9) we have, after simplification

$$\frac{dv}{dc} = -\frac{\delta\left[\frac{1}{C^2}\left(\frac{\epsilon R_v}{\omega} - \beta L\right) - \frac{1}{C^3}(R_v^{\,2} + L^2)\right]}{[D]^2} \qquad \ldots \quad \ldots \quad (10)$$

The condition for maximum voltage across the load, and hence for maximum power, is obtained from (10) in the usual way by

---

[*] See "The Inductor Dynamic Loud Speaker." Oliver, *The Wireless World and Radio Review*, 18th November, 1931.

equating to zero. This leads to the equation

$$\left[\frac{1}{C^2}\left(\frac{\epsilon R_v}{\omega} - \beta L\right) - \frac{1}{C^3}(R_v^2 + L^2)\right] = 0$$

whence, after multiplying by C^2 and collecting terms we have

$$C'' = \left[\frac{\dfrac{R_v^2}{\omega^2} + L^2}{\dfrac{\epsilon R_v}{\omega} - \beta L}\right]$$

where C'' is written to denote a special value of C.

Substitution for ϵ and simplification yield

$$C'' = \left[\frac{R_v^2 + \omega^2 L^2}{\omega^2 L R_v^2}\right] \quad \ldots \quad (11)$$

This equation, therefore, defines the capacity in farads which will develop the maximum possible power in the load at any selected single value of ω. It is of interest to note that this capacity is a function of the valve resistance R_v but not directly of the load resistance R, though the latter may operate upon C indirectly by virtue of its influence in a rational selection of the inductance L*. But, unlike the analysis relating to variable ω (equation 3), the result expressed for variable C in equation (11) does not permit imaginary values due to the relative magnitudes of R_v and R. There is consequently an optimum capacity for both pentode and triode which, theoretically, will yield maximum power at any one frequency since the pentode and triode output circuits, for the purpose of this analysis, are to be regarded as differing only in the relations between R_v and R. But it will be shown that, in practice, the solution is virtually applicable only to the pentode.

In Fig. 5 values of capacity and frequency are plotted from (11) for a pentode circuit having the constants previously employed, namely, $R_v = 60{,}000$ ohms, $L = 40$ henrys, $R = 10{,}000$ ohms. From this curve can be read the capacity required for maximum power at any one frequency. In Fig. 6 are shown experimental curves taken with an Osram pentode, type PT 240, nominal internal resistance 55,000 ohms, the other circuit constants being $L = 40$ henrys (approximately) and $R = 10{,}000$ ohms. The circuit was the same as shown in Fig. 4, but the frequency was maintained constant during each test and the capacity varied. Comparison of the theoretical curve of Fig. 5 with the measured values from Fig. 6 shows satisfactory agreement and confirms that equation (11) defines conditions for maximum power.

The "Coincidence" Effect.

If curves for the two foregoing cases, relating to the same circuit constants, be superimposed it would appear possible that an intersection may occur and fall within what is termed in Fig. 2 the "practical range." At the intersection the conditions for maximum power defined by equations (3) and (11) will be satisfied simultaneously and the power developed in the load will attain its maximum possible value.

In Fig. 7 curves plotted from equations (3) and (11) for $R_v = 60{,}000$ ohms, $R = 10{,}000$ ohms and $L = 40$ henrys are shown superimposed, intersection occurring at a frequency of approximately 108 cycles per second and with a capacity of approximately 0.07 microfarad. As the above circuit constants correspond with those used in the experimental tests, it follows that, in the measured response curves of Fig. 3, the power peak shown in the curve for $C = 0.05$ microfarad is approximately the greatest

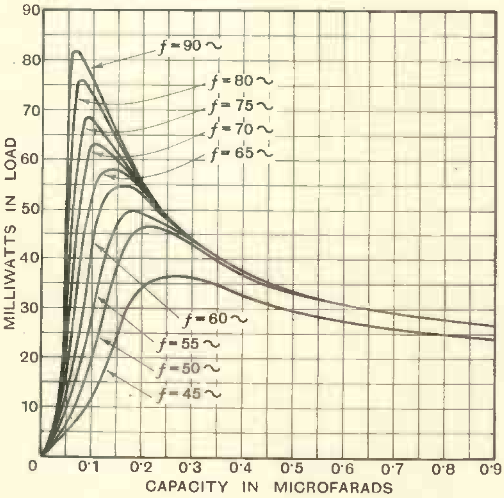


Fig. 6.—*Experimental curves of coupling capacity and power plotted from response curves for different frequencies. Pentode PT240, resistance load* = 10,000 *ohms. Choke inductance under operating conditions* = 40 *henrys.*

---

* *Ibid.*, pages 316 and 317.

obtainable with that circuit, and that, if further tests with smaller capacities had been carried out, the peak, whilst occurring at higher frequencies, would diminish in amplitude.

Throwing equation (11) into a form for the determination of ω in terms of C, L, and R_v we have

$$\omega^2 CLR_v^2 = R_v^2 + \omega^2 L^2$$

whence

$$\omega = \frac{R_v}{(CLR_v^2 - L^2)^{\frac{1}{2}}} \quad \ldots \quad (12)$$

For coincidence between the values of ω defined by (3) and (12) we may write

$$\frac{R_v}{(CLR_v^2 - L^2)^{\frac{1}{2}}} = \frac{1}{\left(CL - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2}\right)^{\frac{1}{2}}}$$

whence

$$R_v^2\left(CL - \frac{R^2C^2}{2} - \frac{L^2}{2R_v^2}\right) = CLR_v^2 - L^2$$

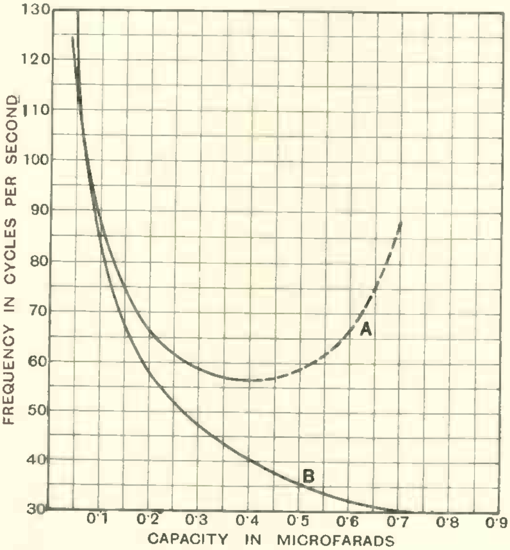


Fig. 7.—*Curve A plotted from equation* (3). *Curve B plotted from equation* (11).

Solving for C we have

$$C^2 R_v^2 R^2 = L^2$$

whence

$$C''' = \frac{L}{RR_v} \quad \ldots \quad \ldots \quad (13)$$

where C''' is in farads and represents the special value of C for this case.

Equation (13) therefore defines the capacity which will produce the utmost possible power peak.

The pulsatance ω''' at which the coincidence peak will occur can be found by substituting for C''' in either (3) or (11). Taking the latter case we have

$$\omega''' = \left[\frac{1}{\frac{L^2}{RR_v} - \frac{R^2L^2}{2R^2R_v^2} - \frac{L^2}{2R_v^2}}\right]^{\frac{1}{2}}$$

whence

$$\omega''' = \frac{1}{L}\left[\frac{RR_v^2}{R_v - R}\right]^{\frac{1}{2}} \quad \ldots \quad (14)$$

Inspection of (14) shows that ω''' is real only when R_v is greater than R. Therefore, when the usual load-matching relationships between R_v and R for pentode and triode are employed, the "coincidence effect" is confined to the pentode circuit.

Substitution of the values $R_v = 60{,}000$ ohms, $R = 10{,}000$ ohms, $L = 40$ henrys in (13) and (14) gives values of capacity and frequency of 0.067 microfarad and 108 cycles per second: these agree with the intersection shown by the curves of Fig. 7.

Summary.

The foregoing results may be summarised as below, the meanings of the various symbols being given by the circuit diagram of Fig. 1.

Case 1.—*Compensation of Power Response Curve for Uniform Response to Lowest Possible Frequency. (Level Compensation).*

$$C' = \frac{(10^6 L)}{R^2}$$

where C' is expressed in microfarads.

$$f' = \frac{0.225 RR_v}{L(R_v^2 - R^2)^{\frac{1}{2}}}$$

where f' is the lowest frequency at which uniform response can be maintained.

Case 2.—*Over-compensation of Power Response Curve at a Particular Low Frequency.*

$$C'' = 10^6 \,.\left[\frac{R_v^2 + \omega^2 L^2}{\omega^2 LR_v^2}\right]$$

where C' is expressed in microfarads and $\omega = 2\pi \times$ (frequency at which over-compensation is desired).

Case 3.—Maximum Possible Low Frequency Power—the Coincidence Case.

$$C''' = \frac{10^6 . L}{RR_v}$$

$$f''' = \frac{1}{2\pi L}\left[\frac{RR_v^2}{R_v - R}\right]^{\frac{1}{2}}$$

where C''' is in microfarads and f''' is the frequency at which augmentation will occur.

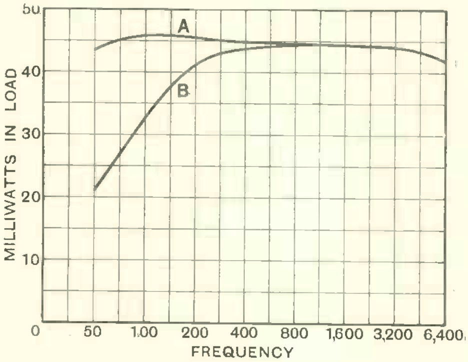


Fig. 8.—Experimental power response curves for Pentode PT240 choke-condenser coupled to resistance load. Curve A, coupling capacity, = 0.3 μF. Curve B, standard coupling condition C = 2.0 μF. Choke inductance = 40 henrys. Transformation ratio = 1.

It was pointed out in the analysis of Case 2 that the result applies to both triode and pentode. In practice, however, the over-compensation effect is sharply defined and of appreciable magnitude with the pentode, but ill-defined and of little acoustic significance with the triode. This results, as will be understood from a general explanation given in the Author's previous paper, from the much higher internal resistance of the pentode and its comparatively low resistance load. Moreover, as the effect is due to resonance between the coupling inductance and condenser, and the desired frequency of over-compensation is likely to be of the order 50 cycles per second, it follows that the triode, with its low inductance coupling, calls for a very large condenser. Thus, for a triode of 1,500 ohms internal resistance coupled to a load of 3,000 ohms, a coupling inductance of about 3 henrys is required (see reference in footnote 5, *ante*). For over-compensation at 50 cycles per second, the coupling capacity C'' works out to be about 5.0 microfarads, a value which is appreciably greater than the 2.0 microfarads customarily employed. The calculation assumed a transformation ratio at the coupling inductance of unity. If this is not the case, the value of C' must be multiplied by the square of the transformation ratio and rapidly becomes very great. Whilst, therefore, the calculation is of some value for the triode because it may indicate that, in certain cases, the usual 2.0 microfarads is much too small, at the same time it has little value as a means of augmenting power on account of the inconveniently large capacities required and the relatively small augmentation. On the other hand, a pentode of resistance 60,000 ohms calls for a coupling inductance of 40 henrys, which gives $C' = 0.25$ microfarad for unity transformation ratio, a value of capacity which means an economy in condenser cost together with a degree of power augmentation which is of practical importance.

Experimental curves illustrating this and other aspects of the above analyses will be found in a paper published by the Author in *The Wireless World and Radio Review*, 29th June, 1932, and for this reason further illustration will be limited in the present contribution to Fig. 8, which indicates the improvement effected in a pentode experimental power response curve when the coupling condenser is reduced from 2.0 microfarads to 0.3 microfarads. The condition is approximately that of level compensation to 50 cycles per second.

Radio Research Board (of Australia) Reports Nos. 2, 3, and 4.

Report No. 2. Investigations on the state of polarisation of sky waves and height measurements of the Heaviside layer in the early morning, by A. L. Green. Pp. 80, with many diagrams.

Report No. 3. The influence of the earth's magnetic field on the polarisation of sky waves, by W. G. Baker and A. L. Green. Pp. 32, with 5 diagrams and addendum.

Report No. 4. A preliminary investigation of fading in New South Wales, by A. L. Green and W. G. Baker; Studies of fading in Victoria, on medium waves at short distances, by R. O. Cherry and D. F. Martyn; Observations on distant stations in which no ground wave is received, by R. O. Cherry. Pp. 59, with many diagrams.

Issued by the Council for Scientific and Industrial Research, Melbourne, Australia.

Interference.*

Notes on Methods for Elimination of Interference Caused by Non-radio Devices.

By E. T. Glas.

(Assistant Engineer, Swedish Board of Telegraphs.)

THE different kinds of interference caused to broadcast reception by various types of apparatus, fed from the mains, can be divided into: *low-frequency* (LF) and *high-frequency* (HF) phenomena. As in most practical matters, no sharp boundary-line can be drawn between the two species. However, no one will hesitate to characterise the well-known interference caused by a mercury rectifier with a fundamental frequency of 300 p.p.s. (6-phase rectifier) as a LF phenomenon, although it may contain HF components to some extent, nor will anyone be doubtful when confronted with a violet ray apparatus, where the fundamental frequency is usually about 200,000 p.p.s., as to the HF nature of the interference produced, although the exciting interrupter gives rise to a LF component too. As a rule, one of the two distinct components is predominant, and in most cases met with in practice this is the HF component.

As the causes of LF interference are usually well known and easily accessible to investigation, we may concentrate on the causes of HF interference. In the first place this interference seems to admit of being explained in one of the two following ways.

1.—The source of interference has the properties of a HF electromotive power, which gives rise to HF currents entering the mains.

2.—The source produces travelling pulses (which may be quite "aperiodic"), these pulses acting on periodic circuits, connected to the mains in some way, by means of shock-excitation.

In fact, experience shows that the actual interference in several cases is not affected by the insertion of an appropriately designed LF filter in the leads to the source, although oscillographic observation indicates that every irregularity of the supplied current, accessible to LF investigation, is smoothed out. The explanation is simple if we accept alternative 1, the HF currents passing the LF filter, because the natural capacity of its coils is comparatively high. This capacity cannot be sufficiently eliminated without the inductance becoming too small for a complete smoothing action.

Thus, alternative 1 accepted, we may turn to the nature of the source. It is well known that the existence of a sparking gap of some kind or other is accompanied by radio interference. When the current through the gap tends to be large, the sparking effect usually gives place to a more or less stationary arc, and the corresponding interference will greatly diminish. However, arcs are liable to cause interference owing to the introduction of a negative resistance, the generated oscillations being modulated by such causes as mains noise, ozone-cleaners for factories, medical lamps, etc. As a rule arcs are nevertheless non-interfering. A typical example is afforded by the tramways, where experience clearly shows that the interference is strongest when the current consumed sinks to a minimum, *i.e.*, when the car is coasting and only the lighting system is fed. Moreover, the interference decreases on wet days owing to the easy formation on such days of true arcs in vapour. Any leakage, particularly in high-tension power lines, is accompanied by, it may be invisible, sparking effects and the corresponding interference will reveal the faulty insulator.

When studying any case of interference, it is essential to pay regard to three fundamental factors, namely, the wavelength of interfering currents, the time-curve of currents, and the propagation path from the source to the receiver.

1. Wavelength—As a rule most commutator-machines of a small and moderate size (power $<$ 10 kw) cause the worst interference on the lowest broadcast-waves, $\lambda = 200 - 300$ m. Simple breaking-devices, as those of flashing-lamps, controlling

---

[*] MS. received by the Editor, April, 1932.

switches and relays of various types, on the contrary, are often most troublesome on the higher waves, $\lambda = 1{,}300 - 1{,}900$ m. The same may be said of violet-ray apparatus, where the actual wavelength of the tuned circuits falls within this range. Leakage, too, gives rise to considerable interference on the higher waves. With regard to arcs, fed from d.c. mains, the wavelength of the maximum interference will be found in some cases to change with time, owing to variable conditions of the arcing gas.

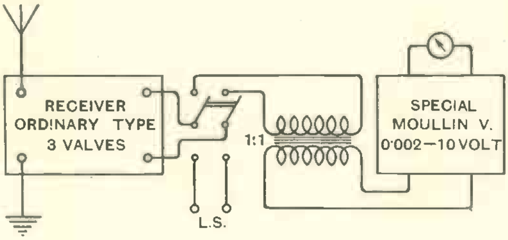
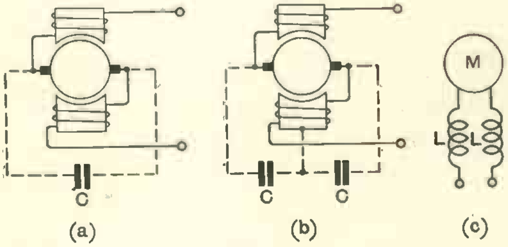


Fig. 1.

2. Time-curve of Current.—This factor is less accessible to direct observation except as regards the irregularities of the LF envelope. However, the indirect results must not be overlooked, as in the case, for instance, of a commutator machine. When one and the same machine of this kind (machine for d.c. or a.c.) is fed alternately with d.c. and a.c., the interference will be very different in the two cases and practically always at its worst in the latter case, where the commutating action is not very good, resulting, among other things, in an unfavourable time-curve.

3. Propagation Path.—Here we have to discriminate between two entirely different modes of propagation. The interfering currents may follow the mains direct to the receivers or may create induction or radiation fields, thus acting through free space, at least to some extent. Although both modes of propagation are met with in most cases, the former usually predominates, as might be expected. Even if this should not be the case, existing metallic wires and other parts have such great influence on the propagation, that the actual interfering effect is governed more by the situation with regard to the mains, etc., than by the geometric distance. Of course, the inductive influence is greatest in the case of apparatus designed to produce HF, such as violet-ray devices.

The three above-mentioned factors have been investigated by comprehensive practical study combined with measurements. There is, however, some doubt as regards the proper method of making such measurements. It has been established that the form of the time-curve is of great importance. As this can only be investigated by difficult and lengthy HF methods, the matter would be considerably simplified if an ordinary measurement of average values, such as a Moullin voltmeter,* could be employed. In fact, practice has shown that this can be done except in some extreme cases, where the ear alone must be relied upon. Fig. 1 shows the circuit that was used. The receiver must be operated at a normal HF input from a (local) broadcast transmitter. This cannot be done during the measuring procedure, but the results must be checked by the ear afterwards, while listening to a programme. If not, serious mistakes may be made. This quantitative method is of considerable advantage when studying the effect caused by altering the electric constants of an anti-interference device.



(a) (b) (c)

Fig. 2.

Before giving the results we will consider the design of such a device in the HF case. By far the simplest procedure, when the source is attacked, is to shunt a condenser directly across the brushes or other contacts where sparks are generated (Fig. 2a). In the case of electric machines we can further take advantage of the capacity between the frame and the windings, by using two condensers

---

* When this instrument has a true square-law characteristic, the R.M.S. is measured independent of the curve-form. It is sometimes of considerable advantage to interconnect a filter, which cuts off very low and very high frequencies, according to the curve of sensibility of the human ear.

and connecting the midpoint to the frame of the machine* (Fig. 2b.) Where this arrangement proves to be satisfactory, experience has shown that the following are the most appropriate values of capacity,

small motors $C = 0.1\ \mu F$
larger motors, generators $C = 2 - 4\ \mu F$
unshielded circuit breaking devices $C = 0.5 - 2\ \mu F$

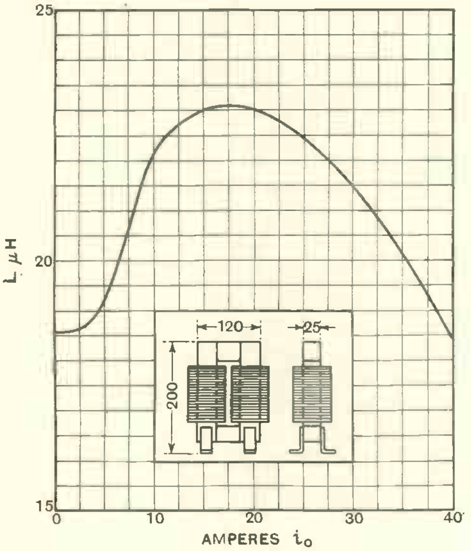


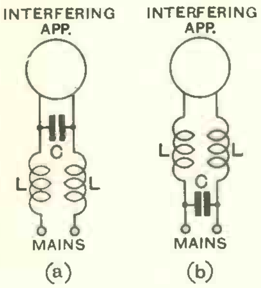
Fig. 3.

In many cases, however, especially with a.c., the condenser method is ineffective, even when the condenser is combined with a series-resistance. The next step is to introduce an inductance, as shown in Fig. 2c. Here practice shows that good values are, for

electric machines $L = 0.5 - 1.5$ mH
circuit breaking points $L = 0.1 - 1.5$ mH

according to the conditions.

The design of the coils may be discussed. Investigation has shown that a coil with iron usually has only slightly more inductance at HF than the same coil constructed without iron, although the inductance at LF may be 50 times as high in the former case. On the other hand, the unfavourable natural capacity of the coil is increased several times by the presence of iron. Thus there does not seem to be any reason to adopt iron when the interference has a pure HF character. Where this is not the case, as for instance in a small generator or a motor of considerable size, fed from a relatively small local power supply, coils with iron will very often prove to be superior owing to the existence of a LF component, which may attain 30 per cent. of the total interference (as shown by measurement of rectified average voltages). When iron is used, care must, of course, be taken to prevent saturation. This is best done by leaving an appropriate air-gap in the magnetic path. Thus coils of at least 20 mH, measured at $\omega = 2\pi \cdot 2{,}000$, can be constructed at a reasonable cost. Their inductance at HF will nevertheless seldom exceed $0.5 - 1$ mH, the natural capacity is usually of the order of 300–700 $\mu\mu F$, all values applying to coils designed for a maximum continuous current of about 50 amps. d.c. Fig. 3 shows the influence of current load on inductance for such a coil of commercial construction, at LF. When the current does not exceed say 8–10 amp.—and the HF component is predominant—coils should always be designed without iron. By well-known methods of winding, the natural capacity in this case can be lowered to about 10 $\mu\mu F$ at an inductance of $1 - 1.5$ mH, without disregarding economy.†



(a) (b)

Fig. 4.

The last step is to introduce complete HF filters, which unfortunately will very often be found quite necessary for circuit breaking points such as relays, switches, keys, etc., and also for several types of electric machines, particularly big ones.

---

* In the a.c. case any dangerous capacity-current should be avoided by inserting a protecting condenser ($\leqq 5{,}000\ \mu\mu F$) in the lead from the midpoint of the series condensers to the frame. Where a *reliable* earth is present, this safety-rule can be neglected of course, but it is of importance in many cases (vacuum-cleaners, fans, etc.), where the frame may not be insulated and, moreover, easy to touch.

† It is, of course, not quite true to look upon the natural capacity as simply shortening the coil, when this capacity is not very large. However, a more intimate study reveals that the said capacity comes out to be chiefly harmful when constructing a reasonable choking coil for frequencies within the broadcasting range.

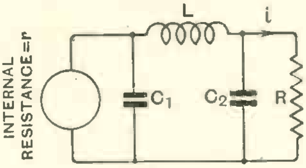


Fig. 5.

Fig. 4a, b shows the two simplest forms of symmetrical HF filters, the electrical symmetry being generally of advantage for the elimination. When shall type a be used, when type b? This, of course, greatly depends on the impedances of the source and of the network in relation to each other. Let us consider a simplified circuit according to Fig. 5, where the internal impedance of the sources is replaced by a lumped resistance. Instead of assuming a pure sine E.M.F., we may consider an E.M.F of the more general form of Fig. 6.

First taking $C_2 = 0$ the method of Heaviside gives the symbolical formula,

$$i = \frac{E}{rLC_1} \cdot \frac{p\omega}{\{(p+\beta)^2+\omega^2\} \cdot \left\{p^2 + p\left(\frac{R}{L}+\frac{1}{rC_1}\right) + \frac{1}{LC_1}\left(1+\frac{R}{r}\right)\right\}} \quad (1)$$

where $p = d/dt$.

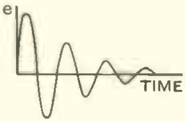
If, however, $C_1 = 0$ we have

$$i = \frac{E}{RLC_2} \cdot \frac{p\omega}{\{(p+\beta)^2+\omega^2\} \cdot \left\{p^2 + p\left(\frac{r}{L}+\frac{1}{RC_2}\right) + \frac{1}{LC_2}\left(1+\frac{r}{R}\right)\right\}} \quad (2)$$

It appears immediately that the two formulas are quite identical but for the reciprocal substitution of r by R and *vice versa*. The generated current of the forced angular frequency ω is here of interest, and for this component we have $(p = -\beta \pm j\omega)$ from . . . (1)

$$i_\omega = \frac{E}{rLC_1} \cdot e^{-\beta t} \cdot \frac{\sin(\omega t + \phi_1)}{\sqrt{\left[\frac{1}{LC_1}\left(1+\frac{r}{R}\right) - \beta\left(\frac{r}{L}+\frac{1}{RC_1}\right) - \omega^2 + \beta^2\right]^2 + \left[\omega\left(\frac{r}{L}+\frac{1}{RC_2}\right) - 2\beta\omega\right]^2}}$$

Fig. 6.—$e = E \cdot e^{-\beta t} \cdot \sin \omega t = \frac{p\omega}{(p+\beta)^2+\omega^2} \cdot E$



As the curve-form is extremely variable in most practical cases, we can substitute a series of HF pulses. One of these will produce a current corresponding to $\beta \rightarrow \infty$, the square-root thus becoming independent of the circuit-constants and

$$/i_\omega/ = \frac{E}{rLC_1} \cdot e^{-\beta t} \cdot f_1(\beta,\omega) \quad \ldots \quad (1a)$$

Similarly from . . . (2)

$$/i_\omega/ = \frac{E}{RLC_2} \cdot e^{-\beta t} \cdot f_2(\beta,\omega) \quad \ldots \quad (2a)$$

Consequently a condenser C_1 should be found preferable, when the internal "resistance" of the source is much greater than the network impedance ("small" machines), whereas a condenser C_2 should be adopted in the opposite case ("big" machines). This has been fully confirmed by practice. Thus the arrangement shown by Fig. 4a has proved to be suitable for small machines and to afford the only reliable method in the case of circuit breaking points, Fig. 4b for machines, the power of which exceeds about 2 kW. This fact does not seem to have been fully recognised in the construction of several anti-interference-devices now on the market. As a rule, the field-coils of a series-machine cannot be regarded as effective chokes at HF owing to their large distributed capacity.*

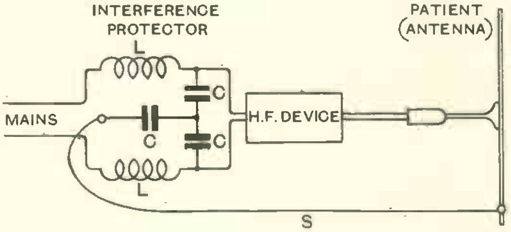


Fig. 7.

Before leaving this question we might consider a very special type of device, namely, the type designed for the elimination of interference caused by violet-ray apparatus (Fig. 7). Such a device has two functions, *viz.*, choking the mains-leads and preventing excessive induction from the patient's body. The latter function is performed by the metallic lead S, which transforms the open circuit of the body into a closed circuit with

---

* For unshielded breaking-points, however, a considerable choking effect of such coils is found to exist, *e.g.*, for ringing-bells.

less pronounced action at a distance. Nevertheless, the choking device must be carefully designed with coils of an inductance of the order of 50 mH, and condensers not smaller than 5,000 $\mu\mu$F. Of course, a Faraday cage could be safely used to prevent induction. The above arrangement, however, will often do. Where the interference is purely of a LF nature, the general design of the device can be maintained, but inductance and capacity must be increased. While HF interference is best attacked at the source, the LF type can usually be completely eliminated at the receiver as well. A particularly important case is the smoothing of the pulsating current from mercury rectifiers. Here a filter consisting of one coil with iron, inductance not less than 2 H, and a condenser of 4–6 μF, shunted across the leads on the receiver side, has been found commercially possible, when the current consumption of the receiver does not exceed 0.3 amp.

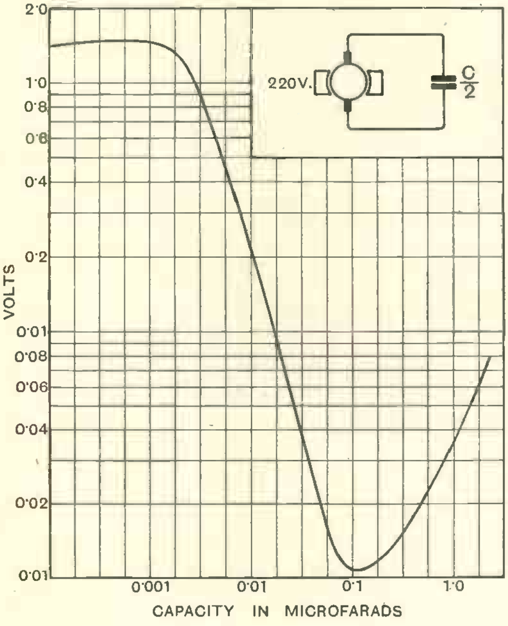


Fig. 8.

Some results of the above-mentioned measurement of average interference-voltages are shown in Figs. 8 and 9. The curves represent the interference from an adding-machine, Fig. 8 dealing with the interference from the motor (1/20 HP, 220 volt d.c., 1,725 r.p.m.) and Fig. 9 that from the start-and-stop key. Appropriate schemes of protective devices will be seen from the drawings. The optimum values of the electrical constants (L and C) can easily be extracted. Note, in particular, the influence of the inductance in Fig. 9. If coils of a certain minimum value of inductance are not inserted, condensers are of no avail, no matter how large. Other curves of interfering devices not reproduced here show a marked resonance-effect for a certain value of the capacity, especially when the coils are very small. Such points must be carefully avoided, as otherwise a pronounced deterioration may result instead of the desired elimination of interference.

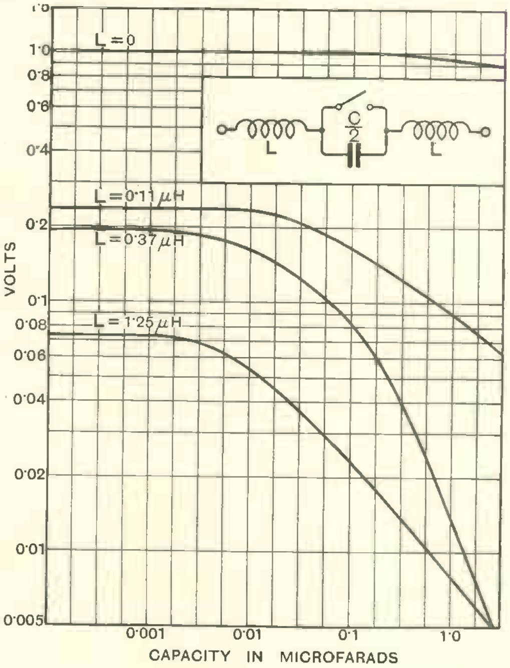


Fig. 9.

To conclude this brief survey, some words should be said about the elimination of interference from sliding contacts, such as those of tramways. The only way of solving this problem seems to be the installation of bows having the proper mechanical and electrical qualities to prevent the generation of sparks. Two different designs have been adopted in practice, namely, bows of iron (with copper-edges and lubrication grooves), called Fischer-bows, and bows furnished with carbon.

Correspondence.

Letters of technical interest are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

High-Selectivity Tone-Corrected Circuits.

To the Editor, The Wireless Engineer.

SIR,—Since the Radio Research Board considered the subject of High Selectivity Tone-Corrected Receiving Circuits of sufficient importance to appoint a special committee to investigate and report upon the merits of receivers of this type, one would have expected a journal of the standing of *The Wireless Engineer* to have dealt with the subject in an unbiased and comprehensive manner.

Instead of this, the writer of the Editorial dealing with the subject in your November issue allowed himself to be flustered by newspaper articles to such an extent that he failed to appreciate the importance of the subject with which he was dealing, and allowed his natural bias to carry him away to such an extent that he even criticised the report itself; but on this point G. W. O. H. can safely be left to his colleagues.

If G. W. O. H. could have forgotten that he was a member of the Radio Research Board, and in his capacity as journalist endeavoured to present an unbiased and explanatory criticism of the Report for the benefit of your readers, he would have found numerous important facts concealed in the verbiage of the Report, which facts are of fundamental importance to the wireless industry, and should have been made clear to your readers.

Apart from these facts, G. W. O. H. might have remedied the omission of his Board, and in fairness to me made it clear that the Special Committee referred to was really appointed to investigate my discoveries (the "Stenode") as a direct result of the early demonstrations which I gave to certain scientists who happen to be members of the Radio Research Board, including Prof. E. V. Appleton, Mr. Watson Watt, and Col. Fuller, at which demonstrations they admitted that the "Stenode" had revealed new phenomena in wireless, which phenomena were of sufficient national importance to warrant a Government investigation.

Instead of giving me credit for these discoveries, G. W. O. H. preferred to follow the lead of his Board and endeavoured to conceal rather than reveal in a tangible form the true facts.

Probably the last paragraph of the article was put in to make up the requisite number of words for the Editorial, but surely it is not the function of your Journal to give its readers a lesson in spelling, and one would have thought that if G. W. O. H. wished to be such a purist he would have remedied such spelling defects in the early drafts of the Report, of which, presumably, he had copies.

J. ROBINSON.

London, W.1.

[It is not clear from the above letter whether Dr. Robinson regards the Radio Research Board or Mr. Colebrook or Prof. Appleton or G. W. O. H. as the chief villain of the piece. That will depend on whether he considers the greater criminal to be he who conceals in verbiage numerous facts of fundamental importance to the wireless industry, or he who fails to find them and make them clear. The Editorial made no pretence of dealing with the subject in a comprehensive manner—that was unnecessary, as it had been done very thoroughly by Mr. Colebrook in the Report itself—but we do say, unhesitatingly, that it was entirely free from bias, even from "natural bias," which is presumably a kind of original sin.

There is one point in the Editorial to which we should like to refer. We said that the effect of the suppression of a neighbouring carrier by means of the quartz crystal rejector would be somewhat like a piano with one or two notes missing. We said "somewhat" because the notes would not be entirely missing unless the corresponding side-bands on both sides of the carrier were suppressed, but we confess that even then the analogy is hardly fair, because the reduction of loudness due to the elimination of one side-band would probably be much less than the analogy suggests, and might, indeed, be hardly noticeable in ordinary use.

What the newspaper articles are to which Dr. Robinson refers we do not know; we referred to one only, and that the one with which the "Stenode" burst upon an astonished world. Rightly or wrongly we have always regarded this as having been inspired by Dr. Robinson, but we certainly never allowed ourselves to be flustered by it. The Editorial Note drew attention to the Report, the price, and where it could be obtained, gave a brief historical preamble showing how interest in the subject had arisen, and after a brief summary of the results of the investigation, concluded by discussing one or two points of minor importance, but yet of sufficient interest, in our opinion, to merit reference. Dr. Robinson little knows how much time an Editor spends modifying spelling, symbols, and grammar: we have even taken the liberty of correcting the grammar of his letter. It becomes a habit.

We should like to emphasise that the Report was not concerned with the distribution of credit for discoveries, but only with a scientific investigation of a much discussed problem, and we respectfully decline the invitation to rush in where the Radio Research Board feared to tread. References were given throughout the Report and in the bibliography to the work of those who had published anything throwing light on the subject, and if Dr. Robinson plays a very small rôle in the list the blame does not lie at the door of *The Wireless Engineer*.

At the foot of p. 605 we gave a list of names of those who had contributed articles on the subject to this journal. This list should have included the names of Professor Appleton and Mr. Boohariwalla, whose article was published in March of this year. Although the list made no pretence of being complete, this paper should have been mentioned, as it is discussed in the Report.—G. W. O. H.

"Capacitative."

To the Editor, The Wireless Engineer.

Sir,—My attention is directed to an *obiter dictum,* which, I confess, I view with certain misgiving, and which I note with amazement appears above the renowned denominant "G. W. O. H." in the Editorial column of your journal for November, 1932.

This concerns the abrogation—I might call it wanton dereliction—of a syllable of the word which I have designated above. While I have every sympathy with your eminent contributor in his laudable campaign for brevity coupled with clear thinking, I cannot but remember that almost equally renowned savants have shared with me the euphonic if longer form of this word in the past.

I am humbly aware that precedent in the form of prior use is no concrete argument because of the notorious negligence of genius in details. Nevertheless, in my stumbling research for truth I have come upon "confirmive" evidence in several dictionaries that "capacitative" may be thought to be formed from "capacitate," not by removal and substitution, but by addition.

It is in no carping or "argumentive" vein that I approach this matter; I would like to know, however, whether your contributor's statement is "representive" of your own opinion, and is therefore to be taken as "authoritive"?

Nt. Harrow. J. C. Wilson

To the Editor, The Wireless Engineer.

Sir,—I am shocked and horrified at the last paragraph of your current Editorial.

Ever since a stern comment appeared in your columns in respect of the lapses from pure English which took place at a certain I.E.E. meeting, I have regarded your Technical Editor as one before whose "authoritative" pronouncements sinners like myself might well quail, but if they are only "authoritive," how can I consider them in the same light?

I cannot waste your space in an attempt to expound my contention that the word "capacitative" is etymologically correct, but I implore Dr. Howe to investigate the Latin origins of the words at issue and then to reconsider his verdict. Any assurance that we may be spared the compulsory use of analogous abbreviations such as "qualitive," "quantitive," etc., will be anxiously awaited by "Too Toppy."

Hampstead, N.W.3.

Successive Heterodyne Receivers.

To the Editor, Wireless Engineer.

Sir,—In his paper in the November issue of *Wireless Engineer and Experimental Wireless,* Mr. E. L. C. White is hardly correct in attributing novelty to the practice, described in *The Wireless World's* article of May 6th, 1931, of feeding signals to the grid and heterodyne to the anode of a bottom-bend triode detector, as this method was described seven years before the article in question, in British Patent Specification No. 226,050 (1924).

Considerations stressed in the Shorter Catechism led me in 1923 to adopt "anode-fed" front-detector circuits, with a screened heterodyne, in the pious hope that the few centimetres anode-grid capacity of the detector might not pass enough heterodyne power through two loosely coupled circuits (tuned not to heterodyne but to signal frequency) to cause appreciable heterodyne radiation. It remained for N. P. Hinton, in 1927, to devise oscillator circuits with "overhang" and to *neutralise* the interelectrode capacity of an anode-fed detector, and for Mr. E. L. C. White, in 1932, to show us, with a four-electrode valve, the best way of avoiding heterodyne radiation. *Palmam qui meruit ferat!*

C. R. Burch, Research Department.
Metropolitan-Vickers Elec. Co., Ltd.

Book Review.

The True Road to Radio.

By Albert Hall, A.R.C.Sc., M.I.R.E., Wh. Ex. Ferranti, Ltd., Hollinwood, Lancashire. 3rd edition.

The object of this book is to give a comprehensive survey of the principles of wireless as applied particularly to high quality receiver design, and in this it succeeds admirably. The treatment adopted is first to describe the problem in simple terms, secondly to investigate the matter technically, and thirdly, to illustrate the practical results obtainable by measurements on Ferranti apparatus.

A large section of the book is devoted to tuning systems and high-frequency amplification; the superheterodyne, however, is only cursorily touched upon, and no mention is to be found of such a recent development as the variable-mu valve; this is, we understand, because to include this material would have meant an unjustifiable delay in publication of the new Edition which was in demand. Both anode bend and grid detection are thoroughly dealt with, and low-frequency and power output stages are treated with a wealth of illustrative data. The use of valve curves for determining the optimum operating conditions is stressed, and numerous examples are given. It seems to the reviewer, however, that a note should have been included to the effect that the curves illustrated are not necessarily applicable to valves at present available under the same type numbers, but to older specimens. It is unfortunate also that an error should have crept into the section dealing with resistance-capacity coupling, wherein it is stated that if the grid leak be increased in value so also must the coupling condenser be increased in capacity. Actually, of course, the coupling capacity is inversely proportional to the resistance of the grid leak.

Although the treatment is largely non-mathematical, a number of formulae are included as an aid to design; those intending to employ them, however, should note that they are not entirely free from printing errors. The book is profusely illustrated and the numerous curves and other data relating to Ferranti components render it as useful for reference as for its more legitimate purpose of explaining the nature of the problems of receiver design and indicating at least one method of solving them.

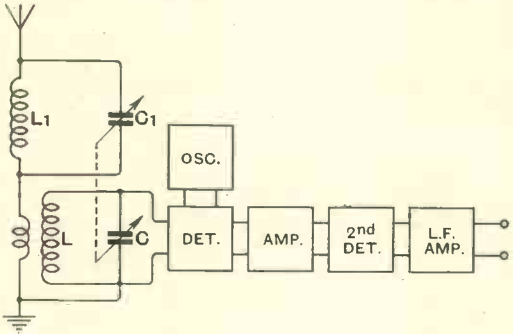
Some Recent Patents.

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

SUPERHETERODYNE RECEIVERS.

Application date, 26th March, 1931. *No.* 375410.

In order to eliminate second-channel interference in a superhet set, more particularly one of the type in which a low intermediate frequency is used, say, 40 kilocycles, a rejector circuit L_1, C_1 is inserted in, or coupled to, the aerial, and is so ganged with the ordinary input circuit L, C as to maintain a constant "difference" frequency, equal to twice the intermediate frequency employed. Both the rotor and stator of the condenser C_1 must be insulated with respect to earth. A construction of condenser suitable for ganging the two circuits together is described in the specification.



No. 375410.

Patent issued to J. Robinson and British Radiostat Corpn., Ltd.

TELEVISION SYSTEMS.

Application date, 6th February, 1931. *No.* 374094.

Relates to scanning-apparatus of the type in which a rotating apertured drum co-operates with a rotating mirror-wheel set at right-angles to the drum. In an arrangement designed to scan an object in fifty lines, fifteen times per second, over a square area, the apertured drum is 9.7 inches in diameter with thirty apertures each 0.017 inch square. The mirror wheel is 9.5 inches in diameter and is fitted with twenty-five tangential mirrors each 2 by 1.2 inches. The motor speed is 1500 revs. per minute, the drum being driven through reduction gearing at thirty-six revs. per minute. This enables a picture ten feet square to be covered at a distance of approximately twenty feet from the mirror.

Patent issued to Marconi's Wireless Telegraph Co., Ltd., and H. M. Dowsett.

Convention date (U.S.A.), 2nd April, 1930.
No. 374974.

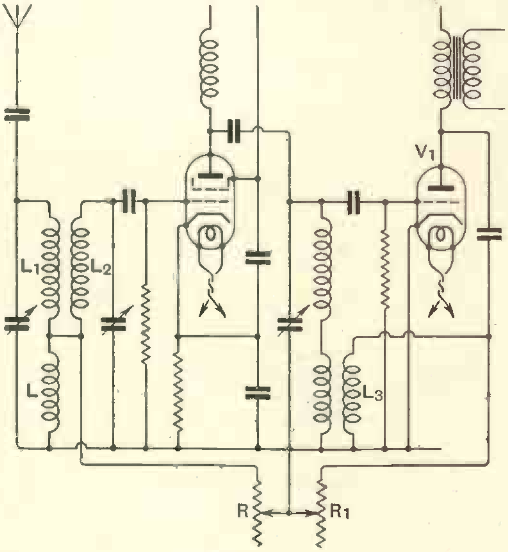
To allow the received picture to be "monitored," provision is made to project a second facsimile picture for the information of a station supervisor outside the cabinet containing the main observer, and without obstructing the latter's view of the primary reproduction. The spiral line of apertures on the scanning-disc overlaps the full 360° by an extra 90°, and a part of the emission from the Neon lamp is diverted through a mirror-and-lens system to pass through a part of the scanning-disc separated by 90° from the part through which the main picture is viewed. A second mirror on the far side of the scanning-disc then reflects the secondary picture through a window in the observer's cabinet to the supervising attendant outside.

Patent issued to Electrical Research Products Inc.

VOLUME AND SELECTIVITY CONTROL.

Application date, 24th March, 1931. *No.* 375357.

A resistance R in parallel with a coil L coupling the two tuned circuits comprising L, L_1, and L_2, of a band-pass input serves as an input volume control which does not disturb the tuning of the ganged circuits. In addition it can be used to regulate the band-width passed by the filter circuit, and therefore the selectivity of the set as a whole. A second resistance R_1 is inserted in parallel with a back-coupling coil L_3 in the output of the detector valve V_1 in order to control reaction. The two resistances R, R_1 are coupled together as shown.



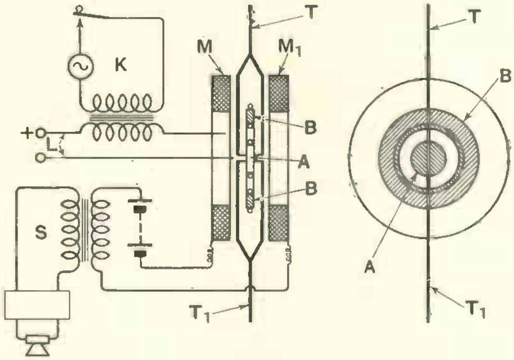
No. 375357.

Patent issued to F. Murphy and E. J. Power.

HIGH-FREQUENCY GENERATORS.

Convention date (U.S.A.), 14th July, 1930.
No. 374311.

High-frequency currents are generated by applying a breakdown voltage from leads *L* across two concentric electrodes *A*, *B* mounted inside a gas-filled container (not shown). As soon as the arc is formed it is made to rotate rapidly, around the annular gap between the electrodes, by the magnetic field from two solenoids *M*, M_1. In its rotation the arc, or discharge current, induces a rapidly alternating EMF in the bifurcated ends of a pick-up wire *T*, T_1 which is used as a transmitting aerial. Morse signals may be superposed by a keying-circuit *K* coupled to the supply leads *L*, or speech signals from a microphone circuit *S* coupled to the solenoid windings *M*.



No. 374311.

Patent issued by Marconi's Wireless Telegraph Co., Ltd.

REMOTE TUNING-CONTROL.

Convention date (U.S.A.), 18th October, 1930.
No. 372687.

In order to tune a superheterodyne set from a distance, the local oscillator in the set is of the multi-vibrator type, wherein the generated frequency depends upon the value of one of the circuit elements, for instance the grid leak or the anode coupling-resistance. The space-current path of an auxiliary valve is arranged in parallel with this frequency-determining element, and the internal impedance of the auxiliary valve is then adjusted from a distance by means of a grid-bias rheostat. The frequency-adjusting rheostat is conveniently combined with a volume-control potentiometer.

Patent issued to Marconi's Wireless Telegraph Co., Ltd.

TWO-WAY TELEVISION.

Convention date (U.S.A.), 1st October, 1930.
No. 371612.

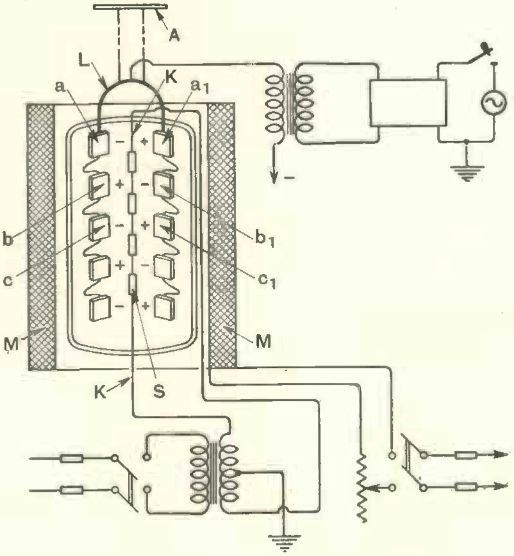
In a two-way television system the analysing system at the receiving end is also utilised to "monitor" the outgoing transmission, so as to give what might be called a "sidetone" representation to the local subscriber of the picture of himself that is being sent to his distant correspondent. The incoming picture is built up by means of a scanning arrangement of the kind in which an electric arc is traversed in zig-zag fashion along a series of interleaved electrodes by the action of a magnetic field created by an electric current encircling the electrode system. A local oscillator superposes an alternating current on the electrode system whereby the latter reproduces, during alternative half-cycles, the incoming picture of the distant correspondent, and during the intervening half-cycles serves as a mirror in which the local correspondent may observe how his image is appearing on the screen at the distant point.

Patent issued to Communication Patents Inc.

SHORT-WAVE OSCILLATORS.

Convention date (U.S.A.), 21st July, 1930.
No. 375095.

Wavelengths of the order of decimetres are generated in a valve of the split-anode "magnetron" type by making each of the anode sections electrically long relatively to the generated wave, and setting them close to each other so as to increase their mutual inductance. As shown each anode consists of a number of "targets" *a*, *b*, *c*, etc., and a_1, b_1, c_1, etc., connected in series by looped wires. The central cathode *K* is screened at intervals by sleeves *S*, so that the electron stream is concentrated on the "targets." The whole assembly is surrounded by a solenoid *M*, producing an axial magnetic field. The effect of this upon the transverse electron stream is to create a standing-wave on the sectionalised anodes, as indicated by the progressive + and — signs. The anode sections are connected at their upper ends by a looped wire *L*, from which the HF energy is tapped off to a radiating aerial *A*.



No. 375095.

Patent issued to Marconi's Wireless Telegraph Co., Ltd.

SCANNING FOR TELEVISION.

Convention date (*U.S.A.*), *7th August*, 1930.
No. 375589.

A single rotating cylinder is arranged to give an equivalent scanning-point to that produced by two separate rotating discs with intersecting scanning-lines. The rim of the cylinder is made sufficiently wide to accommodate a series of inclined parallel slots. Light from a Neon lamp is projected by a lens through one of the slots on to a double set of right-angled prisms, which reflect the image of the slot back through a slot on to a lower point of the same cylinder. Owing to the double reflection through the prisms, the image of the original slot is rotated through 90°, so that it intersects lower slot at right angles, so as to produce a single scanning "point."

Patent issued to A. J. Cawley.

ELIMINATING "MAN-MADE" STATIC.

Convention date (*U.S.A.*), *25th February*, 1931.
No. 375737.

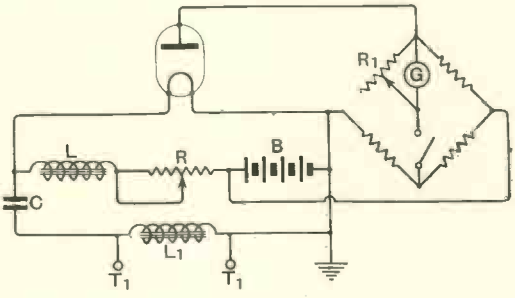
The specification analyses local interference into: (a) that carried by the electric mains which are the common source of supply for domestic labour-saving apparatus, lifts, violet-ray appliances, and other sparking-devices, as well as for the receiving set; (b) field "pick-up" by the aerial and the lead-in, as well as by the coupling-coils in the set, such "fields" being of comparatively limited spread. According to the invention, a receiving set is rendered substantially immune from such interference (1) by locating the aerial in some remote place, say on the top of the roof of an hotel or apartment house, outside the area of spread of the local fields of induction; (2) by providing a screened transmission line or lead-in of low impedance, coupled to the input circuit of the receiver through a filter circuit designed to reject low-frequency disturbances due to sparking-devices. (3) The mains supply unit is also carefully screened, as well as the set, and also the opening through which the sound emerges from the loud speaker. (4) The screening-sheath covering the lead-in or transmission line from the remote aerial is preferably grounded at several points along its length.

Patent issued to Marconi's Wireless Telegraph Co., Ltd.

A.C. METERS.

Application date, *20th August*, 1931. *No.* 376066.

A direct-reading A.C. meter, suitable for low-impedance circuits, and capable of measuring currents varying in value from micro-amps to amperes, and varying in frequency from 25 cycles to 6,000 kilocycles, is based on the known principle of injecting the A.C. current to be measured into the filament of a thermionic valve and then measuring the resulting increase in plate current. The invention is characterized by the feature that the valve is at all times adjusted to pass a saturation current, the increase in the latter, after the application of the A.C. current, giving the desired indication. As shown the filament is heated by direct current from the battery B, through a resistance R and choke L which serve to reduce the applied P.D. say to 2 volts or other rated value. A unipivot galvanometer G is inserted across the diagonal of a Wheatstone-bridge network, one arm of which contains the inter-electrode capacity of the diode or other valve. The current to be measured is applied across the terminals T, T_1, shunted by a heavy choke L_1 and passes through an electrolytic condenser C to the filament. A resistance R_1 serves to compensate the galvanometer G for casual variations in temperature.



No. 376066.

Patent issued to H. E. M. Barlow.

GENERATING ULTRA-SHORT WAVES.

Convention date (*U.S.A.*), *28th July*, 1930.
No. 373847.

Waves a fraction of a centimetre long are generated by passing spark-discharges through a colloidal solution containing metallic particles. In operation the spark "grape vines" itself, *i.e.*, follows branched paths through the liquid and sets up a series of sub-discharges from the ends of the metallic particles. These in turn generate damped oscillations of a wavelength corresponding to the natural "period" of the particles in solution, so that with particles of uniform size the radiation is confined to a comparatively narrow band of waves. To create a more or less uniform distribution of energy, the solution may be subjected to heavy pressure, whilst further concentration is effected by means of a backing-reflector of parabolic section.

Patent issued to Marconi's Wireless Telegraph Co., Ltd.

PRODUCING CIRCULARLY-POLARIZED WAVES.

Convention date (*Germany*), *13th October*, 1930.
No. 375165.

Circularly-polarised waves, which are known to be largely free from fading effects, are produced by feeding HF energy to an aerial system consisting of two conductors twisted around an imaginary cylinder, the two spiral paths being 180° out of phase. Transverse radiators are preferably arranged along the length of each wire, and may extend inwards, *i.e.*, between the two wires, or project outwards from the double line, or both. The ends of the twisted aerials are connected together through a terminating resistance.

Patent issued to Telefunken Ges. für Drahtlose Telegraphie m.b.H.

INDEX.

VOL. IX. The Wireless Engineer & Experimental Wireless. 1932.

I. GENERAL INDEX.

PAGE
ABSTRACTS AND REFERENCES (*see separate Index*)
A.C. Motors (*Patents*) .. 689
Acoustic and Telephone Measurements (*I.E.E. Paper*), H. R. Harbottle .. 451
Acoustic Nomenclature and Definitions (*Editorial*) .. 307
(*Correspondence*) .. 448
Acoustic Studies (*Patents*) .. 663
Aerial, Directive, New Type, T. Walmsley .. 622
Aerials, Drying-out (*Patents*) .. 543
Aircraft D.F. Station at Pulham .. 122
Aircraft Set in Mrs. Victor Bruce's Aeroplane (*Illustration*) .. 428
Aircraft Sets (*Patents*) .. 366
Amplifiers for A.C. Valves (*Patents*) .. 423
Amplifier Tone-control Circuits, M. G. Scroggie 3
(*Correspondence*) .. 153
Amplifiers (*Patents*) .. 425, 603
Amplifiers, Convertible (*Patents*) .. 246
Amplifiers, Direct-coupled (*Patents*) .. 484
Amplifiers, Resistance-coupled (*Patents*) 306, 661
Amplifiers, Short-wave (*Patents*) .. 603
Analysis and Design of a Chain of Resonant Circuits, M. Reed .. 259, 320
Aperiodic Impedance Measuring Set, A. T. Starr .. 325
(*Correspondence*) .. 447
"Apparent Demodulation," Another Viewpoint, E. Mallett .. 248
(*Correspondence*) .. 394, 629
Articles, Preparation of (*Editorial*) .. 247
Association of Special Libraries and Information Bureaux, Scientific Abstracts .. 19
Automatic Calling Apparatus (*Patents*) .. 544
Automatic Gain Control (*Patents*) .. 365
Automatic Grid-bias (*Patents*) .. 58
Automatic "Stand-by" Circuits (*Patents*) .. 363
Automatic Volume Control (*Patents*) 118, 604, 662
"Autotone," Wireless World (*Illustration*) .. 135

Band-pass Circuits (*Patents*) .. 661
Band-pass Couplings (*Patents*) 482, 483, 484
Band Pass Filter, Design of, N. R. Bligh .. 61
Band Pass Filters, Resistance in, G. H. Buffery .. 504
Band-pass Filters, The Theory of, C. W. Oatley .. 608
Band-pass Filter, Two-element, R. T. Beatty 546
Beacons, Navigation (*Patents*) .. 426
BOOK REVIEWS:
Wireless, L. B. Turner .. 25
Siebschaltungen (Filter Circuits), W. Cauer 26
Radio Construction and Repairing (3rd Edition), J. A. Moyer and J. F. Wostrel 66
Dictionary of Electrical Terms, S. R. Roget 129
PAGE
Radio Telegraphy and Telephony, Duncan and Drew .. 215
Thermionic Vacuum Tubes and their Application, E. V. Appleton .. 328
Les Unités Electriques, J. Sudria .. 395
Alternating Current Bridge Methods (3rd Edition), B. Hague .. 448
Handbuch der Bildtelegraphie und des Fernsehens, F. Schröter .. 617
True Road to Radio, A. Hall .. 686
BOOKS RECEIVED: 66, 139, 328, 395, 448, 511, 617, 679
Broadcast Relay Systems (*Patents*) .. 484
Broadcasting, Common Wave (*Patents*) .. 425
Broadcasting House (*Illustrations*) .. 309
Broadcasting with Ultra-short-waves (*Editorial*) .. 59

Capacitive Output Coupling, L. G. A. Sims 314
Carrier Interference Eliminator, W. Baggally .. 388
Cathode-Ray Indicators (*Patents*) .. 362, 365
Cathode-ray Oscillograph in Radio Research (Royal Soc. Demonstration) .. 449
Cathode-Ray Tubes (*Patents*) .. 56, 425, 664
Cathodes, Thermionic (*Patents*) .. 544
"Centimetre" Waves, The Generation of, F. W. Chapman .. 500
Changes in Patent Procedure .. 557
Circularly-Polarized Waves (*Patents*) .. 689
Common Error (*Correspondence*) .. 274
Condenser Circuits (*Patents*) .. 243
Condensers (*Patents*) .. 362
Constant-band Tuning (*Patents*) .. 302
Constant-coupling Circuits (*Patents*) 116, 181, 481, 604
Constant-frequency Generators (*Patents*) .. 58
CORRESPONDENCE, 23, 75, 150, 213, 273, 319, 394, 573, 629, 685
Cossor Cathode Ray Oscillograph .. 387
Coupled Circuits, Some Properties of, R. C. Clinker and T. H. Kinman .. 11
Coupling and Coupling Coefficients (*Editorial*) 485
Coupling Circuits (*Patents*) .. 302, 364
Current-limiters (*Patents*) .. 425

Damping of L.F. Oscillations in a M.C. Loud Speaker, N. W. McLachlan .. 559
Daventry, Empire Station, Masts (*Illustration*) 607
Decibel and Gain Control, H. Stanesby .. 18
"Demodulation, Apparent," Another Viewpoint, E. Mallett .. 248
(*Correspondence*) .. 394, 629
Design of the Band Pass Filter, N. R. Bligh .. 61
Detection by a Straight Line Rectifier of Modulated and Heterodyne Signals, E. B. Moullin .. 378

PAGE

Detector, The, W. B. Lewis 487
Detector Problems, The Graphical Solution, G. S. C. Lucas 202, 253
(*Correspondence*) 273
Developments in the Testing of Radio Receivers (*I.E.E. Paper*), H. A. Thomas .. 269
(*Correction*) 319
Dielectrics, Liquid, Losses in, at Radio Frequencies, W. Jackson 14
Direct Reading Modulation Meter (*Correspondence*) 25, 79
Direction-Finding (*Patents*) 116, 306, 663
Direction Signalling (*Patents*) 305, 602
Distortion in Screen-grid Valves, R. O. Carter 123, 429
Distortion in Valve Characteristics (*Correspondence*) 75
Distributing Broadcast Programmes (*Patents*) 482
Disturbances, Eliminating (*Patents*) .. 305, 363
Dye, Dr. D. W. (*Obituary Notice*) 207
Dynatron Oscillator (*Correspondence*) 77, 152, 213, 446, 574

Earthing Switches (*Patents*) 364
Electro-mechanical Rectification, N. W. McLachlan 329
(*Correspondence*) 573
Electron Discharge Tubes (*Patents*) 542
Empire Broadcasting, Masts at Daventry (*Illustration*) 607
Equivalent Mass of Driven Loud Speaker Cones, M. J. O. Strutt 143
(*Correspondence*) 214
Existence of More than One Ionised Layer in Upper Atmosphere, G. Builder 667

Ferrié, General G. (*Obituary Notice*) .. 207
Field in Immediate Neighbourhood of Transmitting Aerial (*Editorial*) 119
Flash-Arc in High Power Valves (*I.E.E. Paper*), B. S. Gossling 391
Fog-signal Control (*Patents*) 306
Frame Aerials (*Patents*) 56
Frequencies of Double Circuit S.G. Valve Oscillators, N. W. McLachlan 439
Frequency Analysis of the Heterodyne Envelope, F. M. Colebrook 195
Frequency-changer, The Screen-grid Valve As, E. L. C. White 618
(*Correspondence*) 686
Frequency-modulation, Signalling by (*Patents*) 246
Frequency Modulation (*Patents*) 426
Frequency Stabilisers (*Patents*) 425

Gain Control and the Decibel, H. Stanesby 18
Ganged Condensers (*Patents*) 363
Ganged Tuning-controls (*Patents*) .. 243, 603
"Ganging" the Tuning Controls of a Superhet Receiver, A. L. M. Sowerby 70
Generation of "Centimetre" Waves, F. W. Chapman 500
Glow-Discharge Tubes (*Patents*) 115
Graphical Solution of Detector Problems, G. S. C. Lucas 202, 253
(*Correspondence*) 273
Gramophone Motors (*Patents*) 305, 482

PAGE

Gramophone Pick-ups, etc. (*Patents*) 55, 56, 117, 304, 542
Grid Bias from Anode Current, F. J. A. Pound 445
(*Correspondence*) 630
Grid-Leak Resistances (*Patents*) 661

Harmonic Analysis, A Valve Voltmeter Method, W. Greenwood 310
Heterodyne Receivers (*Patents*) 664
H.F. Couplings (*Patents*) 363
H.F. Inductances (*Patents*) 303
High Frequency Generators (*Patents*) .. 688
High Selectivity Tone-corrected Circuits (*Editorial*) 605
(*Correspondence*) 685
Home-recording (*Patents*) 56

Impedance, Aperiodic, Measuring Set, A. T. Starr 325
(*Correspondence*) 447, 573
Impedance Measurement, A Note on, A. T. Starr 615
Inductance Coils (*Patents*) 543
Influence of Valve Resistance in Oscillation Generators, N. W. McLachlan 130
(*Correspondence*) 214
INSTITUTION OF ELECTRICAL ENGINEERS (Papers Read): 20, 84, 140, 208, 269, 331, 391, 451, 513
Institute of Physics, Preservation of Instruments of Historical Importance 438
Insulation, High-frequency (*Patents*) 662
Interference Eliminators (*Patents*) .. 424, 689
Interference: Methods for Elimination, E. T. Glas 680
Inter-valve Couplings (*Patents*) 544

Leipzig 120 kw. Broadcasting Station (*Illustration*) 625
Light-sensitive Bridges (*Patents*) 365
Light-sensitive Cells (*Patents*) 363, 483
Long and Ultra-short Wave Receiver (*Patents*) 116
Losses in Liquid Dielectrics at Radio Frequencies, W. Jackson 14
Loud Speaker Coil of Optimum Mass (*Correspondence*) 214
Loud Speaker Cones, The Equivalent Mass, M. J. O. Strutt 143
(*Correspondence*) 214
Loud Speaker Diaphragms (*Patents*) .. 426, 543
Loud Speaker Diaphragms, etc., Vibrational Frequencies, N. W. McLachlan 626
Loud Speaker Filters (*Patents*) 483
Loud Speaker, M.C., Damping of L.F. Oscillations, N. W. McLachlan 559
Loud Speaker Movements (*Patents*) 243
Loud Speakers (*Patents*) 55, 118, 245, 246, 304, 424, 426, 481, 603

Magnetron Generators (*Patents*) 180
Magnetic Direction-finder (*Patents*) .. 423
Mains-driven Sets (*Patents*) 243, 305
Mains Hum Eliminators (*Patents*) 364, 425, 482, 602
Mains Units (*Patents*) 542
Matching Inductances (*Patents*) 115

PAGE
Methods of Investigating the Vibrational Frequencies of Conical Shells and Loud Speaker Diaphragms, N. W. McLachlan 626
Microphones (*Patents*) 543
Modulated and Heterodyne Signals, Detection by Straight Line Rectifier, E. B. Moullin 378
Modulating Systems (*Patents*) 182, 304, 602, 604
Modulating by Light (*Patents*) 602
Modulation, A New Method (*Editorial*) .. 367
Modulation Level of a Broadcast System, Recording, H. I. Kirke 369
Month in the Air (Marconi Set on Mrs. V. Bruce's Aeroplane) (*Illustration*) 428
Mounting Piezo-Crystals (*Patents*) 366
Moving-Coil Loud Speakers of Midget Design (*Correspondence*) 75, 151
Moving-coil Magnets, C. E. Webb 67
Multi-Channel Television (*I.E.E. Paper*), C. O. Browne 84
Multiples and Sub-Multiples of Ten (Symbols) 252
Mutual Interference of Wireless Signals in Simultaneous Detection, E. V. Appleton and D. Boohariwalla 136
  (*Correspondence*) 214, 394

Navigational Systems, Wireless (*Patents*) 424, 604
Negative Resistances (*Patents*) 423
New Method of Modulation (*Editorial*) .. 367
New Type of Directive Aerial, T. Walmsley .. 622
New Valve Characteristic, P. K. Turner .. 384
New Valve Diagram (*Editorial*) 665

Obituary Notices :
  Dr. D. W. Dyer 207
  General G. Ferrié 207
Olympia, 1932, Impressions 564
Overcoming " Skip Distance " Effect (Zeesen Short-wave Aerial) 194

Patent Procedure, Changes in 557
PATENTS 55, 115, 180, 243, 302, 362, 423, 481, 542, 602, 661
Pentode Amplifiers (*Patents*) 364
Pentode with Capacitative Coupling, L. G. A. Sims 673
Percentage Harmonic Distortion (*Correspondence*) 23, 76
Phase Modulation (*Patents*) 58
Photo Electric Amplifiers (*Patents*) 364
Photo-electric Cells (*Patents*) 115, 116
Photo-electric Circuits (*Patents*) 57
Physical Society's Exhibition (Apparatus Described) 80
Pick-up Volume Control (*Patents*) 302
Picture Transmission (*Patents*) 302
Piezo-electric Crystals (*Patents*) 303
Pocket Receivers (*Patents*) 544
Power Rectifiers (*Correspondence*) 24
Pre-Selected Tuning (*Patents*) 56
Present Knowledge of the Upper Atmosphere (*I.E.E. Paper*), E. V. Appleton 513
Preservation of Instruments of Historical Importance (Institute of Physics) .. 438
Properties of Coupled Circuits, R. C. Clinker and T. H. Kinman 11
Pulham, Aircraft D.F. Station (*Illustration*) .. 122
Push-pull Amplifiers (*Patents*) 57

PAGE
Quartz Resonators and Oscillators (*Correspondence*) 24

Radio Beacons (*Patents*) 303
Radio Research Board, The Work of (*Editorial*) 1
Reaction Control (*Patents*) 481
Receiver for Frequency-modulated Signals (*Patents*) 55
Receiver for Long and Ultra-short Waves (*Patents*) 116
Receiving Systems (*Patents*) 544
Recording of Modulation Level of a Broadcast System, H. L. Kirke 369
Rectification, Electro-mechanical, N. W. McLachlan 329
  (*Correspondence*) 573
Rectifier Units (*Patents*) 362
Rectifier Valves (*Patents*) 243
Rectifiers, Dry-contact (*Patents*) 181
Reflection Methods of Measuring the Depth of the Sea (*I.E.E. Paper*), Commr. J. H. Slee 20
Relaying Programmes (*Patents*) 424
Remote Tuning Control (*Patents*) 688
Reproduction, Wireless or Gramophone (*Patents*) 182
Resistance-coupled Amplifiers (*Patents*) .. 306
Resistance in Band Pass Filters, G. H. Buffery 504
Resonant Circuits, Chain of, Analysis and Design, M. Reed 259, 320
Royal Soc. Demonstration of Cathode Ray Oscillograph 449

Scanning for Television (*Patents*) 689
Scientific and Technical Abstracts (Association of Special Libraries, etc.) .. 19
Screen Grid Amplifiers (*Patents*) 118
Screen-grid Valves as Frequency-changer in the Superhet, E. L. C. White 618
  (*Correspondence*) 686
Screen-grid Valve Oscillators, Double Circuit, Frequencies, N. W. McLachlan 439
Secret Telephony Systems (*Patents*) 366
Selective Reception (*Patents*) 118, 180, 366, 482
Selectivity, Controlling (*Patents*) .. 182, 244
Selectivity of Broadcast Receivers (*Editorial*) 183
  (*I.E.E. Discussion*) 208
  (*Correspondence*) 274, 631
Self-contained Sets (*Patents*) 664
Short-wave Oscillators (*Patents*) 115, 180, 363, 688
Signalling Systems (*Patents*) .. 180, 246, 481, 542
Simplifying the Use of the Starr Impedance Measuring Set, J. Steffensen 512
Smoothing Circuits (*Patents*) 245
Sound Reporting Service (Norag) 201
Spreading of Electromagnetic Waves from a Hertzian Dipole (*I.E.E. Paper*), J. A. Ratcliffe, L. G. Veedy, G. F. Wilkins .. 140
Stabilising Frequency (*Patents*) .. 423, 603
Starr Impedance Measuring Set, Simplified, J. Steffensen 512
Station-Indicator Dials (*Patents*) 661
Stenode (*Correspondence*) .. 24, 78, 150
Straight Sets *versus* Superheterodynes (*Editorial*) 427

PAGE
Studies in Radio Transmission, T. L. Eckersley (*I.E.E. Paper*) .. 331
Sullivan Measuring Instruments .. 563
Superheterodyne Receivers (*Patents*) 244, 246, 543, 687
Switches (*Patents*) .. 602
Synchronising Systems (*Patents*) .. 58

Television in Colour (*Patents*) .. 304
Television, Multichannel (*I.E.E. Paper*), C. O. Browne .. 84
Television Receivers (*Patents*) .. 55
Television Systems (*Patents*) 56, 117, 303, 484, 663, 687, 688
Testing Radio Receivers, Developments (*I.E.E. Paper*), H. A. Thomas .. 269
Tests on Five Ultra-short Wave Receivers, R. L. Smith-Rose and H. A. Thomas .. 186
Theory of Band-pass Filters for Radio Receivers, C. W. Oatley .. 608
Theory of Distortion in Screen-grid Valves, R. O. Carter .. 429
Tone-control Circuits for Amplifiers, M. G. Scroggie .. 3
(*Correspondence*) .. 153
Trains, Reception in (*Patents*) .. 662
Transients and Telephony (*Correspondence*) .. 23
Transformers, H.F. (*Patents*) .. 245
Transmission, Studies in Radio, T. L. Eckersley (*I.E.E. Paper*) .. 321
Transmitting Aerials (*Patents*) .. 58, 180
Tuning Adjustments (*Patents*) .. 243, 602
Tuning Dials (*Patents*) .. 363
Tuning Systems (*Patents*) .. 483
Two-circuit Tuner (*Editorial*) .. 545
Two-element Band-pass Filters, R. T. Beatty 546

PAGE
Ultra-short Wave Receivers, Tests on, R. L. Smith-Rose and H. A. Thomas .. 186
Ultra-Short Waves, Generating (*Patents*) .. 689
Upper Atmosphere: Existence of More than One Ionised Layer, G. Builder .. 667
Upper Atmosphere, Present Knowledge of (*I.E.E. Paper*), E. V. Appleton .. 513

Valve Amplifiers (*Patents*) .. 246, 362, 364
Valve Cathodes (*Patents*) .. 244
Valve Characteristic, A new, P. K. Turner .. 384
Valve Construction (*Patents*) .. 481
Valve Diagram, New (*Editorial*) .. 665
Valve Generators (*Patents*) .. 115
Valve Resistance in Oscillation Generators, N. W. McLachlan .. 130
(*Correspondence*) .. 214, 319
Valve Voltmeter Method of Harmonic Analysis, W. Greenwood .. 310
Valves, A.C. (*Patents*) .. 57
Valves, External Grid (*Patents*) .. 542, 543
Valves, Indirectly Heated (*Patents*) 181, 306, 663
Valves, S-G., Distortion in, R. O. Carter .. 123
Valves, 3-grid (*Patents*) .. 306
Variable Condensers (*Patents*) .. 182
Variable-selectivity Control (*Patents*) .. 663
Variation of Resist. and Cap. of Valves (*Correspondence*) .. 24, 79, 151
Volume and Selectivity Control (*Patents*) .. 687

"Wireless Engineer" Binding Cases and Complete Volumes .. 2
Work of the Radio Research Board (*Editorial*) 1

Zeesen Short-wave Aerial .. 194

II. INDEX TO AUTHORS.

Appleton, E. V. (*I.E.E. Paper*) .. 513
Appleton, E. V. and Boohariwalla, D. .. 136
Baggally, W. .. 388
Beatty, R. T. .. 546
Bligh, N. R. .. 61
Boohariwalla, D. and Appleton, E. V. .. 136
Browne, C. O. (*I.E.E. Paper*) .. 84
Buffery, G. H. .. 505
Builder, G. .. 667
Carter, R. O. .. 123, 429
Chapman, F. W. .. 500
Clinker, R. C. and Kinman, T. H. .. 11
Colebrook, F. M. .. 195
Eckersley, T. L. (*I.E.E. Paper*) .. 331
Glas, E. T. .. 680
Gossling, B. C. (*I.E.E. Paper*) .. 391
Greenwood, W. .. 310
Harbottle, H. R. (*I.E.E. Paper*) .. 451
Jackson, W. .. 14
Kirke, H. L. .. 369
Kinman, T. H. and Clinker, R. C. .. 11
Lewis, W. B. .. 487
Lucas, G. S. C. .. 202, 253
McLachlan, N. W. 130, 329, 439, 559, 626
Mallett, E. .. 248
Moullin, E. B. .. 378
Oatley, C. W. .. 608
Pound, F. J. A. .. 445
Ratcliffe, J. A., Vedy, L. G., and Wilkins, A. F. (*I.E.E. Paper*) .. 140
Reed, M. .. 259, 320
Scroggie, M. G. .. 3
Sims, L. G. A. .. 314, 673
Slee, Commr. J. A. (*I.E.E. Paper*) .. 20
Smith-Rose, R. I. and Thomas, H. A. .. 186
Sowerby, A. L. M. .. 70
Stanesby, H. .. 18
Starr, A. T. .. 325, 615
Steffensen, J. .. 512
Strutt, M. J. O. .. 143
Thomas, H. A. (*I.E.E. Paper*) .. 269
Thomas, H. A. and Smith-Rose, R. I. .. 186
Turner, P. K. .. 384
Walmsley, T. .. 622
Webb, C. E. .. 67
White, E. L. C. .. 618

III. ABSTRACTS AND REFERENCES.

PROPAGATION OF WAVES.

The **Absorption** of Short [and Ultra-Short] Waves in Buildings.—F. Ollendorff, **p. 453.**
Experimental Researches on the Propagation of **Air Waves** in a Long Cylindrical Tube.—Th. Vautier, **p. 218.**
Estimation of Heights Reached by **Air-Waves** which Descend in Zones of Abnormal Audibility.—F. J. W. Whipple : Gutenberg, **p. 277.**
Characteristics of Electromagnetic Radiation from **Aircraft** in Flight.—J. C. Coe and T. C. Rives, **p. 575.**
Wavelengths for **Aircraft Communication.**—Carr, **p. 299.**
The Action of the **Appleton Layer** in the Propagation of Waves of 30 kc/sec. Frequency.—Bureau, **p. 517.**
The **Attenuation of Medium and "Intermediate" Waves** [150, 215 and 700 Metres] by Day over Sea.—J. Bion and P. David, **p. 454.**
The **Attenuation of Short Wireless Waves** at the Surface of the Earth.—G. H. Munro, **p. 514.**
Comparison of Formulae for **Attenuation of Travelling Waves.**—L. V. Bewley, **p. 31.**
Aurora Borealis and the Heaviside Layer.—E. Brüche, **p. 516.**
Australian Radio Research Board Work on the Propagation of Waves.—Australian Radio Research Board, **p. 154.**
Note on Reception of Radio **Broadcast Stations** at Distances exceeding 12 000 Kilometres [Byrd Antarctic Expedition].—L. V. Berkner, **p. 632** : see also Long Paths.
Long Distance Receiving Measurements of **Broadcast Waves** across the Pacific [Seasonal Variation, Dependence on Solar Conditions, etc.].—S. Namba and D. Hiraga. **p. 516.**
Propagation of the **Broadcasting Waves** [345–441 Metres] in Japan.—Y. Takata and Y. Itow, **p. 156.**
The Production of **Circularly Polarised** Electric Waves by a Single Total Reflection.—L. Bergmann, **p. 633.**
The Propagation of Waves in **Cities** [Mathematical Investigation, on Optical Lines, of the Effect of Broadcast Receiving Aerials].—F. Ollendorff, **p. 397.**
Contribution to the Theory of Interference Zones in **Common-Wave Transmission.**—W. Hübner, **p. 517.**
Conductivity of the Ground for an 8.65 Metre Wave.—Palmer, **p. 514.**
Short Wave Reception and [**Cosmic**] Ultra-Radiation.—W. M. H. Schulze, **p. 88.**
The Action of **Cylinders** in an Electromagnetic Wave Field.—Kikuchi, **p. 462.**
Radio Tests on Various Wavelengths on the Lower **Danube** (Bratislaw-Ruse, Bulgaria).—V. Fritsch, **p. 30.**
A **Delay Recording Equipment** using a Steel Band Telegraphone.—Decker, **p. 158.**
The **Diffraction** of Elastic Waves at the Boundaries of a Solid Layer.—J. H. Jones, **p. 576.**
The Spreading of Electromagnetic Waves from a Hertzian **Dipole.**—Ratcliffe, Vedy and Wilkins, **p. 408.**
Dirac's Wave Equation of the Electron and Geometrical Optics.—W. Pauli, **p. 517.**
The H.F. **Discharge** [Study of the Effect of the Distance between the Electrodes].—C. Gutton and G. Beauvais, **p. 217.**
Measurement of Current in Electrodeless **Discharges** by Means of Frequency Variations.—J. Tykocinski-Tykociner, **p. 400.**
Theory of Electromagnetic and Electrostatic Induction in Electrodeless **Discharges.**—J. Kunz, **p. 400.**
Experimental Researches on the **Dispersion in Polar Liquids,** for the case of Radio Waves from 5 to 600 Centimetres.—P. Girard and P. Abadie, **p. 576.**
Lorentz **Double Refraction in Cubic Crystals.**—F. Seitz, **p. 576.**
Investigation of the Effect of Mechanical and Electrical Fields of Force on the **Double Refraction of Quartz.**—N. Günther, **p. 517.**
The Influence of the Properties of the **Earth** on the Propagation of Electromagnetic Waves [Comprehensive Survey].—M. J. O. Strutt, **p. 454.**
Preliminary Study of the Acceleration of **Earthquake Shocks.**—M. Ishimoto, **p. 158.**
Echo of High-Frequency Radio Waves [Echo peculiar to Waves passing through Polar Region or Aurora Zone].—S. Namba, **p. 516.**
Echo Measurements in Wireless Telegraphy.—G. Goubau, **p. 87.**
Equipment for **Echo Measurements** on the Ionosphere [with Rapid Choice of Six Wavelengths : Cathode-Ray Observation with Circular Time Base].—G. Goubau and J. Zenneck, **p. 632.**
Echo Signals in Japan.—T. Minohara, T. Inoue, and S. Ono, **p. 28.**
Echo Signals in Transatlantic Picture Telegraphy [and Results in S-N Direction, Cape Town to Somerton].—H. M. Dowsett, **pp. 216** and **454.**
Further Communications on Near **Echoes** [Delay Times of the Order of 0.01–0.02 Sec.].—H. Mögel, **p. 515.**
Wireless **Echoes of Short Delay.**—E. V. Appleton and G. Builder, **p. 155.**
Electron Shadows in " Double **Eclipse** " of August 31st, **p. 632.**
The Wireless **Eclipse** : Corpuscular Ionisation " Not Proven " ? **p. 632.**
Eclipse Effects on Radio [in America], **p. 632.**
Suggested Wireless Observations during the Solar **Eclipse** of August 31, 1932.—E. V. Appleton and S. Chapman, **p. 396.**
Influence of Solar **Eclipse** upon Upper Atmospheric Ionisation.—S. Chapman, **p. 632.**
Short Waves and the Solar **Eclipse** [Observations on Wavelengths between 16 and 25 Metres], **p. 632.**
Radio during Solar **Eclipses** [1929 Poulo Condore Results].—A. E. Kennelly, **p. 632.**
Eclipses.—See also Lunar, and under " Atmospherics and Atmospheric Electricity."
Electromagnetic Waves and Pulses.—W. E. Sumpner, **p. 400.**
Propagation of Hertzian Waves in **Electronic Gas** under the Influence of a Magnetic Field.—G. Todesco, **p. 216.**
Experimental Confirmation of the Selective Absorption of Hertzian Waves produced by an **Electronic Gas** in a Magnetic Field.—G. Todesco, **p. 633** : see also Ionised.
Collisional Friction on **Electrons Moving in Gases.**—E. C. Childs, **p. 398.**
Dispersion of **Explosion Waves** in the Atmosphere.—P. Duckert, **p. 400.**
Investigations into Polarisation **Fading.**—K. Krüger and H. Plendl, **p. 156.**
On the Connection between Short Wave **Fading** and Disturbances of the Earth's Magnetic Field.—H. Mögel, **p. 276.**
A New Method of Eliminating **Fading** ?—Günther : Bureau of Standards, **p. 277.**
Selective **Fading** and Ionosphere Height Measurements.—H. Plendl, **p. 575.**
Fading and Night Distortion [Absence of Midnight Fading in Spring and Autumn : Fading Periods occurring in Cycles : etc.], **p. 632.**
Measurements in the Near **Field** of a Broadcasting Station [and the Effects of Houses, Aerials, etc.].—Zickendraht, **p. 239.**
Remarks on the Papers " On the Theory of Propagation of Electromagnetic Waves over the **Earth's Surface** " and " On the **Field Radiated from a Finite Antenna** between Two Perfectly Conducting Planes."—R. Weyrich, **p. 28.**
Measurements in the **Field Radiated by a Vertical Antenna,** Excited in its Fundamental Oscillation, between Two Perfectly Conducting Planes.—L. Bergmann and W. Doerfel, **p. 453.**
Field-Intensity Measurements at Frequencies from 285 to 5 400 Kilocycles per Second [at Distances from a Few Wavelengths to 400 Kilometres : Determination of Electrical Constants of the Ground].—S. S. Kirby and K. A. Norton, **p. 515.**
Application of the Hill Differential Equation to the Wave Propagation in Electrical or Acoustic **Filter Networks.**—F. Noether, **p. 335.**
Investigation of the **Front Deformation** of an Electromagnetic Wave.—I. S. Stekolnikov, **p. 277.**
Automatic Recording of **Heaviside Layer** Heights.—E. L. C. White, **p. 400.**
Automatic Recorder for Height of Kennelly-**Heaviside Layer.**—Note from U.S. Bureau of Standards, **p. 156.**
Preliminary Note on an Automatic Recorder giving a Continuous Height Record of the Kennelly-**Heaviside Layer.**—T. R. Gilliland and G. W. Kenrick, **pp. 87** and **334.**
Investigations of Kennelly-**Heaviside Layer** Heights for Frequencies between 1 600 and 8 650 Kilocycles per Second [The Existence of the E and F Regions, and the Part Played by Reflection].—T. R. Gilliland, G. W. Kenrick, and K. A. Norton, **pp. 216** and **334.**
New Devices for Recording Kennelly-**Heaviside Layer** Reflections. H. R. Mimno and P. H. Wang, **p. 632.**
Kennelly-**Heaviside Layer** Studies employing a Rapid Method [Visual Observations of Pulse Patterns on Cathode-Ray Oscillograph] of Virtual-Height Determination.—J. P. Schafer and W. M. Goodall, **p. 575.**
On an Estimation of the Height of the **Heaviside Layer** in Bengal.—H. Rakshit, **p. 29.**
Measurements of the Height of the Kennelly-**Heaviside Layer** in Japan [using Wavelengths of the order of 100 Metres].—T. Minohara and Y. Ito, **p. 515.**
The Kennelly-**Heaviside Layer** [The Original Publications], **p. 157.**
An Effective Apparatus for Measurements on the **Heaviside Layers.**—H. Rukop and P. Wolf, **p. 275.**
Observations on the Stratification of the **Heaviside Region.** New Experimental Equipment.—I. Ranzi, **p. 155.**
Propagation of Wireless Waves [Form and Origin of Multiple Layers in **Heaviside Region**].—H. Nagaoka, **p. 155.**
Past and Future Work on Wave Propagation.—**Heinrich Hertz Association, p. 277.**
Dielectric Constant, Resistance and Phase Angle of **Ice.**—H. Wintsch, **p. 517.**
An Observation on **Interference** Phenomena.—J. M. Faber, **p. 157.**
The Effects on D.F., Fading, etc., of " Electro-**Invasions** " of the Atmosphere : The Connection with Aurora.—Düll, **p. 632.**
The **Ionisation** of the Atmosphere and the Propagation over the Earth of Short Electric Waves, 10–100 metres.—K. Försterling and H. Lassen, **pp. 87** and **217.**

Tables of the **Ionisation** in the Upper Atmosphere.—E. O. Hulbert, **p. 335.**
Some Measurements of Upper-Atmospheric **Ionisation.**—E. V. Appleton and R. Naismith, **p. 575.**
Apparent Increase of Lower Layer **Ionisation** during the Night.—Schafer and Goodall, **p. 575.**
The Collisional Friction Experienced by Vibrating Electrons in **Ionised Air.**—E. V. Appleton and F. W. Chapman, **p. 398.**
The Propagation of Radio Waves in an **Ionised Atmosphere.**—D. Burnett, **p. 27.**
The Adsorption of Ions by Conducting Spherical Particles in an **Ionised Field.**—M. Pauthenier and Mme. Moreau-Hanot, **p. 88.**
Study of the Motion of a Heavy Sphere in an **Ionised Electric Field.**—M. Pauthenier and M. Moreau-Hanot, **p. 217.**
Experimental Control of the Motion of Small Metallic Spheres in an **Ionised Electrical Field.**—M. Pauthenier and M. Moreau-Harot, **p. 217.**
Direct Electrometric Study of the Limiting Charge of a Conducting Sphere in an **Ionised Electric Field.**—M. Pauthenier and R. Guillien, **p. 575.**
The Charge of Small Dielectric Spheres in an **Ionised Electrical Field.**—M. Pauthenier and M. Moreau-Hanot and R. Guillien, **p. 575.**
Ionised Gases in a Magnetic Field: Proof of the Existence of the Rotating Electron.—Th. V. Jonescu and C. Mihul, **p. 157.**
The Dielectric Constant and Conductivity of **Ionised Gases.**—Th. V. Jonescu and C. Mihul, **p. 335.**
The Free Electrons of **Ionised Gases** in a Magnetic Field.—Th. V. Jonescu and C. Mihul, **p. 399.**
On the Behaviour of Electric Waves when Passing Through **Ionised Gases.**—W. Hasselbeck, **p. 399.**
On the Properties of **Ionised Gases** at High Frequencies.—A. Rostagni, **p. 453.**
On the Absorption of Short Electric Waves in **Ionised Gases,** an Attempt at the Demonstration of Long-Wave Transitions in the Spectrum of the Hydrogen Atom.—H. Klumb, **p. 517.**
Experimental **Researches** on the Propagation of an Electromagnetic Wave in a Magnetically Active **Ionised Medium.**—G. Todesco, **p. 454.:** see also Electronic.
The Absorption and Dissociative or **Ionising Effect** of Monochromatic Radiation in an Atmosphere on a Rotating Earth. Part II. Grazing Incidence.—S. Chapman, **p. 27.**
The Recombination of **Ions** in Air at Low Pressures.—Lenz, **p. 519.**
Japanese Papers in These and Recent Abstracts, **p. 155.**
Kennelly-Heaviside Layer.—See Heaviside Layer.
On the Propagation of **Light** in Inhomogeneous Media.—K. Försterling, **p. 217.**
Velocity of Propagation of **Light** in Vacuo in a Transverse Magnetic Field.—C. C. Farr and C. J. Banwell, **p. 576.**
Velocity of **Light** Constant, Not Decreasing with Time.—O. C. Wilson: Gheury de Bray, **p. 576.**
Remarks on the Reflection and Transmission of **Light** by Dissymmetric Media.—R. de Mallemann, **p. 576.**
On the Scattering of **Light** by Supersonic Waves.—P. Debye and F. W. Sears, **p. 576.**
Transference Curves for the Geographical Representation of **Light and Dark Areas,** at any Date and Time, at the Earth's Surface and at the Ionised Layer.—J. Williamson, **p. 334.**
Comparison between a **Line with Distributed Constants** and a T Circuit.—A. Blondel, **p. 88.**
Measurements of the Propagation Constants of an Overhead **Line with Earth Return,** as Functions of the Frequency.—J. Fallou: Carson: Pollaczek, **p. 30.**
New Graphical Solutions of the Calculation of H.T. Transmission **Lines.**—A. Blondel, **p. 88.**
Radio Transmission over **Long Paths.**—Note from the U.S. Bureau of Standards, **p. 276.**
Some Studies of Radio Transmission over **Long Paths** Made on the Byrd Antarctic Expedition.—L. V. Berkner, **p. 334:** see also Broadcast.
Long-Wave Radio Receiving [Field Strength] Measurements at the Bureau of Standards in 1930.—L. W. Austin, **p. 28.**
Twenty-four-hour Receiving Measurements of Low-frequency [**Long-Wave**] Radio Stations Nauen and Warsaw.—E. Yokoyama and I. Tanimura, **p. 156.**
Tables of North Atlantic Radio Transmission Conditions for **Long-Wave** [15–23 kc] Daylight Signals for the Years 1922–1930.—L. W. Austin, **p. 398.**
Correlation between **Long-Wave** Radio Signal Strength and the Passage of Storms.—S. J. Briggs: Bureau of Standards, **p. 455.**
Theory of the Propagation of Low-Frequency [**Long**] Electromagnetic **Waves** [Change from Metallic to Dielectric Reflection, etc.].—E. Yokoyama and S. Namba, **p. 454.**
The Propagation of **Longitudinal and Transverse Waves** in Isotropic Elastic Non-homogeneous Media [Mathematical Study].—G. Lampariello, **p. 158.**
Velocity of Explosion-generated **Longitudinal Waves** in a Nepheline System.—L. D. Leet and M. Ewing, **p. 158.**
Formation of **Love Waves** in a Two-Layer Crust.—H. Jeffreys, **p. 158.**
Investigations at the Perkins Observatory of Changes in the Kennelly-Heaviside Layers as a Function of **Lunar Altitudes.**—H. T. Stetson [and G. W. Pickard], **p. 156.**
Notes on Correlation Investigations between Kennelly-Heaviside Layer and **Lunar Altitudes.**—G. W. Pickard, **p. 156.**
Measurements of the Photochemical Energy of the Moon obtained during the **Lunar Eclipse** of 27th Sept., 1931.—G. Blum, **p. 30.**
Some Observations of the **Behaviour** of Earth Currents and Their Correlation with **Magnetic Disturbances and Radio Transmission.**—Bemis, **p. 88.**
Recent Developments in Radio-Transmission **Measurements.**—G. W. Kenrick and G. W. Pickard, **p. 157.**
Effect of **Meteors** on the Heaviside Layer.—A. M. Skellett, **p. 156.**
Effect of **Meteors** on Radio Transmission.—H. Nagaoka, **p. 516.**
The **Optics** of Radio Transmission.—E. Merritt, **p. 158.**
The Variations of the **Ozone** Content of the Atmosphere.—P. Harteck, **p. 27.**
Ozone Content of the Atmosphere.—R. Mecke, **p. 157.**
On the Cause of the Close Correlation between Atmospheric **Ozone** Content and Meteorological Conditions.—H. Petersen, **p. 335.**
On the Distribution of **Ozone** in the Earth's Atmosphere.—D. Chalonge, **p. 335.**
The Shortest Wavelength in Sunlight [and the Measurement by It of the Amount of **Ozone**].—F. W. P. Götz, **p. 157.**
The Investigation of the Vertical Distribution of **Ozone** in the Atmosphere.—F. W. P. Götz, **p. 633.**
A Theory of the **Ozone** of the Lower Atmosphere and Its Relation to the General Problem of Atmospheric Ozone.—O. R. Wulf, **p. 633.**
The Ultraviolet Absorption Spectrum of **Ozone.**—A. Jakowleva and V. Kondratjew, **p. 276.**
The Mechanism of the Formation of **Ozone** from Oxygen under the Influence of Electron Discharge: of Nitrogen Oxides from a Nitrogen-Oxygen Mixture.—L. A. M. Henry, **p. 157.**
The Photochemical **Ozone** Equilibrium in the Atmosphere.—Mecke: Faraday Society, **p. 335.**
On the **Penetration of Daylight** into the Sea [Observations to Depths of over 1 400 Feet, and Their Interpretation].—E. O. Hulbert: Beebe, **p. 517.**
The Possibility of a **Periodic Electrical Disturbance,** possessing an Axial Symmetry, passing along a Cylinder without Dissipating Itself Laterally.—R. Ferrier, **p. 158.**
Radio Transmission Problems Treated by **Phase Integral Methods.**—T. L. Eckersley, **p. 514.**
Phenomena Accompanying Radio Transmission.—G. Marconi, **p. 27.**
The **Piccard-Kipfer Ascent.**—A. Piccard, **p. 157.**
Prof. **Piccard's Exploration Ascent** into the Stratosphere.—A. Piccard, P. Kipfer and others, **p. 157:** see also Stratosphere.
The Intermediate Free Path Case in the Theory of a **Plasma.**—Tonks, **pp. 600-601.**
Plasma-Electron Resonance, Plasma Resonance and Plasma Shape.—L. Tonks, **p. 88.**
Wireless Communication in the **Polar Regions** [and the Causes of its Difficulties.—K. Krüger, **p. 334.**
The **Polar Year** Radio Research Board Expedition to Northern Norway, **p. 575.**
Polarisation of Down-coming Wireless Waves in the Southern Hemisphere.—E. V. Appleton, **p. 154.**
Polarisation of Down-coming Wireless Waves.—J. A. Ratcliffe and F. W. G. White, **p. 276.**
Polarisation Phonemena of Low-Frequency Waves.—S. Namba, **p. 87.**
Polarisation of High-Frequency Waves and Their Direction Finding.—Namba, Iso and Ueno, **p. 87.**
Measurement of the **Ponderomotive Force** Exerted on Resonators in the Electromagnetic Field.—K. Fritz, **p. 218.**
Remarks on the Papers " On the Theory of **Propagation of Electromagnetic Waves over the Earth's Surface** " and " On the Field Radiated . . . ".—R. Weyrich, **p. 28.**
Communication with **Quasi Optical Waves.**—Karplus, **p. 34.**
Radiation from Antennae under the Influence of the Earth. D.—Radiation Measurements with Antennae.—M. J. O. Strutt, **p. 27.**
A **Radiometer** Sensitive to Hertzian Waves [and Useful in Exploring Electromagnetic Fields].—Beauvais, **pp. 474-475.**
Charts of Distance **Range** of Radio **Waves**: **Day and** Night Frequency Characteristics.—U.S. Bureau of Standards, **p. 454.**
Distance **Ranges** of Radio Waves.—Notes from the U.S. Bureau of Standards, **p. 276.**
Distance **Ranges** of Radio Waves from 10 Kilocycles to 30 Megacycles/Sec.].—J. H. Dellinger, **p. 398.**
Reflection Measurements on Radio Waves.—G. J. Elias and C. G. A. von Lindern, **p. 396.**
Precision Measurements of **Refraction Coefficients** [of Water] by Drude's Second Method.—G. Mie and E. Frankenberger, **p. 157.**
On the Reflection at the Surface of the Ground of a Spherical and Isotropic **Seismic Wave.**—L. Cagniard, **p. 400.**
The Determination of Thicknesses of the Continental Layers from the Travel Times of **Seismic Waves.**—A. W. Lee, **p. 576.**
Contour Diagrams of Field Strengths in **Ship-Shore Telephony.**—Anderson and Lattimer, **p. 335.**
Effect of **Shore Station Location** upon Signals.—R. A. Heising, **p. 156.**
Diurnal Variation of Predominating Directions for **Short-Wave**

(40-Metre) Signals received in Schenectady.—E. H. Kanzelmyer, p. 576.
Discussion on "Some Experiences with **Short-Wave** Wireless Telegraphy."—N. H. Edes: J. C. Coe, p. 398.
Scattered Radiation from **Short-Wave** Beams.—G.W.O.H.: Mögel, p. 29.
Some Effects of Topography and Ground on **Short-Wave** Reception.—Potter and Friis, p. 344.
Studies in Radio Transmission [**Short Waves**: based on Facsimile Telegraphy and Received Signal Strength Measurements on Long-Distance Channels].—T. L. Eckersley, pp. 454 and 632.
On the Propagation of the **Short Waves.**—Anazawa, Asukai, Hattori, Hayasi, Minohara, Nakagami, Tanaka, Tani and Yokoyama, p. 28.
Solar Activity and Radiotelegraphy.—L. W. Austin, p. 276.
Concerning the Influence of the Eleven-Year **Solar Activity** Period upon the Propagation of Waves in Wireless Telegraphy.—H. Plendl, p. 334.
Short-wave Reception and **Solar Activity** [Increased Wavelength of Optimum Waves near Sunspot Minimum].—H. Mögel: Plendl, p. 515.
The Influence of the Eleven-Year **Solar Activity Period** on the Propagation of [Short and Medium] Waves in Wireless Telegraphy.—H. Plendl, p. 29.
Solar and Radio Periodicities.—C. G. Abbot: Austin, p. 516.
Velocity of **Sound** in the Stratosphere.—B. Gutenberg: Whipple, p. 575.
Contributions on the Subject of **Sound Propagation,** particularly Bending and Anomalous Propagation.—B. Sandmann, p. 335.
Sound Rays as Extremals [Calculation of Propagation through Atmospheric Layers of Different Qualities, particularly of Different Wind Velocities].—H. Bateman, p. 455.
Influence of Atmospheric Conditions upon the Audibility of **Sound Signals.**—B. R. Hubbard, p. 277.
On the **Space Waves** from a Vertical Doublet on a Plane Earth.—B. van der Pol and K. F. Niessen, p. 87.
Demonstration of **Standing Electric Waves** Using a Simple Receiver.—R. Ramshorn, p. 517.
Formation of **Standing Waves** on Lecher Wires.—Mohammed and Kantebet, p. 175.
The **Stratosphere** and the Uppermost Atmospheric Layers.—Ch. Maurain: Piccard, p. 88: see also Piccard.
Composition and Temperature of the **Stratosphere.**—B. Gutenberg, p. 276.
The "Middle Air" and the **Stratosphere.**—R. Soreau, p. 575.
On the Displacement of Water, and the Nature of the Waves recorded, in **Submarine Explosions.**—J. Ottenheimer, p. 576.
Contribution to the Study of the Propagation of Electromagnetic Fields in **Subterranean Caves and Tunnels** [Short Wave Tests, and the Reception of Broadcasting Signals].—V. Fritsch, p. 397.
New Optical Properties of Solids and Liquids submitted to the Action of **Supersonic Waves.**—P. Biquard and R. Lucas, p. 576.
Surges in Continuously Variable Cables.—A. Gemant, p. 218.
On the Distribution of the Energy Stream in **Total Reflection.**—F. Noether, p. 217.
On the Energy Flowing in the Second Medium in **Total Reflexion.**—A. Rostagni, p. 400.
The **Transmission** of **Telegraphic Signals.**—Bartelink and Bast, p. 88.
The Non-Uniform **Transmission Line.**—A. T. Starr, p. 576.
On the **Transparency** of the Lower Atmosphere.—Buisson, Jausseran and Rouard, p. 400.
Transparency of the Pure Atmosphere: On the Transparency of the Air.—J. Duclaux and M. Hugon: P. Chofardet, p. 455.
Effect of Radiation on the Equilibrium of the Higher Layers of the **Troposphere,** and the Nature of the Transition from Troposphere to Stratosphere.—K. R. Ramanathan, p. 575.
A Possible Connection between the **Troposphere** and the Kennelly-Heaviside Layer.—I. Ranzi, p. 632.
Gas Discharges at **Ultra-High Frequencies.**—L. Rohde, p. 399.
Transmission Experiments with [**Ultra-Short**] 1.3 Metre Waves.—Pfetscher and Beck, p. 341.
The Attenuation of **Ultra-Short** Radio Waves due to the Resistance of the Earth: and An Experimental Direction Finder for Use on Ultra-Short Waves.—R. L. Smith-Rose and J. S. McPetrie, p. 29.
The Propagation along the Earth of [**Ultra-Short**] Radio Waves on a Wavelength of 1.6 Metres.—R. L. Smith-Rose and J. S. McPetrie, p. 514.
The Problem of **Ultra-Short-Wave** Broadcasting.—F. Schröter, p. 30.
Effect of Iron Ore Deposits on **Ultra-Short-Wave** Communication.—Spangenberg, p. 576.
Ultra-Short-Wave Ship and Shore Communication.—Uda, pp. 298-299.
Communication Tests for Radio Telephony by means of **Ultra-Short** [4.6 and 5.8 Metre] **Waves** between Niigata and Sado.—Uda, p. 360.
Field Strength Measurements on **Ultra-Short Waves** [and the Polarisation and Attenuation of Such Waves].—K. Sohnemann, p. 30.
The Propagation of **Ultra-Short Waves** in a Large City.—G. Leithäuser, p. 276.
Broadcasting with **Ultra-Short Waves.**—G.W.O.H., p. 218.
Some Recent Progress in the Field of **Ultra-Short Waves.**—J. Marique, p. 396.
Ultra-Short Waves, Papers dealing with.—Marconi, Karplus, pp. 27, 34.
Radio Communication over 170 Miles with **Ultra-Short Waves** [Marconi's Recent Results], p. 632.
Notes on the Waves in **Visco-Elastic** Solid Bodies.—K. Sezawa, p. 633.
The Periodic Waves on the Surface of **Water.**—J. Baurand, p. 88.
The Development of the **Wave Conception**: Part VI.—K. Uller, p. 158.
Reception and **Weather Conditions** [German Amateurs' Observations], p. 223.
Winter in the Ionosphere.—R. A. Watson Watt, p. 400.

ATMOSPHERICS AND ATMOSPHERIC ELECTRICITY.

The Theory of the Electrification of **Aerosols.**—H. S. Patterson, p. 91.
Properties of **Aerosols.**—S. C. Blacktin, p. 160.
Charged **Aerosols and Ball Lightning.**—W. C. Reynolds, p. 91.
On Two Different Types of **Atmospheric.**—F. Schindelhauer, p. 277.
Atmospheric Electricity: Field and Ionic Distribution in a Gas Traversed by a Current and Containing Electricity Carriers of Little Mobility.—J. Scholz, p. 160.
High-Frequency **Atmospheric Noise.**—R. K. Potter, p. 31.
An Estimate of the Frequency Distribution of **Atmospheric Noise.**—R. K. Potter, p. 633.
Correlation of Radio **Atmospherics** with Meteorological Conditions.—T. Nakai, p. 335.
Tests on the Distribution in Space of **Atmospherics** [Application of Verdan Principle to Space instead of to Time].—E. Montoriol and R. Subra: Lillo, p. 517.
Lightning Discharges as Sources of **Atmospherics** causing Interference with Broadcast Reception.—H. Norinder, p. 518.
The Diurnal Variation of **Atmospherics** at Paris, from 1928–1931. The Respective Influences of the Sources and of Propagation.—R. Bureau, p. 401.
Direction-Finding Researches on **Atmospherics.**—R. Bureau, p. 518.
The Part Played by Propagation Phenomena in the Recording of **Atmospherics** [and the Action of the Appleton Layer on Waves of 30 kc/sec. Frequency].—R. Bureau, p. 518.
Atmospherics: Analysis of Data obtained in 1928 at Monte Cassino by the Italian Atmospherics Service.—B. Paoloni and P. Ilardi, p. 218.
On the Results of the Continuous Record of **Atmospherics** [at Tokyo, since 1927].—J. Asakura, p. 158.
27-day Period of **Atmospherics** in Wireless Telegraphy.—F. Schindelhauer, p. 633.
Atmospherics and Lightning.—R. A. Watson Watt, p. 577.
A Dynatron Trip Relay Circuit Applicable to the Recording of **Atmospherics of Various Strengths.**—Fucks, p. 91.
Magnetic Disturbances observed in Potsdam on Days of S. Norwegian **Aurora.**—A. Röstad, p. 336.
Radio Direction Finding Experiments [and Signal Strength Measurements] with **Aurora**: "Electro-Invasions" of the Atmosphere—Düll, p. 633.
Some New Theoretical and Experimental Results on the **Aurora** Polaris [Electron Ray Tests and Periodic Space Paths].—E. Brüche: Störmer, p. 336.
Problem of the **Aurora.**—C. Störmer, p. 402.
Audibility of the **Aurora** Polaris.—H. U. Sverdrup, p. 89.
The Emission Bands of the Polar **Aurora** in the Spectrum of the Night Sky.—J. Dufay, p. 89.
Synthesis of the Polar **Aurora.**—A. Dauvillier, p. 159.
On the Theory of the Polar **Aurora.**—A. Dauvillier, p. 218.
Height of the Polar **Aurora** in Canada.—J. C. McLennan, H. S. Wynne-Edwards, and H. J. C. Ireton, p. 89.
Results of Cinematographic Measurements of **Auroral Heights,** and Proof of the Occurrence of Infra-Red Auroral Radiation [and of Auroral Penetration of 65 Kilometres above the Earth].—W. Bauer, p. 578.
Australian R.R.B. Work of Atmospherics.—Australian Radio Research Board, p. 158.
Meteorograph with Automatic Short Wave Transmission (for **Balloon Work**).—H. Kirsten: Moltchanoff, p. 220.
New Meteorographs with Wireless Distant Recording [for **Balloon** Work, etc.].—L. Heck and G. Sudeck: Moltchanoff, p. 337.
New Radiometeorological Methods [for Sounding **Balloons**].—P. Duckert and B. Thieme, p. 337.
Air **Breakdown** at Low and High Frequencies with Various Electrodes.—F. Miseré, p. 337.
Measurement of the Amount of Electricity Flowing during Electrical **Breakdown.**—P. Rosenlöcher, p. 337.
Optical Investigation of Spark **Breakdown** in Air at Atmospheric Pressure using the Suppressed Breakdown.—W. Holzer, p. 635.
Calculation of the Electrical **Breakdown Field Strength** of Gases by means of Nernst's Heat Theorem.—O. Mayr, p. 455.
The **Breakdown Field-Strengths** of the Homogeneous Field in Air.—H. Ritz, p. 402.

On the Growth of the Space Charges in the Electrical **Breakdown of a Gaseous Path.**—N. Kapzov, **p. 402.**
Broadcasting and [its suggested Effect on] **the Weather.**—E. V. Newnham : Humphreys, **p. 336.**
Electrical Conditions in Stratified **Clouds.**—M. Grabham, **p. 160.**
Disintegration of the Atomic Nucleus by **Cosmic Rays.**—C. D. Anderson and R. A. Millikan, **p. 160.**
Energies of **Cosmic-Ray** Particles.—C. D. Anderson, **p. 634.**
The Nature of **Cosmic Radiation.**—J. Barnóthy and Magdalene Forró, **p. 90.**
The Constancy of **Cosmic Rays.**—R. D. Bennett, J. C. Stearns and A. H. Compton, **p. 90.**
Diurnal Variation of **Cosmic Rays.**—R. D. Bennett, J. C. Stearns and A. H. Compton, **p. 578.**
The Production of Artificial **Cosmic Rays** [from Beryllium bombarded by Alpha Rays].—W. Bothe and H. Becker, **p. 336.**
The Nature of the **Cosmic Radiation.**—W. Bothe, **p. 634.**
Dependence of the Ionisation Produced by the **Cosmic Penetrating Radiation** upon Pressure and Temperature.—J. W. Broxon, **p. 578.**
On the Range of Fast Electrons and Neutrons [Are **Cosmic Rays** Neutrons ?]—J. F. Carlson and J. R. Oppenheimer : W. H. Watson and F. R. Terroux, **p. 219.**
Comparison of **Cosmic Rays** in the Alps and the Rockies.—A. H. Compton, **p. 219.**
Further Investigation of **Cosmic Rays.**—A. H. Compton, **p. 219.**
Tests to Determine the Nature and Source of the **Cosmic Rays.**—A. H. Compton, **p. 336.**
Cosmic Ray Intensity Varies with Change in Latitude.—A. H. Compton, **p. 519.**
Variation of the **Cosmic Rays** with Latitude.—A. H. Compton, **p. 578.**
Use of Argon in the Ionisation Method of Measuring **Cosmic Rays.**—A. H. Compton and J. J. Hopfield, **p. 635.**
Measurements of **Cosmic Radiation** in Northern Sweden.—A. Corlin, **p. 578.**
Contribution to the Knowledge of the Solar Component of **Cosmic Radiation.**—A. Corlin and V. F. Hess, **p. 160.**
Contemporary Advances in Physics, XXIII. Data and Nature of **Cosmic Rays.**—K. K. Darrow, **p. 278.**
Cosmic Ray Fluctuations Connected with Those of Magnetism, Earth Currents and Electric Field.—Dauvillier, **p. 160.**
The Sun as the Origin of **Cosmic Rays.**—V. Cofman : Dauvillier **p. 578.**
Aurorae and **Cosmic Rays.**—A. Dauvillier, **p. 633.**
Theoretical Considerations on **Cosmic Radiation.**—W. Heisenberg, **p. 456.**
On the Disintegration Process Caused by **Cosmic Radiation.**—W. Heisenberg, **p. 456.**
Problems of **Cosmic Radiation.**—G. Hoffmann, **p. 635.**
Neutrons and **Cosmic Rays.**—L. D. Huff, **p. 219.**
On the Determination of the Nature of **Cosmic Radiation** from Coincidence Measurements.—J. N. Hummel, **p. 579.**
Investigations on the Electron Counter [Reference to its Use in Determining the Ionising Power of **Cosmic Radiation.**—J. N. Hummel, **p. 579.**
A Calculation Concerning the Nature of the Secondary Corpuscular **Cosmic Radiation.**—T. H. Johnson, **p. 456.**
The Production of Multiple Secondaries in Lead by **Cosmic Radiation.**—T. H. Johnson and J. C. Street, **p. 456.**
A Cloud Expansion Chamber for Automatically Photographing the Tracks of Corpuscular **Cosmic Rays.**—T. H. Johnson, W. Fleischer, Jr., and J. C. Street, **p. 579.**
Experiments on the Corpuscular **Cosmic Radiation.**—T. H. Johnson and J. C. Street, **p. 579.**
An Interpretation of **Cosmic-Ray** Phenomena.—T. H. Johnson, **p. 634.**
Vertical Tube Counter- and Barometric-Effects of **Cosmic Radiation** at Sea-Level.—W. Kolhörster, **p. 401.**
The Verification of the Theory of the Vertical Tube Counter Effect of the **Cosmic Radiation.**—W. Kolhörster, **p. 635.**
The Specific Ionisation of **Cosmic Radiation.**—W. Kolhörster and L. Tuwim, **pp. 90** and **278.**
The Specific Capacity for Coincidence Production of **Cosmic Rays** beyond 10 Centimetres of Lead at Sea Level.—W. Kolhörster and L. Tuwim, **p. 634.**
Variation of Intensity of **Cosmic Ultra-Radiation.**—F. Lindholm, **p. 578.**
Cosmic Ray Particles.—G. L. Locher, **p. 336.**
Cosmic Ray Tracks occur in Groups of Two or Three.—G. L. Locher, **p. 579.**
On the Solar Period of the Hard **Cosmic Radiation.**—W. Messerschmidt, **p. 278.**
On the Solar Period of **Cosmic Radiation.**—W. Messerschmidt, **p. 336.**
On the Atmospheric Pressure Coefficient of the Hard **Cosmic Radiation.**—W. Messerschmidt and W. S. Pforte, **p. 336.**
Similarity between **Cosmic Rays** and Gamma Rays.—R. A. Millikan and I. S. Bowen, **p. 90.**
Further Experiments on the Uniformity of Distribution of the **Cosmic Radiation** [Absence of Direct Solar Effect on Cosmic Ray Intensities].—R. A. Millikan, **p. 278.**
Cosmic-Ray Ionisation and Electroscope-Constants as a Function of Pressure.—R. A. Millikan, **p. 278.**
Cosmic-Ray Energies and Their Bearing on the Photon and Neutron Hypotheses.—R. A. Millikan and C. D. Anderson, **p. 455.**
On an Attempt to Deflect Magnetically the **Cosmic Ray Corpuscles.**—L. M. Mott-Smith, **p. 278.**
A New Experiment Bearing on **Cosmic-Ray** Phenomena.—L. M. Mott-Smith and G. L. Locher, **p. 90.**
On the Structure of **Cosmic Radiation.** II. Comparison Measurements with Two High Pressure Ionisation Chambers.—W. S. Pforte, **p. 89.**
Measurement of **Cosmic Radiation** at a Height of 16 000 m.—A. Piccard, E. Stahel, P. Kipfer, **p. 579.**
The Intensity of the **Cosmic Radiation** at 16 000 Metres Altitude.—A. Piccard, E. Stahel and P. Kipfer, **p. 519.**
On the Spectrum of **Cosmic Radiation.** I.—The Measurements in Autumn, 1928.—E. Regener, **p. 336.**
Intensity of **Cosmic Radiation** in the High Atmosphere.—E. Regener, **p. 634.**
Absorption and Diffusion of **Cosmic Rays** in Lead and Iron.—B. Rossi : Steinke, **p. 160.**
Tests on the Magnetic Deflection of the **Cosmic Rays.**—B. Rossi, **p. 401.**
Terrestrial Magnetic Field and Corpuscular [**Cosmic**] **Radiation.**—B. Rossi, **p. 579.**
Calculation of the Action of the Earth's Magnetic Field on a Corpuscular [**Cosmic**] **Radiation** generated in the Atmosphere.—B. Rossi, **p. 634.**
The Effects on **Cosmic Radiation** of Passage through Different Materials.—H. Schindler, **p. 219.**
Contribution to the Question of Statistical Fluctuations of the Natural Radiation of Radiation Apparatus [Application to Investigations on **Cosmic Rays**].—W. M. H. Schulze, **p. 90.**
Angular Distribution of the **Cosmic Rays.**—D. Skobelzyn, **p. 160.**
On the Mechanism of the Phenomena of Ultra-penetrating Radiation (**Cosmic Rays**).—D. Skobelzyn, **p. 579.**
The Corpuscular Explanation of **Cosmic Rays.**—F. Soddy, **p. 90.**
Factors Influencing Ionisation Produced by **Cosmic and Gamma-Rays.**—J. C. Stearns and W. Overback, **p. 456.**
Disintegration of Lead by **Cosmic Radiation.**—E. G. Steinke and H. Schindler, **p. 401.**
On the Disintegration of Matter by **Cosmic Radiation.**—E. G. Steinke and H. Schindler, **p. 578.**
New Measurements of [**Cosmic**] **Radiation** at Great Heights—Preliminary Communications.—G. A. Suckstorff, **p. 579.**
First **Cosmic-Ray Telescope** Built at [Bartol] Research Laboratory.—W. F. G. Swann, **p. 219.**
Electrons as **Cosmic Rays.**—W. F. G. Swann, **p. 634.**
The Direct Detection of Individual **Cosmic Rays.**—W. F. G. Swann and J. C. Street, **p. 579.**
Cosmic Radiation as Neutron Radiation.—R. Swinne, **p. 456.**
Neutron, Atomic Brick, May Solve Mystery of **Cosmic Rays, p. 336.**
On the Calculation of the Ion Counter Tube Effect of the **Cosmic Rays,** and their Absorption Laws according to Counter Tube Measurements.—L. Tuwim, **p. 278.**
Some Remarks on the Principles of Experiments with **Cosmic Ray** Coincidences.—L. Tuwim, **p. 579.**
The Analysis of **Cosmic-Ray** Observations.—L. D. Weld, **p. 578.**
Measurements of **Cosmic Radiation** between 57° and 67° N.—K. Wölcken, **p. 160.**
Cosmic Radiation : see also Penetrating, Ultra-Penetrating, Ionisation, Geiger-Müller.
Slow Cloud Ionisation confirms **Direct-Stroke Theory.**—C. L. Fortescue, **p. 32.**
Electric **Discharge** from Water Drops [and the Difference between Positive and Negative Discharges, etc.].—J. J. Nolan and J. G. O'Keeffe, **p. 577.**
Studies on Electric **Discharge.** Part VIII [Dust Figures] : Development of Electric Discharge as affected by the Residual Charge—Study with a Unidirectional Pulsating Wave.—Toriyama and Sawa : Mochizuki, **p. 577.**
The Electrodeless **Discharge** as Measured by the Cathode-Ray Oscillograph (Number of Initiating Electrons, etc.) : also The Step-by-Step Discharge (and Krug's Denial).—Buss, **p. 421.**
Gas **Discharge** and Breakdown [Preliminary Note].—W. Rogowski, **p. 635.**
On the Characteristics of the Currents in a **Discharge in Air** at Low Pressure [Cathode-Ray Oscillograph Investigation].—R. Anthouard, **p. 519.**
On the **Discharge Delay** in Homogeneous Electric Fields and Air at Atmospheric Pressure.—R. Strigel, **p. 278.**
Discharge : see also Breakdown, Spark.
On the Electrical Properties of **Dust and Fog.**—H. Sachsse, **p. 635.**
Dependence of the Normal **Earth Current** on Latitude.—D. Stenquist, **p. 159.**
The Theoretical Limit of the **Earth's Atmosphere.**—G. Roncali, **p. 456.**
Eclipse Effects on Radio [in America], **p. 633.**
Eclipses.—See also under " Propagation of Waves."
The Electric Field at the Summit of the Puy de Dôme.—E. Mathias and G. Grenet, **p. 89.**
On the Value of the **Electrical Field** of the Atmosphere at High

Latitudes [Explanation of Andrée's Low Average Value of 12 Volts].—E. Salles, **p. 519.**
Variation of the **Electrical Potential** of the Atmosphere during a Storm.—R. Di Maio, **p. 337.**
The Stationary Velocity Distribution of **Electrons Diffusing in an Electric Field.**—M. Didlaukis, **p. 337.**
Variation of the Surface Tension of the "**Fulminant Material**" as a Function of Temperature and Molecular Weight.—E. Mathias, **p. 220.**
Investigations and Applications of the **Geiger-Müller Counter** in a Circuit with a Cathode-Ray Tube, particularly a Coincidence Circuit [for Cosmic Rays].—G. Medicus, **p. 278.**
A Simple [Thyratron in Trip Circuit] **Counting** Arrangement for the Impulses of a **Geiger-Müller Ion Counter.**—R. Jaeger and J. Kluge, **p. 635.**
Short Report on the Meteorological-Aerological Observations on the **Graf Zeppelin Arctic Trip.**—Weickmann and Moltchanoff, **p. 337.**
Impulse Testing Technique.—Foust, Kuehni and Rohats, **p. 519.**
Study of the **Infra-Red Radiation** emitted by the Earth's Atmosphere.—J. Devaux, **p. 160.**
Methods for Measuring **Interfering Noises.**—Espenschied, **p. 100.**
The Effect of Electron Attachment on the **Ion Mobility Curves** in the Zeleny Air Blast Method of Ion Mobility Measurement.—L. B. Loeb and N. E. Bradbury, **p. 220.**
Character of Atmospheric **Ionisation.**—P. A. Sheppard, **p. 219.**
Ionisation as a Function of Pressure and Temperature.—A. H. Compton, R. D. Bennett and J. C. Stearns, **p. 89.**
On the **Ionisation** in Pressure Chambers [including those used in Cosmic Ray Experiments].—E. G. Steinke and H. Schindler, **p. 219.**
Rate of **Ionisation** of the Atmosphere.—G. R. Wait and O. W. Torreson, **p. 277.**
Ionisation at High Gas Pressures.—R. M. Sievert, **p. 455.**
Determination of the Coefficient of **Ionisation** by Collision [in Dry Air] using Large Plate Distances and Higher Pressures.—F. H. Sanders, **p. 577.**
The Residual **Ionisation** [due to Cosmic Radiation] in Nitrogen at High Pressures.—J. W. Broxon, **p. 219.**
On Electronic **Ionisation** of Nitrogen, Oxygen and Air at Low and High Pressures.—K. Masch, **p. 635.**
Ionisation Measurements on the Piccard-Kipfer Ascent, **p. 157.**
The **Ionisation of the Atmosphere** Measured from Flying Aircraft.—D. C. Rose, **p. 160.**
The **Ionising Efficiency** of Electronic Impacts in Air.—J. Thomson, **p. 401.**
Theory and Method of Determination of Size of **Ions in** the Atmosphere.—H. Israel, **p. 160.**
The Ageing of **Ions** in Air and Nitrogen.—J. Zeleny, **p. 160.**
Distribution of Mobilities of **Ions in Air.**—J. Zeleny, **p. 219.**
The Mobilities of Atmospheric **Large Ions.**—R. K. Boylan, **p. 402.**
The Absolute Values of the Mobility of Gaseous **Ions** in Pure Gases: Mobility Experiments in Gaseous Mixtures and Ageing Experiments in Pure Gases.—N. E. Bradbury, **p. 455.**
The Recombination of **Ions** in Air at Low Pressures.—E. Lenz, **p. 519.**
The Number of Langevin **Ions** in the Free Atmosphere at Washington, D.C.—G. R. Wait and O. W. Torreson, **p. 577.**
On the Degree of Homogeneity of the Filtered Gamma Rays of ThC″ and the Verification of the **Klein-Nishina Formula.**—D. Skobelzyn, **p. 456.**
The Application of **Lichtenberg Figures.**—Y. Toriyama and U. Shinohara, **p. 635.**
Polarisation of **Light from the Sky** and Its Connection with Other Meteorological Elements.—W. Smosarski, **p. 160.**
Lightning Investigation as Applied to the Aeroplane.—A. O. Austin, **p. 278.**
Unusual **Lightning.**—H. E. Beckett and A. F. Dufton, **p. 32.**
Results of **Lightning** Measurements in 1931 [on a Swiss H.T. Power Line, with Two Cathode-Ray Oscillographs].—K. Berger, **p. 519.**
Recent Progress in Protecting Buildings against **Lightning.**—A. Boutaric : Schaffers, **p. 337.**
Thunderstorms and Protection against **Lightning** [including Figures for Duration, Current Strength, etc., of Lightning Strokes].—G. Cario, **p. 277.**
Unusual **Lightning.**—C. J. P. Cave, **p. 32.**
Correlations between the Field Changes due to **Lightning** and the Appearance of the Flashes.—E. L. Halliday, **p. 32.**
Spherical **Lightning** with Multiple Explosions.—J. Imbrecq, **p. 161.**
The Relation of Branching of **Lightning** Discharges to Changes in the Electrical Field of Thunderstorms.—J. C. Jensen, **p. 519.**
The Connection between Points of an Overhead Line struck by **Lightning** and the Presence of Underground Streams : Divination by Hazel Twig.—Lehmann, **p. 577.**
Branching of **Lightning.**—J. L. P. Macnair, **p. 91.**
On Ascending **Lightning** Flashes.—E. Mathias, **p. 91.**
Granulated " Bead Necklace " **Lightning.**—E. Mathias, **p. 91.**
" Bead Necklace " **Lightning** composed of Short Lines.—E. Mathias, **p. 160.**
Globular and Ascending **Lightning** in Mountains and Elevated Plateaus.—E. Mathias, **p. 519.**
Measurements of **Lightning** Surges on Transmission Lines in Sweden.—H. Norinder, **p. 401.**
The Influence of Earth Resistance on **Lightning** [Mathematical Investigation].—F. Ollendorff, **p. 455.**
Lightning Researches at 10^7 Volts.—F. W. Peek, Jr., **p. 577.**
Branching of **Lightning.**—B. F. J. Schonland and T. E. Allibone, **p. 91.**
Duration and Magnitude of a **Lightning** Discharge.—R. S. J. Spilsbury, **p. 91.**
Relation between the Length of an Overhead Telephone Line in Bare Wire and the Number of Damaging Effects produced by **Lightning** on the Apparatus and Cables connected to the Line.—D. Stenquist, **p. 577.**
On the Difference between Oak and Beech as regards Danger of Being Struck by **Lightning.**—B. Walter, **p. 402.**
Description and Theory of the Messien **Lightning Arrester** [depending on Ionisation by Radioactivity].—J. Clément : Messien, **p. 577.**
Lightning Arrester Grounds.—H. M. Towne, **p. 337.**
Terrestrial **Magnetic Activity** and its Relations to Solar Phenomena.—J. Bartels, **p. 633.**
Magnetic and Electric Observations in the Sahara.—C. Le Camus and F. de Saint-Just, **p. 160.**
Use of **Magnetic Data** for Investigating Radiation from the **Sun.**—J. Bartels, **p. 159.**
Some Observations of the Behaviour of Earth Currents and Their Correlation with **Magnetic Disturbances** and Radio Transmission.—Isabel S. Bemis, **p. 88.**
Seasonal Variations in **Magnetic Storms.**—H. B. Maris, **p. 277.**
Features of the Current-System of the Upper Atmosphere as Revealed by the Diurnal **Magnetic Variations** at Huancayo, Peru.—A. G. McNish, **p. 577.**
Pulsations of Terrestrial **Magnetism** [Eschenhagen's Waves] as the result of the action of Clouds of Electric Corpuscles.—C. Störmer, **p. 159.**
Work of the Bell System relating to Terrestrial **Magnetism and Electricity.**—O. B. Blackwell, **p. 159.**
Meteorographs.—See Balloon.
Radio and the **Meteorological Service.**—L. A. Sweny, **p. 635.**
Meteorology and the Radiogoniometry of Atmospherics.—R. A. Watson Watt, **p. 577.**
Do **Meteors** cause Static ?—J. Cage, **p. 337.**
Effect of **Meteors** on Radio Transmission [and the Production of Atmospherics].—Nagaoka, **p. 516.**
Absorption Measurements of the **Penetrating Corpuscular Radiation** in a Metre of Lead.—B. Rossi, **p. 219.**
Proof of a Secondary Radiation Caused by the **Penetrating Corpuscular Radiation.**—B. Rossi, **p. 401.**
Photography of **Penetrating Corpuscular Radiation.**—P. M. S. Blackett and G. Occhialini, **p. 634.**
Measurements on the Absorption of the **Penetrating Corpuscular Rays** coming **from** Inclined Directions.—B. Rossi, **p. 90.**
The Variation of **Penetrating Radiation** with Zenith Distance.—G. Bernardini, **p. 401.**
Ionisation by **Penetrating Radiation** as a Function of Pressure and Temperature.—A. H. Compton, R. D. Bennett and J. C. Stearns, **p. 336.**
On the **Penetrating Radiation.**—A. Piccard (Brussels), **p. 90.**
The Problem of the **Penetrating Radiation.**—B. Rossi, **p. 160.**
Recent Researches on the **Penetrating Radiation :** The Absorption Curve of the Penetrating Corpuscular Radiation.—B. Rossi, **p. 456.**
An Attempt to Detect the Spontaneous Transformation of Helium into **Penetrating Radiation.**—G. T. P. Tarrant and L. H. Gray, **p. 219.**
The **Physiological Effects** of Atmospheric Electricity.—C. Dorno, **p. 456.**
Slow Electrons Make Possible "**Polar Light**" in Laboratory.—V. Cofman : Dauvillier, **p. 578.**
Significance of Geoelectric Data from the **Polar Regions.**—O. H. Gish, **p. 160.**
Some Atmospheric Electrical Instruments for use on the British **Polar Year** Expedition, 1932–1933.—P. A. Sheppard, **p. 578.**
Simultaneous Registration of **Potential Drop, Space and Surface Charge.**—H. Mothes, **p. 277.**
Photography of the **Solar Corona** apart from Eclipse Times.—B. Lyot : Esclangon : Fabry, **p. 89.**
Spectroheliographic Study of the **Solar Corona** apart from Eclipse Times.—B. Lyot, **p. 219.**
Some Remarks on the Length of the Actual **Solar Period.**—H. Mémery, **p. 89.**
Maxima of Intensity of **Solar Radiation** observed at Nice and at Thorenc (Maritime Alps).—L. Gorczynski, **p. 89.**
Solar Radiation as a Meteorological Factor.—H. H. Kimball, **p. 519.**
The Time Lag of the Electric **Spark.**—J. A. Tiedeman, **p. 277.**
On Displacements of the Striking Point of a Fairly Long Electric **Spark** with Unchanged Spark Gap.—B. Walter, **p. 455.**
An Optical Study of the Formation Stages of **Spark Breakdown.**—F. G. Dunnington, **p. 91.**
Spark Constant for Spark Formation with Various Boundary Voltages.—M. Toepler and T. Sasaki, **p. 337.**
Spark Discharges in the Air, Part II : Relation between High-Frequency and Impulsive Discharges.—Y. Asami, **p. 577.**

Sparking Potential and Electrode Material.—L. B. Loeb, p. 220.
The Kindling of Electric **Sparkover.**—C. E. Magnusson, p. 337.
On Electric **Sparks** [between Surface of Charged Insulating Plate and an Earthed Conductor: Difference in Appearance according to Polarity].—T. Kobayasi, p. 577.
The Influence of the **Stratosphere** on the Dynamics of the Weather (Review of the Relations between Events in the Stratosphere and in the Troposphere).—H. Ertel, p. 402.
The Second Exploration of the **Stratosphere.**—Piccard, p. 634.
Cyclic Variations in the Heat and Light given out by the **Sun.**—C. G. Abbot, p. 160.
The Electrical Properties of the **Sun.**—A. Dauvillier, p. 337.
The Electromagnetic Phenomena produced on the Earth by the Electron Emission from the **Sun.**—A. Dauvillier, p. 337.
Interruptions to Lines Concentrated at **Sunrise.**—E. E. George and W. R. Brownlee, p. 89.
Sunrise Interruptions [to Overhead Lines] Attributed to Ionisation of Heaviside Layer [causing Increased Tension Gradient].—A. Menge: George and Brownlee, p. 577.
Periodic Variations in Natural Phenomena [Correlation of **Sunspot Periods** with Climatic Elements, Submarine Upheavals, Mortality, etc.].—W. B. Schostakowitsch, p. 159.
Mean Areas and Heliographic Latitudes of **Sunspots** in the Year 1930, p. 89.
Correlation between **Sunspots** Calcium Flocculi and the Sun's Radiation.—K. Sotome, p. 89.
The Relative Numbers of **Sunspots.**—M. Omschansky, p. 402.
Investigation of **Surface Discharge** with Impulse Voltage.—P. Rosenlöcher, p. 220.
Condensers and **Surges** [Application of Heaviside Operational Methods to Surges—particularly of Non-Rectangular Form—on Lines].—J. L. Miller, p. 401.
Terrestrial and Solar Coronae and their Relation to Cosmic Phenomena.—L. Vegard, p. 337.
Terrestrial Magnetism: Recent Work of the Carnegie Institution: Polar Year Plans.—J. A. Fleming, p. 402.
The Eleven-Year **Thermal Wave** at the Earth's Surface.—F. Dilger, p. 402.
Elementary Description of the Statical Field of a **Thunder Cloud.**—F. Ollendorff, p. 220.
Point Discharge Measurements below **Thunderstorms.**—J. Schonland and C. A. Coppens, p. 31.
Correlation of Atmospherics [in Japan] with **Thunderstorms.**—A. Kimpara, p. 158.
High-Frequency [**Ultra-Penetrating**] Rays in the Aurora Borealis, and High Altitude Tests on Mount Everest.—E. A. Smith, p. 91.
The **Ultra-Penetrating Radiation.**—R. Desoille: Geiger, p. 90.
The **Ultra-Violet Light Theory** of **Comet-Activity.**—H. B. Maris, p. 159.
Ultra-Violet Transmission of the Atmosphere.—R. S. Rockwood and R. A. Sawyer, p. 578.
Some Investigations on the Deformation and Breaking of **Water Drops** in Strong Electric Fields.—W. A. Macky, p. 31.

PROPERTIES OF CIRCUITS.

The Influence of the Interelectrode Capacity between the Grid and the Anode in Multi-Stage Resonance **Amplification.**—V. I. Siforov, p. 279.
The **Amplification Ratio** of Resistance-Coupled Valve Combinations.—P. Kapteyn, pp. 278, 338 and 456.
The Resistance-Coupled **Amplifier** regarded as an Oscillatory Circuit.—K. Schlesinger, p. 32.
The Resistance-Coupled **Amplifier** as Oscillatory Circuit: Correspondence.—H. G. Baerwald: Schlesinger, p. 221.
An Untuned Radio-Frequency **Amplifier** [using an Intervalve Transformer with Associated Tightly-Coupled Circuit Tuned to a High Frequency].—F. W. Schor, p. 161.
On the Indispensable and Sufficient Condition of Absence of Self-Excitation in a Multi-Stage Resonance **Amplifier.**—V. I. Siforov, p. 279.
A Simplified General Method for Resistance-Capacity Coupled **Amplifier** Design.—D. G. C. Luck, p. 635.
Switching-on Processes in Resistance-Coupled **Amplifiers** [Behaviour to Transients].—K. Schlesinger, p. 33.
An Outline of the Theory for the Operation of Triode Power **Amplifiers** [and Oscillators].—Y. Fukuta, p. 161.
Regeneration Theory [Stability of **Amplifiers** whose Output is Connected to the Input through a Transducer].—H. Nyquist, p. 279.
On Distortion Correction by Resonance Methods, in Resistance-Coupled **Amplifiers.**—H. Bartels, p. 220.
On Self-Excitation of **Amplifiers** by Coupling the Anode Currents.—W. O. Schumann, p. 635.
The Experimental Investigation of Parasitic Reactive Couplings in Resonance **Amplifiers.**—V. I. Siforov and E. V. Viland, p. 340.
On the Calculation of Resonance **Amplifiers.**—V. I. Siforov, p. 635.
A Theoretical Comparison of Coupled **Amplifiers with Staggered Circuits.**—J. R. Nelson, p. 580.
On a Generalisation of the Idea of the **Anti-resonant** [Stopping, Rejector] Circuit.—M. Rousseau, p. 580.
An Application of the Circle Diagram to the Design of **Attenuation and Phase Equalisers.**—N. M. Rust, pp. 161 and 280.
On a Method for the Determination of Roots of **Auxiliary Equations of the 3rd and 4th Degree** in connection with the Investigation of Electrical Oscillations in Complex Circuits.—L. Mirlas, p. 403.
A Common Error [in Connection with the Use of the Term "**Beat Note**" in the Combination of Two Sinusoids of Different Frequencies].—W. F. Floyd, p. 458.
On the Theory of **Beats.**—V. S. Gabel, p. 280.
Simple Telephone **Broadcasting Networks.**—Apanasenko, p. 360.
The Fall of Potential in a Charged Insulated **Cable.**—D. K. McLeery, p. 519.
Capacitive Output Coupling [between Output Valve and Acoustic Load].—L. G. A. Sims, p. 456.
The Analysis and Design of a **Chain of Resonant Circuits.**—M. Reed, p. 456.
The Magnetic Field Intensity Near a **Circular Loop** Carrying an Electric Current [Theoretical Investigation].—A. L. Fitch, p. 581.
Oscillatory **Condenser Discharge.**—M. Rousseau, p. 580.
Apparatus for Exhibiting Some Properties of **Coupled Circuits.**—R. C. Clinker and T. H. Kinman, p. 161.
Damping and Its Reduction in **Coupled Circuits.**—H. J. Eilers, p. 161.
Wavelength Characteristics of **Coupled Circuits having Distributed Constants.**—King, p. 635.
A Mechanical Analogy for **Coupled Electrical Circuits** [New System of Mechanically Coupled Pendulums].—H. J. Reich, p. 520.
Correction and Supplement to the Paper "**Coupled Oscillatory Circuits.**"—H. Hecht: Petržilka, p. 458.
Potentials, Resistances and Tuning in **Damped and Undamped Circuits.**—M. Osnos, p. 635.
Degeneration [into Relaxation Oscillations] in Valve Oscillators.—W. Reichardt, p. 91.
The Apparent **Demodulation** of a Weak Station by a Stronger One.—W. B. Lewis: Colebrook, p. 33.
"Apparent **Demodulation**": Another Viewpoint.—Mallett, p. 460.
Mutual **Demodulation** and Allied Problems.—H. L. Kirke, p. 92.
Demodulation.—See also under "Reception."
Investigations into Anode **Detection.**—G. Ulbricht, p. 32.
Analytical Study [based on Carson's Series Development] of Valve Circuits for Anode **Detection** of Telephony Signals.—J. P. Woods, p. 92.
[Analytical Study of] Plate **Detection** of Radio Signals.—J. P. Woods, p. 281.
The Calculation of **Detection Performance** in a Vacuum Tube Circuit for Large Signals.—J. P. Woods, pp. 457 and 523.
The **Detection** by a Straight Line Rectifier of Modulated and Heterodyne Signals.—Moulin, p. 522.
The Mutual Interference of Wireless Signals in Simultaneous **Detection [Apparent Demodulation].**—Appleton and Boohariwalla, p. 343.
Further Notes on the **Detection of Two Modulated Waves** which Differ Slightly in Carrier Frequency.—Aiken, p. 343.
Detection.—See also under "Reception."
Designing **Detector** Circuits.—Turner, p. 224.
Quality **Detectors:** A Survey of Rectification.—W. Greenwood and S. J. Preston, p. 161.
Discharge Tubes: Jumping Glow Phenomenon Caused by Hydrocarbon Vapour.—W. A. Leyshon, p. 281.
On Periodic Movements of the Negative Glow in **Discharge Tubes.**—W. A. Leyshon, p. 341.
Is the Relation $\mathfrak{D} = \epsilon\mathfrak{F}$ in the **Electrostatic Field** Always Valid?—P. Andronescu, p. 458.
On the Calculation of **Mechanical Vibratory Systems** by the Use of the **Equivalent Electrical Circuits.**—A. Forstmann, p. 221.
The Representation of Electro-Mechanical Systems by Pure [**Equivalent**] **Electrical Circuits.**—W. Hähnle, p. 636.
Equivalent Electrical Networks.—O. Brune, p. 222.
Equivalent Electrical Networks.—N. Howitt, p. 581.
Tube Amplifier **Equivalent Parallel Circuit.**—G. D. Robinson, p. 33.
The Electromagnetic **Field** produced by a Wire Traversed by a Sinusoidal Alternating Current above a Conducting Layer.—Dubourdieu, p. 339.
The Design of the Band Pass **Filter.**—Bligh, p. 224.
Extension of the **Filter Network Theory.**—M. J. O. Strutt, p. 402.
Calculation of the Building-Up Time of Band-Pass **Filters.**—Labus, p. 537.
New Theory and Design of Wave **Filters.**—Cauer, p. 537.
Filters.—See also Transient, Networks, and under "Subsidiary Apparatus."
On Resonance Phenomena in **Frequency Division.**—L. Mandelstam and N. Papalexi, p. 279.
The Phenomena of **Frequency Division** in Radio Technique.—N. Kryloff and N. Bogoliuboff, p. 403.
A Thermionic **Frequency Doubler.**—Stedman, p. 294.
On the Theory of the **Frequency Variation** of an Alternating Current Measuring Circuit with Direct Current Apparatus and Dry-Plate Rectifiers.—L. Cremer, p. 340.
Harmonic Analysis of the Plate Current in a Vacuum Tube Circuit.—S. Leroy Brown, p. 457.
Studies of the Current in a Circuit in which R, L or C are subjected to **Harmonic Variations.**—J. B. Pomey, p. 340.

Calculation of **Heegner's Network.**—U. B. Kobzarev, **p. 340.**
A Note on the Frequency Analysis of the **Heterodyne Envelope :** Its Relation to Problems of Interference.—F. M. Colebrook : Vigoureux, **p. 402.**
Simplified **H.F. Calculations.**—W. A. Barclay, **p. 33.**
The Conduction of **High-frequency Oscillatory Energy.**—Roosenstein, **p. 38.**
The Effect of **Hysteresis** in Heating by an Oscillating Magnetic Field.—A. Blondel, **p. 458.**
Contribution to the Experimental Study of Electrical **Induction.**—Turpain and Sabatier, **p. 347.**
A Point of Stable Potential of an **Insulated Electrode** in a Triode.—G. A. Beauvais, **p. 221.**
Stable Potential of an **Insulated Electrode** in a Triode.—G. A. Beauvais, **p. 340.**
Impedance Characteristics of Loaded **Lecher Systems.**—L. Tonks, **p. 280.**
The Impedance of a Loaded **Line** with a Partially or Wholly Inoperative Coil.—E. Adam, **p. 34.**
Generation of Combination and Harmonic Frequencies by **Linear and Non-Linear Vacuum Tube Circuits.**—C. P. Boner and M. O. Boner, **p. 457.**
On the Admittance of **Linear Oscillating Systems.**—M. J. O. Strutt, **p. 33.**
A Simple Procedure for the Investigation of the **Magnetic Field** of a System of Current-Carrying Conductors of Any Shape of Cross Section.—W. Krämer, **p. 162.**
The **Magnification of the Tuned Circuit.**—Sowerby, **p. 345.**
Oscillations of Systems with **Negative Characteristics.**—Runge : Rosing : Steimel, **pp. 282-283.**
On an Electrical Self-maintaining System containing a **Neon Tube** [and a Method of Measuring the Leakage Resistance of a Condenser].—B. Decaux and Ph. Le Corbeiller, **p. 33.**
Synthesis of a Finite **Two-Terminal Network** whose Driving-Point Impedance is a Prescribed Function of Frequency.—O. Brune, **p. 280.**
On the Maintenance in Oscillation of the Most General Passive **Network.**—Ph. Le Corbeiller, **p. 457.**
Electric Waves in Branched **Networks.**—F. Ollendorff, **p. 580.**
On the Time Admittances of **Transmission Networks.**—J. L. Barnes and C. T. Prendergast, **p. 581.**
Mathematical Analysis of **Non-Linear Circuits.**—A. Boyajian, **pp. 34** and **222.**
The Question of **Non-Linear Distortion.**—Hofer, **p. 223.**
Some Examples of **Non-Linear Oscillations.**—N. Kryloff and N. Bogoliuboff, **p. 403.**
Optical Retroaction [for Generation of Sinusoidal and Relaxation Oscillations].—Sewig, **p. 342.**
Optimum Tuning Conditions for High Frequency Plant [to Satisfy Various Requirements].—M. Osnos, **p. 340.**
The Properties of a Freely **Oscillating Circuit** containing Inductance, Capacity and Ohmic Resistance in Series.—M. Osnos, **p. 457.**
Investigation of the **Oscillation Threshold** in Triode Circuits.—Giovanni, **p. 340.**
Calculation of a Valve **Oscillator** with Detuned Oscillating Circuit.—Berg, **pp. 341-342.**
The Problem of **Pentode Output Fidelity.**—Tulauskas, **p. 44.**
Papers dealing with **Poincaré's Law** that of All Bodies of Equal Volume the Sphere has the Smallest Capacity.—G. Szegö, **p. 341.**
Real, Wattless and Apparent **Power in Electrical Circuits with Non-sinusoidal Current and Voltage** [New Definitions rendering valid the Formulae holding for Sinusoidal Currents].—S. Fryze, **p. 519.**
The **"Pull-In" Effect** in Radio Technique.—N. Kryloff and N. Bogoliuboff, **p. 403.**
Form of the E.M.F. produced with **Pulsating Angular Velocity.**—L. V. Stecula, **p. 280.**
Asymmetry of **Push-Pull Circuits.**—E. S. Anceliovič, **p. 280.**
The **Quadripole** and its Special Modes of Connection.—H. König, **p. 340.**
The Variation of the Apparent Resistance of a Symmetrical **Quadripole** with the Load.—H. König, **p. 340.**
The Principles of **Quadripole Theory.**—E. W. Selach, **p. 280.**
The Range of Validity of the Strecker-Feldtkeller Matrix Equations for **Quadripole Systems.**—H. G. Baerwald, **pp. 221** and **519.**
Quadripoles and their Applications.—H. G. Baerwald, **p. 581.**
On the Stability of **Quasi-periodic** Motion.—A. Witt : Kryloff and Bogoliuboff, **p. 580.**
Rectification of an A.C. Voltage by a Circuit consisting of a Diode, a Resistance and a Capacity.—N. Carrara, **p. 34.**
Some Notes on Grid Circuit and Diode **Rectification.**—Nelson, **p. 583.**
Regeneration Theory.—Nyquist. See Amplifiers.
Resistance, Self Inductance and Capacity.—W. Holzer, **p. 222.**
On the **"Retardation Networks"** (Part III).—K. Nagai, **p. 403.**
Wattless **Retroaction.**—H. Braude (Leningrad), **p. 337.**
A Circuit whose **Retroaction is Independent of Frequency** [for Audio-frequencies 20 to 20 000 Cycles per Second].—L. Brillouin and M. Lévy, **p. 338.**
Frequency Multiplication by the Use of a **Rochelle Salt Condenser.**—Wologdin, **p. 294.**
An Examination of **Selectivity.**—Langley, **p. 343.**
Property of a Circuit having **Self-Inductance, Capacity and Resistance.**—M. Osnos, **p. 280.**
Some Examples of **Similarity** between Equations representing Relations of Electrical Circuits.—Y. Watanabe, **p. 581.**
Investigations on the **Singing Conditions** in Two-Wire Amplifiers, and their Application to a New Amplification Measuring Method.—W. Weinitschke, **p. 92.**
Frequency-dependent Echo Damping Measurements on **Lines,** by the **Singing-Point Method,** and their Use for Determining Position, Nature and Magnitude of a Fault.—W. Weinitschke, **p. 280.**
Skin-Effect in a Ring of Circular Cross Section [and the Calculation of Self-Inductance].—V. Fock, **p. 636.**
Contributions to the Theory of the **Stability of Electrical Circuits,** in particular of Alternating Current Circuits.—J. J. Sommer, **p. 34.**
The Natural Electromagnetic Oscillation of a Rod-shaped Conductor at the **Surface of Separation of Two Media** with Different Dielectric Constants.—Ruprecht, **p. 287.**
The Phenomena of **Synchronisation** [and the Exact Processes of Beat-Note Formation].—H. Abraham, **p. 579.**
On the Mutual Leakage Inductances in **Transformers** with Several Secondaries.—A. Blondel, **p. 33.**
Ideal **Transformers** and **Linear Transformations** [Theoretical Investigation].—W. Cauer, **p. 458.**
The **Transient Current** in a Rejector Circuit [and Application of Results to Telephonic Filters].—J. B. Pomey, **p. 457.**
Equilibrating [**Transient**] **Processes** in Some Composite Circuits.—L. Mirlas, **p. 161.**
The **Transient Response** of the Triode Valve Equivalent Network.—W. Jackson, **pp. 161** and **280.**

TRANSMISSION.

Modern Radio Equipment for **Air Mail and Transport** Use [the G.E.C. Transmitter Type RT-76-A].—A. P. Berejkoff and C. G. Fick, **p. 637.**
A Study of Class B and C **Amplifier** Tank Circuits.—P. H. Osborn, **p. 521.**
Class "B" Audio Power **Amplifiers** [Plate Current Flowing only when Grid is Excited].—C. L. Farrar, **p. 283.**
The Operation of Vacuum Tubes as Class B and Class C **Amplifiers.**—C. E. Fay, **pp. 283** and **343.**
Contribution to the Study of the Electrical Oscillations of the Carbon **Arc.**—A. Kotecki, **p. 459.**
On **Asymmetric Telegraphic Spectra** [and the Possibilities of Single Side Band Morse Transmission].—C. R. Burch, **p. 162.**
The Smallest Short Wave Transmitter [for **Balloon** Work].—B. Thieme, **p. 459** : see also under "Atmospherics and Atmospheric Electricity."
On the Question of the Generation of **Barkhausen-Kurz** Electron Oscillations.—W. J. Kalinin, **p. 223.**
Outline of a Possible Interpretation of the **Barkhausen-Kurz** Electronic Oscillations : The Interpretation of Electronic Oscillations.—A. Rostagni, **pp. 223, 341** and **637.**
On the Influence of Gases on **Barkhausen-Kurz** Oscillations.—H. Rindfleisch, **p. 581.**
Gill-Morrell and **Barkhausen-Kurz** Oscillations.—G. Potapenko, **p. 581.**
The **Barkhausen-Kurz Effect** according to Wave Mechanics.—K. Umeda : Schuster, **p. 582.**
Eliminating the 'Phone Monologue : Two Workable Schemes for **Break-In** Operation.—M. F. Chapin : G. Ewing, **p. 583.**
Broadcast Transmitter Measurement using a Common Wavemeter.—E. A. Laport, **p. 343.**
Constant Frequency Oscillators.—F. B. Llewellyn, **p. 163.**
More About Economical **Crystal Control :** Efficient Frequency Doubling—Clearing Up Neutralization—Isolating Sources of Trouble.—G. Grammer, **p. 36.**
A Multi-Frequency **Crystal-Controlled** Monitor used to Control a Transmitter.—Reinartz, **p. 93.**
The **Dynatron Oscillator :** Ease of Modulation and Use as Beat-Frequency Oscillator : The Frequency Formula and the Influence of the Varying Negative Resistance.—Wm. D. Oliphant : F. P. Basto : Colebrook, **p. 164.**
The **Dynatron Oscillator :** the Interdependence of its Frequency Variation and the Content of Harmonics.—J. Groszknowski : Colebrook, **p. 582 :** other correspondence **pp. 222, 342** and **404.**
A Direct-Coupled Amplifier for the **Dynatron Oscillator.**—E. G. Fraim, **p. 342.**
The Measurement of the **Efficiency** of Valve Oscillators with the help of a [Copper Oxide] Photoelectric Cell.—J. Groszkowski, **pp. 163** and **637.**
The Increase of the **Efficiency** of an Electron Tube Oscillator by the Simultaneous Working at Two Different Wavelengths.—S. I. Tetelbaum, **p. 582.**
Electron Oscillations in Triode Vacuum Tubes [the Relation between the Various Types—B.-K., Pierret, and Hollmann : Transmitter and Receiver for 17 Centimetre Waves].—S. Uda and T. Mikami, **p. 582.**
Electron-Coupled Oscillator Circuits [for Short Waves] : Combining the Features of Oscillator and Buffer Amplifier.—J. B. Dow, **p. 222.**

Push-Pull **Electron-Coupled Oscillators** [for Steady Frequency Short-Wave Working].—Ross Jones : Dow, **p. 582.**
A Recent Development in Vacuum Tube Oscillator Circuits [Constant Frequency by **Electronic Coupling**].—Dow, **pp. 93 and 164.**
The Spread Sideband System on Short Wave Telephone Links [Effect of Selective **Fading** on a Displaced Frequency Privacy System of Telephony, and Its Avoidance].—L. T. Hinton, **p. 35.**
A New **Fading-free** Method of Broadcast Transmission.—H. Günther : Bureau of Standards, **p. 283.**
A 24 000 Watt Band-Pass **Filter** [for Tests on Simultaneous Telephonic Transmissions on Single Aerial].—Brotherton, **p. 106.**
Greatly Increased Range without **Loss** of Speech Quality by Suppression of **Frequencies below 1 000 Cycles per Sec.**—J. P. Shanklin, **p. 582.**
Preventing Impedance Variations in Aerial Circuit from Affecting **Frequency** [Additional Screening Electrode], **p. 637.**
A Method for the Approximate Calculation of a Thermionic **Frequency Changer** [based on Anode Dissipation].—Joffe, **p. 359.**
New Methods of **Frequency Control** [particularly for Ultra-Short-Wave Transmitters] employing Long **Lines** [Lecher Wires or Aperiodic Lines in place of Crystal Control].—J. W. Conklin, J. L. Finch and C. W. Hansell, **p. 93.**
A **Frequency Indicator** for [Broadcasting] Transmitters, **p. 343.**
A Cathode-Ray **Frequency Multiplier** [for Obtaining Ultra-High Frequencies].—N. C. Jamison, **p. 520.**
Improvements in **Frequency Multipliers** [for Crystal-Controlled Aircraft Transmitters].—E. G. Watts, **p. 341.**
Frequency Stabilisation of Radio Transmitters.—Y. Kusunose and S. Ishikawa, **p. 342.**
The **Frequency Stability** of the Triode Oscillator.—C. Matteini, **p. 342.**
Gill-Morrell and Barkhausen-Kurz Oscillations.—R. Cockburn, **p. 223.**
Gill-Morrell and Barkhausen-Kurz Oscillations.—E. C. S. Megaw and R. Cockburn, **p. 404.**
Harmonic Generation by Grid Circuit Distortion.—F. E. Terman, D. E. Chambers and E. H. Fisher, **p. 222.**
Elimination of **Harmonics** in Vacuum Tube Transmitters.—Y. Kusunose, **p. 342.**
Background **Hum** in **Radio Transmitters** [Definitions of Objective and Subjective Ripple : its Measurement and Frequency Analysis].—H. Brückmann, **p. 521.**
A Point of Stable Equilibrium of an **Insulated Electrode** in a Triode [and the Formation of Oscillations in a Dynatron Circuit].—Beauvais, **p. 221.**
Employment of Positive **Ion Sheath** in Signalling by Frequency Change.—Thomson-Houston Company, **p. 582.**
Ionised Gases and the Behaviour of Valves with Positive Grids.—Th. V. Jonescu, **p. 92.**
Electric Oscillations in **Ionised Gases**—Some Remarks on Their Present Theories.—J. Kunz, **p. 223.**
On the Existence of H.F. Oscillations in the Secondary Current of H.T. **Magnetos.**—J. Jaffray and P. Vernotte, **p. 458.**
On the Hull **Magnetron** [Calculation of Wavelength].—L. Pincherle, **p. 404.**
On the [Split-Anode] **Magnetron** Oscillations [Types A and B].—K. Okabe, M. Isida and M. Hisida, **p. 581.**
The Investigation of Amplitude- and Frequency-**Modulated** Transmitters.—W. Runge, **p. 35.**
The Reception of Frequency-**Modulated** Radio Signals.—Andrew, **p. 522.**
The Fourier Analysis of **Modulated High Frequency Currents.**—M. Grützmacher, **p. 94.**
The Impedance of the Valve Generator for a Constant-Voltage **Modulating Frequency.**—J. Groszkowski, **p. 94.**
A Stroboscopic Method of Measuring Frequency- and Phase-**Modulation** [in Amplitude-Modulated Transmitters].—A. Heilmann, **p. 93.**
Amplitude, Phase, and Frequency **Modulation.**—H. Roder, **pp. 162 and 520.**
A Defect in Transmissions : Frequency **Modulation** as a Little-Known Source of Interference, **p. 522.**
On **Modulation** of Frequency.—A. M. Kugushev, **p. 283.**
Over-Voltage in the Source ot the Anode Current by Grid **Modulation** of a Radio Telephone Transmitter.—G. A. Zeitlenok, **p. 283.**
The Advantage of Moderate Depth of **Modulation** and Sufficient Proportion of Carrier Wave, in Ensuring True Synchronisation between Transmitter and Receiver.—Abraham, **p. 582.**
Distortion in **Modulation** by Iron-Cored Choke, investigated on the Machine Generator [and an Improved Modulation System].—M. Pohontsch, **p. 582.**
Theory of **Modulation** and its Practice.—Y. Fukuta, **p. 405.**
Note on the "De-phasing" Method of **Modulation.**—S.F.R. Chireix System.—H. Chireix, **p. 94.**
A New Method of **Modulation** (Chireix Dephasing System].—G.W.O.H. : Chireix, **p. 520.**
High Audio Power from Relatively Small Tubes : Application to Transmitter **Modulation.**—Heising : Barton, **p. 44.**
A New Method of Measuring the Degree of **Modulation** of a Telephony Transmitter.—J. Kammerloher, **p. 35.**
A Direct Reading **Modulation Meter.**—A. H. Cooper and G. P. Smith, **pp. 162 and 223.**
Modulation Meters and Indicators for Broadcasting Control Rooms.—Lubszynski and Weigt, **p. 240.**
An Instrument for Measuring **Modulation Ratio.**—V. N. Lepeshinskaja-Krakau, **p. 343.**
New Methods for the Measurement of **Modulation Ratio** [using Critical Voltage of a Neon Tube].—A. L. Minz, **p. 582.**
Modulation and Sidebands : Relation . . . etc.—N. F. S. Hecht, **p. 341.**
Note Relative to Hecht's Paper on "**Modulation and Side Bands.**"—J. B. Pomey : Hecht, **p. 520.**
The **Modulation System** of the Russian High-Power Station at Schtschelkowo.—H. Wigge, **pp. 162 and 458.**
An Analogy between Abbé's Theory of the Formation of Microscope Images and the Theory of Carrier Wave and Sidebands in the **Modulation of Wireless Waves.**—W. F. Einthoven, **p. 405.**
The Class B Push-Pull **Modulator.**—L. E. Barton, **p. 36.**
High-Power Performance from the Small 'Phone Transmitter : a Class B **Modulator** for Sets using Type '10 Tubes.—J. J. Lamb, **p. 94.**
Multiplex Transmission and **Secret** Radiotelephony.—Chireix : Villem, **p. 405.**
Oscillations of Systems with **Negative Characteristics.**—I. Runge : Rosing : Steimel, **p. 282.**
Operating Mechanisms of **Negative Resistance Oscillators** [Mathematical and Graphical Investigation].—R. Usui, **p. 342.**
On the Maintenance in Oscillation of the Most General Passive **Network.**—Le Corbeiller, **p. 457.**
The Question of **Non-Linear Distortion.**—R. Hofer, **p. 223.**
Optical Retroaction [for Generation of Sinusoidal and Relaxation Oscillations].—R. Sewig, **p. 342.**
Principal Electrical Relations in an **Oscillating Triode** [Graphical and Analytical Treatment].—S. I. Zilitinkevitch, **p. 341.**
On the Influence of Valve Resistance **in Oscillation Generators** [and the Stabilisation of Frequency by Series Anode Inductance].—N. W. McLachlan : Mallett, **p. 342.**
Valve Oscillators adjusted near to the **Oscillation Threshold** [Mathematical Investigation].—Y. Rocard, **p. 405.**
A Reversed-Current Feed-Back **Oscillator** [retaining Convenience of Dynatron Oscillator but oscillating up to 10 or 15 Megacycles].—W. van B. Roberts, **p. 343.**
A Recent Development in Vacuum Tube **Oscillator** Circuits.—Dow, **pp. 93 and 164.**
Calculation of a **Valve Oscillator with Detuned Oscillating Circuit.**—A. I. Berg, **p. 341.**
A New Treatment of Electron Tube **Oscillators** with Feed-Back Coupling.—C. K. Jen, **p. 163.**
On the Calculation of Electron Tube **Oscillators** [based on Anode Dissipation].—A. I. Joffe, **p. 283.**
Operating Mechanisms of Negative Resistance **Oscillators** (III) : Analytical Studies on the Fundamental Characteristics of Triode Oscillators.—R. Usui, **p. 459.**
Parasitic Oscillations in Broadcast Transmitters [and Their Cure].—A. D. Ring, **p. 583.**
Phase Displacement between Current and Voltage as a Possible Carrier of Communication.—Lubberger and Schleicher, **p. 162.**
Phase Modulation and Secret Communication.—T. Küzirai and T. Sakamoto, **p. 458.**
Phase Shift in Radio Transmitters [Causes and Effects : Cathode-Ray Oscillographic Investigation and Mathematical Treatment].—W. A. Fitch, **p. 520.**
Polyphase Electron Tube Oscillators [and particularly their Use for Ultra-Short-Wave Generation].—A. Arenberg, **p. 282.**
Asymmetry **in Push-Pull Circuits.**—Anceliovič, **p. 280.**
On Steady State Conditions in **Quartz-Controlled** Single and Two-Circuit Transmitters.—V. Petržílka and W. Fehr, **p. 636.**
Application of **Quartz Plates** to [Broadcasting and Aircraft] Radio Transmitters.—O. M. Hovgaard, **p. 521.**
Communication with **Quasi Optical Waves.**—E. Karplus, **p. 34.**
The **Resistance** of the Valve Generator.—S. I. Zilitinkevitch, **p. 458.**
Valve **Resistance** in Oscillation Generators [Reduction of Negative Resistance by Auxiliary Positive Resistance : Influence on Oscillation at Very High Frequencies, etc.].—N. W. McLachlan, **p. 459.**
On the Variation of the **Resistance** of Thermionic Valves at High [and Ultra-High] Frequencies.—Mitra and Sil, **p. 463.**
The Mode of Action of **Screen-Grid Transmitting Valves** [based on the Philips' Company's Valves].—de la Sablonière, **pp. 527-528.**
On the Frequencies of Double Circuit [R.F. and A.F.] **Screen-Grid Valve** Oscillators.—N. W. McLachlan, **p. 582.**
Secret Communication.—See Multiplex, Phase Modulation.
Short and Medium Wave Transmitter on s.s. "Santa Maria."—C. J. Pannill, **p. 223.**
Frequency Control Equipment of Post Office **Short-Wave Transmitters.**—E. J. C. Dixon, **p. 35.**
The **Single Side-Band System** Applied to Short Wavelengths.—A. H. Reeves, **p. 94.**
Stable and Unstable Oscillation of a Two-Circuit Valve Generator with Super-critical Coupling.—P. von Handel, **p. 35.**
An Experimental Study of the **Tetrode** as a Modulated Radio-Frequency Amplifier [particularly for Radiotelephone Transmission on Frequencies of and above 500 kc].—Robinson, **p. 168**

Trains of Waves Emitted at Constant Intervals of Time.—G. Petrucci, **p. 637.**

The Calculation of Leakage in Auto-**Transformers** [and their Use in Heising-Modulated Transmitter Circuits].—Gürtler, **p. 236.**

The Non-Uniform **Transmission Line.**—Starr, **p. 576.**

Building a Low-Cost 1 750-kc 'Phone-C.W. **Transmitter** [using Class B Modulator and Type 46 Valves].—G. Grammer, **p. 583.**

The Transmission and Reception of **Ultra-Short** Waves that are Modulated by Several Modulated High Frequencies.—M. von Ardenne, **p. 582.**

The Production of 28 Centimetre [**Ultra-Short**] Waves in Water by means of a 2.5 Metre Valve Oscillator.—Bergmann, **p. 636.**

A Two-Triode Circuit for the Generation of **Ultra-Short** Waves.—N. Carrara, **p. 222.**

The Dynatron Oscillator: with a New Circuit for **Very High Frequencies.**—F. M. Colebrook, **p. 34**: see also Dynatron.

Investigations on Valves Producing **Ultra-Short** Waves.—H. Collenbusch, **p. 403.**

On the **Ultra-High-Frequency** Oscillation of the Magnetostatic Vacuum Tube.—W. Dehlinger, **pp. 404** and **520.**

On the Production of **Ultra-Short** Electro-magnetic Waves.—A. Giacomini, **p. 581.**

Electrical Oscillations of **Very Short Wavelength.**—E. W. B. Gill, **pp. 34** and **282.**

Ultra-Short-Wave Oscillators [Positive Grid Connection].—C. Guttoп and G. Beauvais, **p. 34.**

Wavelength Characteristics of Coupled Circuits having Distributed Constants [and Application to the Electron Oscillator for **Ultra-Short** Waves].—R. King, **p. 637.**

Special Transmitting Circuit for **Ultra-Short** (Centimetre) Waves.—F. Noack: Kohl, **p. 282.**

Increased Power for **Ultra-Short** Waves.—H. N. Kozanowski: Westinghouse Company, **p. 404.**

A New Circuit [of Greatly Increased Power] for the Production of **Ultra-Short-Wave** Oscillations [Symmetrical Plate and Filament Lecher systems between Two Triodes].—H. N. Kozanowski, **p. 581.**

Summary of Work on the Production of **Ultra-Short** Waves.—Littmann, **p. 582.**

The Generation of [**Ultra-**] **Short** Waves.—W. W. Maslennikoff, **p. 341.**

Vacuum Tubes as [**Ultra-**] **High-Frequency** Oscillators.—E. D. McArthur and E. E. Spitzer, **p. 93.**

Electron Oscillations [**Ultra-Short** Waves round 35 Centimetres in Wavelength] in Four-Electrode Tubes.—K. Morita, **p. 341.**

A Note on the **Ultra-Short-Wave Oscillation** by the Back-Coupling Connection [Diodes and Triodes].—K. Morita, **p. 341.**

A New Type of **Ultra-Short-Wave** Oscillator ["Standing Wave Oscillator" with 12 kw Output at Minimum Wavelength around 3 Metres].—I. E. Mouromtseff and H. V. Noble, **p. 636.**

Transmitter for Amsterdam **Ultra-Short-Wave** Broadcasting Tests.—Nordlohne: Philips' Company, **p. 637.**

Practical 5-Metre [**Ultra-Short-Wave**] Working.—H. L. O'Heffernan and S. G. Morgan, **p. 459.**

Transmission Experiments with [**Ultra-Short**] **1.3 Metre Waves.**—O. Pfetscher and R. Beck, **p. 341.**

On the Measurement of the Energy of **Ultra-Short** Electromagnetic Waves.—G. Potapenko, **p. 281.**

On the Dependence of the Length of the **Ultra-Short** Electromagnetic Waves upon the Heating Current of the Tube and upon the Amplitude of the Oscillations.—G. Potapenko, **p. 281.**

Investigations in the Field of the **Ultra-Short** Electromagnetic Waves. Parts I to IV.—G. Potapenko, **pp. 281, 281, 520** and **582.**

Circuits and Valves for **Ultra-Short** (Decimetre) Waves.—Rindfleisch and Rohde, **p. 282.**

The Generation of **Ultra-Short** Waves of 1 Metre and Under: Valves for.—Rohde, **p. 586.**

The [**Ultra-Short Wave**] Oscillations occurring in Valves with Positive Grids.—A. Rostagni, **p. 92.**

The Calculation, from Energy Considerations, of the Limiting Frequencies at which Inversion of the Dynamic Characteristic Occurs, for Various Reaction Coupling Methods: *and* the Generation of **Ultra-Short** Waves.—J. Sahánek: Hollmann, **p. 35.**

On the Production of **Ultra-Short** Waves of 12 Centimetres.—S. Sonada and T. Takayama, **p. 341.**

On the Production of Various Electron Oscillations [**Ultra-Short**—Decimetre—Waves] by an Electron Tube: T.V.V. Type D.K.: Cymotron U.F.-101.—S. Sonada and T. Takayama, **p. 459.**

Direct Piezoelectric [Tourmalin] Control for **Ultra-Short** Waves.—Straubel, **p. 235.**

Generation of **Ultra-Short** Waves by Grid Distortion Harmonic Generator.—Terman, Chambers and Fisher, **p. 222.**

Radio Telephony by **Ultra-Short** [50-Centimetre] Waves.—Uda, **p. 164.**

Ultra-Short-Wave Telephony Transmitter.—S. Uda and J. Ikeuchi, **p. 637.**

Investigation of Oscillators for Wavelengths of the Order of a Decimetre [Valves with Spiral Grids and Anodes, for **Ultra-Short Wave** Generation].—U.S.S.R. Electrotechnical Institute, **p. 341.**

A New Method for Generating **Ultra-Short** Waves [down to a 130-cm Fundamental].—G. M. Vinnik and E. K. Zavoisky, **p. 636.**

An Experimental Study of Regenerative **Ultra-Short-Wave** [3-Metre] Oscillators.—W. H. Wenstrom, **p. 163.**

Historical Review of **Ultra-Short-Wave** Progress [chiefly in the Generation of Oscillations].—W. H. Wenstrom, **p. 163.**

The German P.O. **Ultra-Short-Wave** Transmitter for Broadcasting and Television, **p. 404.**

Construction of an **Ultra-Short-Wave** (8 m) Transmitter with Tourmalin Crystal Control, **p. 459.**

Ultra-Short Waves.—See Barkhausen-Kurz, Frequency (Control, Multiplier), Gill-Morrell, Magnetron, Polyphase, Quasi-Optical, Resistance.

The Behaviour of the Electron Valve at **Very High Frequencies.**—H. E. Hollmann, **p. 281.**

On the Electrical Oscillations of **Very Short Wavelength.**—A. Rostagni, **p. 282.**

Experiments with **Very Slow Oscillations** [1 c.p.s. and under] produced by Thermionic Valves.—F. Moeller, **p. 163.**

Study of **Weak Oscillations** in Valve Oscillator Circuits.—B. Giovanni, **p. 342.**

RECEPTION.

A New Light-Weight Receiver for Small **Aeroplanes.**—Standard Telephones and Cables, Ltd., **p. 166.**

An Efficient Battery-Operated Radio Receiver [using Eveready 2.5 volt "**Air Cell**" Batteries for Filaments and Dry Cells for Anodes, giving 1 000 Hours' Working].—L. E. Barton and L. T. Fowler, **p. 284.**

Battery Design Problems of the **Air Cell Receiver.**—F. T. Bowditch, **p. 284.**

The **Amplification Ratio** of Resistance-Coupled Valve Combinations.—Kapteyn, **pp. 278-279** and **338-339.**

The Resistance-Coupled **Amplifier** as Oscillatory Circuit.—Baerwald: Schlesinger, **p. 225.**

The A, B and C of **Amplifier** Classifications [Explanation of the Differences between Class A, Class B, and Class C Amplifiers].—G. Grammer, **p. 584.**

Amplification of the **Class B** Audio **Amplifier** to A.C. Operated Receivers.—L. E. Barton, **p. 583.**

An Untuned Radio-Frequency **Amplifier** [using an Intervalve Transformer with Associated Tightly-Coupled Circuit Tuned to a High Frequency].—Schor, **p. 161.**

Amplifier Tone-Control Circuits.—Scroggie, **p. 230.**

Resistance-coupled **Amplifiers** with an Amplification of the order of 450 per Stage.—Kapteyn, **p. 285.**

Output **Amplifiers** for 110-Volt D.C. Receivers.—J. R. Nelson, **p. 344.**

Resistance and Transformer Coupling for **Amplifiers**: a Comparison.—A. Forstmann, **p. 522.**

Amplifiers for Bands of Frequencies [for Frequency-Changing Receivers].—P. Drouin, **p. 521.**

A Theoretical Comparison of Coupled **Amplifiers with Staggered Circuits.**—Nelson, **p. 580.**

Reducing Errors due to **Atmospherics** by utilising their Irregularity in Space.—Montoriol and Subra, **p. 524.**

Automatic Device for Tuning-in to Different Stations at Different Times.—G. Frantz, **p. 408.**

Automatic Suppression of Intercarrier Noise in Radio Receivers [with Automatic Gain Control].—P. O. Farnham, **p. 408.**

Automatic Gain Control [and the Wunderlich Double-Grid Valve].—A. Dinsdale, **p. 639.**

Circuits to Obtain Detection and Delayed AVC [**Automatic Volume Control**: Variations of the Farnham Circuit].—J. R. Nelson: Farnham, **p. 407.**

Automatic Volume Control [Resistor between Detector Cathode and Negative Terminal of Common Source of Plate Supply, with Tapping to Screen Grid of R.F. Valve].—**p. 639.**

Automatic Volume Control—is it Worth While?—W. T. Cocking, **p. 639.**

The Problem of **Automatic Volume Control** without Auxiliary Valve finally Solved.—E. Rossman, **p. 639.**

Automatic Volume Control and Anti-Fading Device, **p. 639.**

Automobile Radio Problems Face Solution in 1932, **p. 284.**

New Use for Old Circuit [Revival of **Autoplex Circuit,** particularly for Midget Receivers].—H. G. Boyle, **p. 584.**

The **Autotone.**—F. L. Devereux and H. F. Smith, **p. 283.**

The **Autotone Portable.**—F. L. Devereux, **p. 524.**

New **Band Pass Circuit.**—N. R. Bligh, **p. 166.**

The Design of the **Band Pass Filter.**—N. R. Bligh, **p. 224.**

Band Pass Filters [for Broadcast Receivers].—H. Brykczynski, **p. 522.**

Bass Drum and Tympani—the 5 000 Cycle Limit, **p. 344.**

The **Battery V-M Three.**—W. I. G. Page, **p. 345.**

The **Beelitz** Overseas Receiving Station.—Mögel, **p. 539.**

Number of **Broadcasting Listeners** at 1st January, 1932, in Various Countries, **p. 524.**

Quantitative Investigations on **Broadcast Receivers.**—A. Harnisch, **pp. 94** and **164.**

Broadcast Receivers: I.E.E. Discussion on The Trend of Design.—C. F. Phillips and others, **p. 405.**

Developments in **Broadcast Receivers** during 1931, **p. 345.**

Mass Production of Radio **Cabinets.**—A. W. Richards, **p. 37.**

Radio in **Canada**—Trade Conditions in 1931, p. 525.
[**Chicago**] Trade Show Sees New Sets, Circuits, Tubes, p. 459.
Broadcast Reception in a **City** : Tuning to the " Calibrated " or the " Common " Tuning Point.—Ollendorff, p. 405.
Synchronous Electric **Clock** for Incorporation in Radio Receivers.—Ferranti, Ltd., p. 461.
New Development in Tuning **Coils** [" Ferrocart " Cores].—Hans Vogt, p. 640.
Use of a Vacuum Tube Operated Relay to **Control Blasting in** Radio Receivers.—B. Ephraigm, p. 36.
Controlling Volume with the Variable-Mu Valve.—N. R. Bligh and E. D. Whitehead, p. 95 : see also Volume, Automatic.
The Oscillating [**Crystal**] **Detector**.—Noack : Habann, p. 538.
What's Wrong with our **C.W.** Receivers ? [Suggested Elimination of " Image " Signal on " Other Side of Zero Beat " in Beat-Note Reception, with Increased Effectiveness of Audio-frequency Selectivity].—J. J. Lamb, p. 583.
Damping and Its Reduction in Coupled Circuits [in connection with Selective and Distortion-free Broadcasting Receivers].—Eilers, p. 161.
" Apparent **Demodulation** " : Another Viewpoint.—E. Mallett, p. 460.
Weak Signal **Demodulation** by a Strong Carrier.—E. V. Appleton, p. 460.
" **Demodulation.**"—F. M. Colebrook, p. 523.
Demodulation.—See also under " Properties of Circuits."
Radio **Design** and the Trend of the Radio Industries [in U.S.A.], p. 284.
Notes on the **Design** of Radio Receivers [Lecture before Radio Club of America].—L. Walsh, p. 584.
Dynamic Symmetry in Radio **Design.**—A. Van Dyck, p. 638.
Investigations into Anode **Detection.**—Ulbricht, p. 32.
Grid Circuit Linear **Detection** [using a Screen-Grid Valve].—J. R. Nelson, p. 224.
The Mutual Interference of Wireless Signals in Simultaneous **Detection.**—E. V. Appleton and D. Boohariwalla, p. 343.
The Mutual Interference of Signals in Simultaneous **Detection.**—E. V. Appleton : Callendar, pp. 405 and 523 : see also Demodulation.
Wireless Signals : their Mutual Influence in Simultaneous **Detection.**—E. V. Appleton and D. W. Fry, p. 583.
Further Notes on the **Detection** of Two Modulated Waves which Differ Slightly in Carrier Frequency.—C. B. Aiken, p. 343.
The **Detection** by a Straight Line Rectifier of Modulated and Heterodyne Signals.—E. B. Moullin, p. 522.
The Calculation of **Detection Performance** in a Vacuum Tube Circuit for Large Signals.—Woods, p. 457.
The Calculation of **Detection Performance** for Large Signals.—J. P. Woods, p. 523.
Hyper-sensitive **Detection Systems** [using the Autoplex Circuit].—H. G. Boyle, p. 36.
Detection.—See also under " Properties of Circuits."
Overload Limit Extension of the Tetrode **Detector** [Automatic Grid Bias Regulation extended to Filament-Type Detectors].—P. O. Farnham, p. 166.
Designing **Detector Circuits.**—P. K. Turner, p. 224.
A Cure for **Detector Damping.**—C. H. Smith, p. 95.
Detector Distortion at Low Input Voltages.—H. A. Brown, G. W. Pickels and C. T. Knipp, p. 284.
The Graphical Solution of **Detector Problems.**—G. S. C. Lucas, pp. 406 and 460.
Quality **Detectors** : a Survey of Rectification.—Greenwood and Preston, p. 161.
The **Diode.**—H. L. Kirke, p. 224.
More about the **Diode.**—H. L. Kirke, p. 408.
Distant Control of a Receiver by Automatic Telephone Dial, p. 461.
Measurement of Class B Amplifier **Distortion** [Plotting the Form Factor as Indicator of Distortion].—C. L. Farrar, p. 460.
On **Distortion Correction** by Resonance Methods, in Resistance-Coupled Amplifiers.—Bartels, p. 220.
Linear **Distortions** in Broadcast Receivers and Their Compensation by Low-Frequency Equalisation Devices.—A. Clausing and W. Kautter, p. 638.
Analysis and Reduction of Output **Disturbances** resulting from the Alternating Current Operation of the Heaters of Indirectly Heated Cathode Triodes.—J. O. McNally, p. 639.
An Undesirable Coupling Link in Radio Receivers [Common **Earth** Lead to Aerial System and Filaments or Chassis, or Both].—A. E. Teachman, p. 284.
Can Radio Sets be sold to **Europe** ? [with Statistics].—S. E. Laszlo, p. 166.
Tendencies in Radio Construction at the Eighth Annual Paris **Exhibition.**—M. Adam, p. 37.
Receivers at the Eighth German Radio **Exhibition**, p. 38.
Receivers at Olympia and other **Exhibitions**, p. 52 : see also Olympia.
A Three-Circuit Four-Valve Receiver with **Exponential Valve**, p. 524.
[The Construction of] Two Receivers for the Reduction of **Fading.**—R. Schadow, p. 406.
An Automatic Device for the Selection of the Temporarily Strongest Receiver Output [in Spaced-Receiver Reception for Combating **Fading**].—H. E. Kallmann, p. 406.
Microphonic **Feed-Back** Phenomena in Radio Receivers [particularly Self-Contained Receivers].—H. A. Brooke, pp. 225 and 640.
Counteracting Acoustic **Feed-Back** through the Tuning Condenser [particularly in Midget Receivers].—Z. Bouck, p. 225.
Higher **Fidelity** Standards are Here !, pp. 463-464.
Improved **Fidelity** of Two-Speaker Radio Receivers.—Knowles, p. 464.
The Construction of **Filter Circuits** in the German Broadcast Receiver Industry.—E. Schwandt, p. 96.
Constant Peak Band Pass **Filters.**—W.G.I.P, p. 37.
Novel Wireless Receiver, **Flat Elements on Flat Panel**, p. 36.
On the Action of Tuned Rectangular **Frame Aerials** when Receiving Short Waves.—Palmer, p. 526.
Single Valve **Frequency Changes** [and the Use of the Pentode].—W. T. Cocking, p. 639.
A New Two-Grid-Valve **Frequency-Changing Circuit** for 10–100 Metre Waves.—G. H. J. Horan, p. 36.
The Reception of **Frequency-Modulated** Radio Signals.—V. J. Andrew, p. 522.
A Defect in Transmissions : **Frequency Modulation** as a Little Known Source of Interference, p. 522.
Should Radio Receivers be **Fused** ? p. 345.
Quick-acting **Fuses** for Radio Receivers.—Sundt : Littelfuse Laboratories, p. 408.
Fuses and Scale **Illumination** in Receivers, p. 225.
" **Ganging** " the Tuning Controls of a Superheterodyne Receiver.—A. L. M. Sowerby, p. 225.
Oscillator for **Ganging**, p. 639.
G.E.C. 1932–33 Radio Programme.—G.E.C., p. 584.
A New Circuit for the Production of High Negative **Grid Bias.**—L. Medina, p. 225.
Automatic **Grid Bias.**—M. G. Scroggie, p. 345.
Grid Bias from Anode Current : Some Necessary Precautions [to avoid Effects due to A.F. Component in Added Resistance].—F. J. A. Pound, p. 639.
The Frequency Analysis of the **Heterodyne Envelope** : Its Relation to Problems of **Interference.**—Colebrook, p. 402.
Putting Back the **High Notes.**—W. T. Cocking, p. 405.
Directed Radio in **Hotels, Hospitals**, etc. New System eliminates Wiring for Room Reception—Steel Frame of Building serves as Aerial, p. 37.
The Measurement of Radio **Interference** [High Frequency Spectra of Disturbances from Motors, Rectifiers, etc.].—J. Alexander, pp. 524 and 639.
A Carrier **Interference** Eliminator.—W. Baggally, p. 523.
Radio **Interference** Elimination a Co-operative Task.—C. C. Campbell and H. N. Kalb, p. 37.
Radio **Interference** Problems [in California].—C. C. Campbell and H. N. Kalb, p. 640.
Electrical **Interference** in Motor Car Receivers.—L. F. Curtis, p. 407.
Reducing Radio **Interference** from Transmission Lines.—F. B. Doolittle, p. 584.
Reduction of Radio **Interference** from Telephone Power Plants.—J. M. Duguid, p. 96.
Trolleybuses and [**Interference** with] Radio Reception.—S. W. Duncan, p. 95.
Testing and Using Radio-**Interference** Choke Coils [for Power Lines].—B. E. Ellsworth, p. 584.
A Portable Meter for Tracing and Measuring **Interference**, embodying a " Standard Noise " Generator.—Gen. Elec. Company, p. 37.
Receiver Attachment for Cutting-Out **Interference** from Apparatus and Machines.—E. Gloor, p. 461.
The Possibility of Suppressing **Interference** with Broadcast Reception due to Electrical Make-and-Breaks.—K. Heinrich, p. 37.
Interference Prevention for Street Cars [Trams, etc., with Overhead Wires].—Hermle, p. 640.
On the Nature and Causes of the **Interference** with Broadcast Reception proceeding from H.T. Overhead Lines.—J. Herweg and G. Ulbricht, p. 166.
Eliminating **Interference** Caused by Electrical Equipment.—A. Larsen, p. 407.
Man-Made **Interference** and the Best Aerial for Its Suppression.—Leithäuser : Zerlett, p. 524.
Prevention of **Interference** with Broadcast Reception due to H.T. Overhead Lines : the Local Use of H.F. Chokes.—F. S. Mabry, p. 37.
A New Contribution to the Fight against Industrial [Power Line] **Interference** with Broadcast Reception.—S. Manczarski, p. 37.
Radio **Interference** [from Electrical Apparatus and Lines] : Its Causes and Elimination.—J. McCandless, p. 640.
Radio **Interference** from Insulator Corona.—F. O. McMillan, p. 224.
Radio Inductive **Interference** : Methods Employed [in Canada] to Locate and Suppress the Interference at its Source.—H. O. Merriman, p. 407.
Radio Inductive **Interference.**—H. O. Merriman, p. 407.
The Reduction of Atmospheric and Man-Made **Interference** in Reception.—E. Nesper, p. 224.
Protecting Devices against Local **Interference** for Connection at the Receiver.—E. Nesper, p. 407.
Transient-produced Oscillations in Branched Network, and the **Interference** caused by Them.—Ollendorff, p. 584.

The Siemens **Interference** Tracing Apparatus.—Siemens Company, **p. 95.**
The Incandescent Electric Lamp as a Cause of Radio **Interference.**—Wider : Koetz, p. 584.
Eliminating **Interference** from Thermostatically Controlled Electric Cushions.—A. C. Wiese, p. 524.
Polydoroff [**Iron**] Cores for Superheterodynes [either in Pre-Selector Stage or Oscillator].—Langley : Polydoroff, **p. 345 :** see also Permeability.
The Magnetic Susceptibility of **Iron** Powder Compositions, and its Dependence on Particle Size and Separation.—E. Gerold, **p. 640.**
Lamp Resistances for D.C. Receivers.—Henderson, **pp. 477-478.**
Current **Limiting Systems, p. 639.**
Generation of Combination and Harmonic Frequencies by **Linear and Non-Linear Vacuum Tube Circuits.**—Boner and Boner, **p. 457.**
The **Magnification** of the Tuned Circuit.—A. L. M. Sowerby, **p. 345.**
Personnel and Equipment for the Small **Manufacturer.**—Z. Bouck, **p. 408.**
Broadcast Receivers using the **" Micromesh "** Valves.—Standard Telephones and Cables, **pp. 462-463.**
The **Modern Straight Five.—W. I. G. Page and W. T. Cocking, p. 460.**
A Six-Valve **Motor-Car Receiver** mounted on Steering Column and using Condenser Aerial under Running Boards.—J. W. Berge, **p. 406.**
The **New Zealand** Radio [Receiver] Market, **p. 96.**
Background Noise in [Aircraft] Receivers.—W. Brintzinger and H. Viehmann, **p. 523.**
Background Noises.—W. T. Cocking, **p. 165.**
Olympia—1932 : **Olympia** in Review, **p. 639.**
The Trend of Progress [**Olympia** Radio Show], **p. 638.**
Effects on Reception of **Over-Modulation.**—C. E. Kilgour, **p. 284.**
The **Owin** Radio Apparatus Works', Hanover, All-Mains Five-Valve Receiver using Exponential Valves, **p. 584.**
Licences under the Amplifier **Patents, p. 461.**
Extensively Used [U.S.A.] **Patents** relating to Amplifying Circuits, **p. 584.**
A Single-Valve Portable Receiver for **Pedestrians.**—H. Prinzler, **p. 461.**
New **Pentode** Output Circuit.—L. G. A. Sims, **p. 524.**
The Application of **Permeability Tuning** to Broadcast Receivers [and the Use of Polyiron].—R. H. Langley : Polydoroff, **pp. 524 and 584 :** see also Iron.
Piezoelectric Band-Pass Filter.—J. Efrusi, **p. 285.**
Municipal **Police** and Radio.—A. Mestre, **p. 525.**
Police Wireless [Pocket Receiver and Calling Device], **p. 640.**
Power Grid and Leaky Grid—A Comparison.—W. I. G. Page, **p. 95.**
Problems that Face the Radio Engineer.—V. M. Graham, **p. 96.**
Problems of **Push-push Amplification.**—C. E. Kilgour, **p. 344.**
The New State **Radio Receiving Centre** at Noiseau [Paris].—G. Espinasse, **p. 96.**
The **Receiver of the Future, p. 165.**
Recording Characteristics of Radio Signals and Static [at the Bureau of Standards Laboratory].—S. R. Winters : Parkinson, **p. 225.**
Some Notes on Grid Circuit and Diode **Rectification.**—J. R. Nelson, **p. 583.**
Regeneration with Differential Condenser : Introduction of 1 000 Ohms Resistance in Series with Smaller Capacity, **p. 461.**
The Saic **" Filter-Aerial "** and a Comparison with Ordinary Filters.—Saic, **p. 407.**
The **Schaleco-Super-DX Receiver.**—Schackow, Leder and Company. **p. 460.**
To Teach **Schools** how to Select Radio Equipment. [Paragraph on the Co-operation between R.M.A. and U.S. Office of Education], **p. 285.**
Receiving Equipment for **Schools Broadcasting.**—H. Fasal, **p. 406.**
What Should the Ideal **Schools Broadcasting** Receiver Look Like ? Construction of a Battery-driven Receiver for Schools. The Detection of Faults in School Receivers. The Most Suitable Installation of a School Receiving Equipment, **p. 407.**
The Modern **Screened Coil.**—A. L. M. Sowerby, **p. 36.**
A Highly **Selective** Audio-frequency Transformer (Vibrating Reed Type) for Radiotelegraphic Channels spaced only 75 Cycles.—Gunn, **p. 345.**
Problems in **Selective** Reception.—M. V. Callender, **p. 638.**
Selectivity in Radiotelegraph Reception : Audio and Radio Frequency Selectivity : the Application of Band-Pass and Low-Pass Filters : the Simplification of their Design and Construction.—R. A. Hull, **p. 224.**
More About Audio **Selectivity** [and Its use in Radiotelegraphy].—L. W. Hatry : Hull, **p. 345.**
An Examination of **Selectivity.**—R. H. Langley, **p. 343.**
Super-Selectivity *versus* Sidebands [Advantages of Great Selectivity with Audio Compensation], **p. 343.**
The **Selectivity** of Broadcast Receivers : I. E. E. Discussion, **p. 405.**
The **Selectivity** of Broadcast Receivers. I.E.E. Discussion : A Correction.—H. L. Kirke, **p. 460.**
The **Selectivity** of Broadcast Receivers [Introduction to Discussion].—C. L. Fortescue, **p. 522.**
Increasing **Selectivity** by Crystal in Intermediate Circuit of Superheterodyne, **p. 522.**
Selectivity and Tone Correction.—F. M. Colebrook, **p. 165.**
Eckert **Selectivity-Increasing** Attachment.—C. H. W. Nason, **p. 224.**
Modern Fabrication of Radio Receivers and Other Like Assemblies [particularly the use of **Self-Tapping Screws**].—A. C. Lescarboura, **p. 225.**
Sensitivity Controls—Manual and Automatic.—D. D. Israel, **p. 344 :** see also Volume, Automatic.
Formation of the Institute of Radio **Service Men** in Chicago, **p. 37.**
German **Shielded Down-Leads, p. 640.**
Marconi **Short-Wave** Receiver Type Rg. 31a [15 to 200 Metres : Suitable for Duplex Working], **p. 584.**
Onward March of **Short-Wave** Radio [and the R.M.A. Statement on Short-Wave Reception], **p. 584.**
Short-Wave Adaptors for Broadcast Receivers.—Burne Jones & Company, **p. 584.**
Some Effects of Topography and Ground on **Short-Wave Reception.**—R. K. Potter and H. T. Friis, **p. 344.**
Short Wave Reception and Ultra-Radiation.—Schulze, **p. 88.**
The Modulated Current in the Resonance Circuit, the **Side Band Coefficient,** and the Radio Receiver Characteristics related to Them.—S. Takamura, **p. 344.**
Physical Reality of **Side-Bands** [and the Relative Height of the Three Peaks].—F. M. Colebrook, **p. 165.**
Practical Points in Connection with **Single-Knob Tuning.**—H. Fasal, **p. 408.**
Engineering Acoustics : No. 88. **The Stenode Principle, p. 584.**
The Stenode Radiostat.—F. G. Philpott : **G.W.O.H, p. 165.**
The Stenode Radiostat.—**J. Robinson, p. 225.**
The **Stenode Radiostat.**—P. G. Davidson : Robinson, **p. 343.**
The **Stenode Receiver** and the Side-Band Theory.—J. Robinson : Fortescue, **p. 36.**
Straight Sets versus Superheterodynes, p. 584.
Receiver for **Submarines :** Reception under Water [3000–20 000 Metre Waves].—Soc. Franç. Rad:élec., **p. 406.**
Radio Reception and **Sun Spots.**—H. T. Stetson, **pp. 95 and 408.**
The Single-Signal **Superhet.**—Lamb, **p. 583.**
Single Dial **Superheterodyne.**—F. H. Haynes and W. T. Cocking, **p. 95.**
An Advanced Television and Short-Wave **Superheterodyne** Receiver [avoiding Motor-Boating and Other Reaction Troubles by Use of Carborundum Detectors in Both Stages].—Tanner, **p. 591.**
The Modern Band Filter **Superheterodyne** with Fading Compensator, for Amateur Construction : Introductory.—E. Rossmann, **p. 524.**
The Superheterodyne as the Receiver of the Future.—R. Wigand : Brüller, **p. 95.**
The **Superheterodyne** as the Long-Distance Receiver of the Future.—S. Brüller, **p. 406.**
Changing a Tuned R.F. Type of Receiver to a **Superheterodyne** [" Superheterodyne Converter with Remote Control."]—General Motors Radio Corporation, **p. 408.**
Stabilising **Superheterodyne** Performance : Electron-Coupled Oscillators Using Heater-Type Tubes.—J. J. Lamb : Dow, **p. 406.**
Superheterodyne Improvements.—W. T. Cocking, **p. 345.**
The Padding Condenser : Graphic Solution of a Single-Dial **Superheterodyne Problem.**—B. F. McNamee, **p. 461.**
[Prevention of] Acoustic Feedback in **Superheterodyne Receivers.**—E. Messing, **p. 406.**
A Solution of the **Superheterodyne Tracking Problem** [Mathematical: Determination of the Oscillator Inductance and Fixed Series Condenser].—V. D. Landon and E. A. Sveen, **p. 639.**
Single Control **Superheterodynes.**—H. Andrewes, **p. 95.**
One Knob Control for **Superheterodynes.**—A. L. M. Sowerby, **p. 345.**
Super-regeneration and Short [and Ultra-Short] Waves.—H. B. Dent, **p. 406.**
The Action of the **Super-regenerative** Receiver.—G. Gorelik and G. Hintz, **p. 164.**
A Balanced Modulator **Super-regenerative** Circuit.—W. van B. Roberts : Armstrong, **p. 584.**
A Cigar-Box **Super-regenerative** Receiver [550–1 000 kc, using a 4.5 v Anode Battery and One Triode].—W. van B. Roberts, **p. 406.**
The Reimann **" Synchronous "** Receiver.—Reimann, **p. 461 :** see also Zero-Beat.
" Synchronous " Reception.—H. de Bellescize, **p. 521.**
A Modern Receiver for **Telegraphic Traffic** on " Medium " Waves [3000 to 21 000 Metres : the Noiseau Station Equipment].—G. Espinasse, **p. 523.**
Developments in the **Testing** of Radio Receivers.—H. A. Thomas, **pp. 460 and 524.**
The **Testing** of Broadcast Receivers [at the Radio Institute, Warsaw].—S. Dierewianko, **p. 524.**
Modern Production Sensitivity Measurement [Receiver **Testing** Equipment for Large or Medium Size Plants].—R. F. Shea, **p. 584.**
Testing Radio Receivers on the Assembly Line.—A. E. Thiessen General Radio Company, **p. 584.**
Testing Set for Broadcast Receivers, **p. 584.**
German Testing Sets for Radio Servicing, p. 639.
Continuity **Tests** of Radio Receivers.—J. F. Rider, **p. 408.**
A Receiver for the Automatic Recording of **Time Signals** [for Longitude Determinations], and the Response Time of the Apparatus.—A. Schagger, **p. 284.**

Tone Correction and Distortion.—N. W. McLachlan, p. 460.

Tone Correction Explained, p. 638.

Ford Car Planetary Gear Principle for **Tuning Dial** of Receiver.—American Radiostat Company, p. 37.

Luminous Neon Column Operated by Amplified Carrier Wave as **Tuning Indicator** for Receivers (Fada Automatic Flashograph), p. 37.

Receivers for **Ultra-Short-Wave** Broadcasting.—Nordlohne: Philips' Company, p. 638.

Historical Review of **Ultra-Short-Wave** Progress.—Wenstrom, p. 163.

Ultra-Short-Wave Receivers [German].—R. Raven-Hart, p. 285.

Tests on Five **Ultra-Short-Wave** Receivers [7 to 13 Metres: Two-Stage with Retroactive Detector; Super-regenerative; and Supersonic Heterodyne].—R. L. Smith-Rose and H. A. Thomas, p. 406.

An **Ultra-Short-Wave Super-Regenerative** Five Metre Receiver.—E. P. Hufragel and G. J. Herrscher, p. 585.

Do **Ultra-Short-Wave** Transmissions Interfere with Broadcast Reception? p. 95.

Radio Telephony by **Ultra-Short** [50-Centimetre] **Waves.**—S. Uda, p. 164.

Receivers for **Ultra-Short** (Decimetre) **Waves.**—Rindfleisch and Rohde, p. 285.

Special Receiving Circuit for **Ultra-Short** (Centimetre) **Waves.**—F. Noack: Kohl, p. 285.

The Detection of Micro-Waves [**Ultra-Short**—Decimetre—**Waves**].—N. Carrara, p. 461.

Highly Sensitive Indicators for **Ultra-Short Waves** below 10 Centimetres [Radiometer and Bolometer Reception].—W. Zobel, p. 585.

The Aperiodic Amplification of **Ultra-Short Waves** [by the Use of Loewe Multiple Valves with Tuned Choke Coupling].—M. von Ardenne, p. 637.

The Transmission and Reception of **Ultra-Short Waves** that are Modulated by Several Modulated High Frequencies.—von Ardenne, p. 582.

Ultra-Short Waves.—See also Super-regeneration.

The **Variable-Mu Three.**—W. I. G. Page and W. T. Cocking, p. 95.

Visual Tuning of Band-Pass Amplifiers [using Dynatron Oscillator].—R. De Cola, p. 408.

The Desirability of Incorporating Automatic Mains **Voltage Control** in a Receiver.—A. C. Lescarboura, p. 36.

The Remote **Volume Control.**—W. T. Cocking, p. 95.

Volume Control in Screen-Grid Valve Receivers.—W. Nikolaus, p. 639.

Volume Controls: a Review of the Development of Volume Control Systems, including Design to meet Present-Day Requirements.—W. S. Parsons, p. 408: see also Automatic, Control(ling) Limiting, and Sensitivity.

Causes of **Volume Fluctuations** in A.C. Mains-Driven Receivers, p. 284.

The Importance of **Volume Level.**—R. Raven-Hart, p. 407.

Communication in the New **Waldorf Astoria**, p. 37.

Distributing Programs in the **Waldorf Astoria.**—J. J. Kuhn, p. 284.

A Balanced **Wave Trap.**—W. S. Percival, p. 638.

Reception and **Weather Conditions.**—German Amateurs, p. 223.

The **Wireless World "Autotone"**: High Circuit Selectivity with Tone Correction, p. 344.

The **Wireless World Baby Superhet.**—W. T. Cocking, p. 639.

Wireless World Monodial A.C. Super.—W. T. Cocking, p. 345.

Wireless World Power Radio-Gram.—A. L. M. Sowerby and H. F. Smith, p. 171.

The **Wireless World Three.**—F. H. Haynes: W. T. Cocking, pp. 37, 37 and 284.

Zero-Beat Tuning used in Highly Selective (Oscillating) Broadcast Receiver.—F. Reimann, p. 344: see also Synchronous.

AERIALS AND AERIAL SYSTEMS.

The **Absorption of Energy** by a Wireless Aerial.—J. A. Ratcliffe, p. 38.

Investigation of **Airplane** Antennas on Models.—P. A. Petrov, p. 285.

Characteristics of **Airplane** Antennas for Radio Range Beacon Reception.—H. Diamond and G. L. Davies, p. 346.

The Vertical Polar Diagram of a Marconi **Beam Aerial.**—T. L. Eckersley, p. 346.

The Space Radiation Diagram of the Telefunken **Beam Aerial** System.—R. Bechmann, p. 38.

Radiation Measurements on a Modern Telefunken **Beam Aerial** System at the Nauen High-power Station.—K. Krüger and H. Plendl, p. 167.

Aeroplane Measurement of the Radiation Characteristics of Short Wave **Beam Aerials.**—K. Krüger and H. Plendl, p. 226.

Portable Apparatus for the Adjustment of **Beam Aerials.**—Soc. Franç. Rad:élec., p. 408.

Radiation Characteristics of **Beam Antennas** [and the Dispersion of the Beam by the Heaviside Layer].—T. Minohara, K. Tani, and Y. Ito, p. 527.

Calculation of the Radiation Energy of Dipole Aerials—Telefunken **Beam Systems** according to the Poynting Method.—J. Labus, p. 285.

Broadcasting Aerial System for the Suppression of Fading.—C. Lorenz Company and German P.O., p. 346.

Short [and Ultra-Short] Wave **Broadcasting Aerials** [to Eliminate Skip Distance Effect: as at Zeesen Station].—O. Böhm, p. 525: see also Skip Distance.

"Long Wave" [Medium Wave] **Broadcasting Aerials** with Suppression of High Angle Radiation [the "Disc" or "Wheel," "Cylinder" or "Polygon," and "One-Wire" Aerial Systems].—O. Böhm., p. 526.

The Breslau **Broadcasting Station One-Wire Aerial** for the Suppression of Near Fading.—Böhm, p. 526.

Preliminary Communication on Experiments on the Prevention of [Short Range] Fading in **Broadcast Transmissions** with Aerial Systems of Ordinary Height—Quarter Wavelength—and Great Horizontal Spread [Suppression of Space Wave].—H. Harbich and W. Hahnemann, p. 166.

A Continuously Loaded **Cable** for use at High Frequencies [at Receiving Stations of Long-Wave Transatlantic Telephony Circuit].—F. E. Nancarrow and H. Stanesby, p. 226.

Circuit Relations in Radiating Systems and Applications to Antenna Problems.—P. S. Carter, p. 585.

The Action of **Cylinders** in an Electromagnetic Wave Field.—H. Kikuchi, p. 461.

The Spreading of Electromagnetic Waves from a **Hertzian Dipole.**—J. A. Ratcliffe, L. G. Vedy and A. F. Wilkins, pp. 347 and 408.

Study of the Harmonics of Symmetrical and Asymmetrical **Dipole** Oscillators.—K. F. Lindman, p. 347.

The Radiation Energy of the **Dipole Aerial with Reflector.**—J. Labus, p. 640.

Experiments on the Tuning of **Directional** [Lecher Wire Type] Short Wave Aerials.—F. Kiebitz, p. 226.

Development of **Directive** Transmitting Antennas by R.C.A. Communications, Inc.—P. S. Carter, C. W. Hansell and N. E. Lindenblad, p. 38.

Directive Aerial System with Groups of Varying Effective Height, p. 640.

Short Wave **Directive Aerials** at Bandoeng.—W. F. Einthoven, p. 408.

Field Distribution and Energy Emission of **Directive Aerials.**—E. Siegel and J. Labus, p. 347.

Application of Plane Wave Optical Theory to Calculation of Vertical Plane **Directivity** of Aerials.—Potter and Friis., p. 347.

Radiation from Antennae under the Influence of the **Earth.** D.—Radiation Measurements with Antennae.—Strutt, p. 27.

The Effect of the **Earth** on the Natural Wavelength, Impedance and Admittance of a Single Horizontal Wire.—G. Hara, p. 285.

A Method for Determining the Effect of the **Earth** on the Radiation from Aerial Systems.—J. S. McPetrie, pp. 347 and 527.

A Simple Non-polarising **Earth** for Curing "Noisy Grounds" [Daniell Cell Porous Pot, Copper Sulphate Solution and Copper Rod].—W. Butz, p. 348.

An Experimental and Analytical Investigation of **Earthed Receiving Aerials.**—F. M. Colebrook, p. 526.

Reducing **Fading** by Alternately Connecting Power Amplifier to Vertical Aerial and Horizontal Dipole, p. 640.

Aerials for Suppression of **Fading.**—See also Broadcasting, Skip Distance.

Feeder Adjustments for Short Wave Vertical Aerials.—N. Wells, p. 167.

Note on a One-Wire **Feeder** for Travelling Waves.—G. A. Uger, p. 346.

Elimination of Reflection in H.F. **Feeders.**—K. Posthumus, p. 346.

The Conduction of High-frequency Oscillatory **Energy** [**Feeder** Theory and Measurements].—H. O. Roosenstein, p. 38.

New Damping Measurements on High-Frequency **Feeders.**—K. Baumann and H. O. Roosenstein: Gothe, p. 226.

Transmission Lines [Transmitting and Receiving **Feeders**] for Short-Wave Radio Systems.—E. J. Sterba and C. B. Feldman, p. 585.

Remarks on the Papers . . . "On the **Field** Radiated from a Finite Antenna . . ."—Weyrich, p. 28.

Measurements in the **Field** Radiated by a Vertical Antenna, Excited in Its Fundamental Oscillation, between Two Perfectly Conducting Planes.—Bergmann and Doertel, p. 453.

The **Field** in the Immediate Neighbourhood of a Transmitting Aerial.—G.W.O.H.: Ratcliffe, Vedy and Wilkins: Zickendraht, p. 347.

The Electromagnetic **Field** produced by a Wire [of Infinite Length] Traversed by a Sinusoidal Current above a Conducting Layer.—Dubourdieu, p. 339.

The **Fields** produced by a Line traversed by an Alternating Current with Earth Return, and by a Horizontal Aerial.—F. Pollaczek, p. 462.

Mast **Foundations** in Sea and in Wet Ground, p. 527.

When a **Frame Aerial** is Worth While.—A. L. M. Sowerby, p. 586.

Receiving **Frame Aerials** for Low-frequency Alternating Magnetic Fields [for Loth System].—Bourgonnier and Durepaire, p. 350.

On the Action of Tuned Rectangular **Frame Aerials** when Receiving Short Waves.—L. S. Palmer, p. 526.

The Action of Short-Wave **Frame Aerials.**—L. S. Palmer and L. L. K. Honeyball, p. 640.

Graphical Determination of Polar Patterns of Directional Antenna Systems.—G. L. Davies and W. H. Orton, **p. 527.**

Graphical Method of Calculating the Mechanical Design of an Aerial.—I. S. Gonorovsky, **p. 348.**

A **Graphical Synthesis** of Aerial Arrays.—A. W. Ladner, **p. 167.**

Mutual **Impedance** of **Grounded Wires** above the Surface of the Earth.—R. M. Foster, **p. 641.**

Effect of **Height** of Transmitting Aerial (Aircraft in Flight).—Coe and Rives, **p. 586.**

Contribution to the Experimental Study of Electrical **Induction.**—A. Turpain and H. Sabatier, **p. 347.**

A Half-Wave **Mast Antenna, p. 167 :** see also Tower.

Multi-Hertzian Oscillators.—H. Kikuchi, **p. 462.**

Aerial Lead-in in an Area of High **Noise** Level.—H. J. Loftis and H. C. Forbes, **p. 226.**

Eliminating Background **Noise** [from Lift Relays, etc., using Dipole Aerial with Closely Coupled Transformer and Two-Wire Shielded Cable leading to Short-Wave Receiver].—W. Bell, **p. 586 :** see also Screened, Shielded.

The **Propagation** of Radio Frequency Currents along a Wire of Finite Length.—F. W. G. White, **p. 585.**

The **Radiation Characteristics** of Earthed Umbrella, L and T Aerials.—L. Hochgraf, **p. 226.**

Radiation Resistance of Complex Antennas.—K. Tani, **pp. 167** and **285.**

More about the **Radiation Resistance.**—B. L. Rosing, **p. 285.**

A Method of Calculating **Radiation Resistance**, and Its Application to the Investigation of the Efficiency of Multiple Aerials of Simple Type.—E. T. Glas, **p. 586.**

Tests with **Receiving Aerials.**—E. Neckenbürger, **pp. 226** and **408.**

A **Reciprocal Theorem** in the Theory of Diffraction [Application to Theory of Loud Speakers and Aerial Arrays].—Smith, **p. 640.**

On the Free Electrical Vibrations of **Rod-Shaped** Conductors.—K. F. Lindman, **pp. 461** and **640.**

What Can the "**Screened Aerial**" Do ? [Possibility of Cutting-Out Local Disturbances by Screening the Down-Lead].—E. Nesper, **p. 409.**

Special "Soludra" Cable for **Screened Down-Leads, p. 527.**

German Shielded Down-Leads, p. 640.

Reducing "Radio Inductive Susceptiveness" of Broadcast Receivers by Use of **Shielded Lead-in** or Underground or Grounded Aerials.—Merriman, **p. 409.**

On the Straight Wire [**Short-Wave**] Receiving Antenna with Distributed E.M.F.—H. Iwakata, **p. 462.**

Developments in **Short-Wave Directive** Antennae.—E. Bruce, **p. 96.**

Overcoming "**Skip Distance**" Effect [New Single-Mast Short Wave Aerial System at Zeesen]., **p. 408 :** see also Broadcasting.

On the **Space Waves** from a Vertical Doublet on a Plane Earth.—van der Pol and Niessen, **p. 87.**

Man-Made **Static** and the Best Aerial for Its Suppression.—Leithäuser : Zerlett, **p. 524.**

[Insulated] Radio **Tower** Tuning and Lighting.—V. V. Gunsolley, **p. 586.**

Single Insulated **Tower** as Broadcasting Aerial.—I. T. and T., **p. 285 :** see also Mast.

Principles of Radio **Tower** Design.—T. W., **p. 38.**

Towers with Reduced Staying, Bouvier-Bourseire System.—Soc. S.F.R. : Bourseire, **p. 96.**

Radio **Towers** and Antennas.—N. Gerten, **p. 38.**

Short-Wave Broadcast **Towers** [Base and Guy **Insulators** for].—R. L. Jenner, **p. 586.**

Antenna Resonance **Transformers.**—V. V. Tatarinov, **p. 285.**

Tuning Dipole Aerials by Shunted Flash-Lamp Combined with Weston Photronic Cell leading to Microammeter in Operating Room, **p. 586.**

Aerials and Reflectors used in Italian 50-Centimetre [**Ultra-Short-**] **Wave** Demonstration.—G. Marconi, **p. 96.**

Effect of Aerial Height in **Ultra-Short-Wave** Broadcasting in Cities.—Schröter, **p. 38.**

Reflectors and Feeders for **Ultra-Short**—18 Centimetre—**Waves** [Dover-Calais Service].—R. Darbord, **p. 346.**

Application of the Principle of Huyghens to the Calculation of Reflectors for **Ultra-Short-Waves.**—R. Darbord, **p. 525.**

The Action of Sheet Metal and Grid Reflectors for **Ultra-Short Waves** [Experimental Investigation].—W. Köhler, **p. 525.**

VALVES AND THERMIONICS.

Can Radio Tubes Be Sold **Abroad** ?—S. E. Laszlo, **p. 350.**

The Use of Thermionics in the Study of **Adsorption** of Vapours and Gases.—J. A. Becker, **p. 410.**

The Development of an Electron-Emitting **Alloy.**—O. S. Duffendack, R. A. Wolfe and D. W. Randolph, **p. 227.**

The New 57 as a High Gain **Audio Amplifier.**—L. C. Waller, **p. 587.**

An **Automobile** Tube of Increased Output [Eveready Raytheon Type LA].—M. Bareiss, **p. 350.**

The Electrical Conduction of **Barium Oxide** and its connection with Electronic Emission [the Actions in the Activating Process and in Actual Working].—W. Meyer and A. Schmidt, **p. 348.**

A Measurement of **Boltzmann's Constant** by means of the Fluctuations of Electron Pressure in a Conductor [containing Description of Attenuator System].—H. D. Ellis and E. B. Moullin, **p. 588.**

On the **Burning-Out** Process of Wires Heated in Vacuo.—L. Prásnik, **pp. 168, 410** and **588.**

Thermionic Emission in **Caesium-Oxide Photocells** at Room Temperatures.—E. F. Kingsbury, **p. 228.**

Cathode-Ray Tube as a Recorder of Receiving Valve Characteristics.—M. von Ardenne, **p. 97.**

Experimental Investigations of Distillation **Cathodes** [Acid Process, Barium on Platinum].—W. Hinsch, **p. 96.**

Cathodes.—See also Alloy, Barium, Cobalt, Cold, Filaments, Oxide.

Determination of the Cube Term in a Valve **Characteristic.**—Stedman, **p. 286.**

A New Valve **Characteristic** [for Comparing or Designing Detectors].—P. K. Turner, **p. 528.**

The Various Types of **Characteristic Curve** [particularly of German Screen-Grid and Pentode Valves].—K. Nentwig, **p. 528.**

Thermionic Valve **Characteristics.**—A. Gehrts, **p. 348.**

Desirable Tube **Characteristics :** A New Point of View, with Special Reference to Screen-Grid Amplifier Tubes [by Consideration of the Equivalent Parallel Circuit].—G. D. Robinson, **p. 586.**

"**Cheater Circuits**" for Synthetic Testing of Mercury-Vapour Tubes [for Economy in Power and Apparatus].—J. L. Zehner : G.E.C., **p. 588.**

Papers on the Use of Valves as **Class A, B and C** Amplifiers.—Farrar : Fay, **p. 283.**

New Tubes for **Class B** Audio : the Type RCA-46 Amplifier [Zero Bias] and Type RCA-82 Rectifier.—G. Grammer, **p. 587.**

A Tube for **Class B** Amplifier Service [Radiotron RCA-46 and Cunningham C-46], **p. 587.**

The Operation of Vacuum Tubes as **Class B** and **Class C** Amplifiers.—Fay, **p. 349.**

Photoelectric and Thermionic Emission from **Cobalt.**—Cardwell, **p. 234.**

Cobalt Alloy Filaments [with Tensile Strength Four Times that of Nickel].—De Forest Company, **p. 168.**

A "**Cold**" Filamentless Radio Tube.—C. W. Hough : A. Hund, **p. 38.**

[**Cold**] Valve without Filament or Vacuum.—A. Hund, **p. 349.**

Status of **Cold-Cathode** Tubes Abroad.—I. J. Saxl : Seibt : von Ardenne, **p. 286.**

Filamentless [**Cold Cathode**] Radio Tubes [on Glow-Discharge Principle].—M. Guntherschulze and F. Keller, **p. 168.**

Effect of the Target on Breakdown in **Cold Emission.**—W. H. Bennett, **p. 228.**

Effect of a Glass Target on **Cold Emission.**—W. H. Bennett, **p. 588.**

Dynamic Arrangement for **Comparing the Constants** of Two Triodes.—C. Dei, **p. 409.**

Spurious **Contact Potentials** and "Trapped" Electrons.—W. B. Nottingham, **p. 228.**

Which Tube for the **Crystal Oscillator** ?—G. Grammer, **p. 349.**

The Influence of the Grid/Plate Capacity of the **Detector** Valve in Radio Receivers without Retroaction.—A. van Sluiters, **p. 228.**

A New High Quality **Detector** Tube.—Wunderlich, **p. 409.**

The RCA 55 : A Duplex-Diode Triode Unipotential Cathode **Detector** Valve, **p. 463.**

Remarks on the Triangular Valve **Diagram.**—H. Klingelhöffer and A. Walther, **p. 227.**

Diffusion of **Electrons** Back to an Emitting Electrode in a Gas.—I. Langmuir, **p. 228.**

The **Diode.**—Kirke, **p. 224.**

More About the **Diode.**—Kirke, **p. 408.**

The Deviation of Anode Currents in **Diodes** from the Three-Halves Power Law.—A. Gehrts, **p. 463.**

Distortion in Valve Characteristics.—G. S. C. Lucas, **pp. 168** and **229.**

Coefficients of Non-Linear **Distortion** of Amplifying Triodes.—A. Clausing, **p. 587.**

Measurement of Class B Amplifier **Distortion** [Plotting the Form Factor as Indicator of Distortion].—C. L. Farrar, **p. 463.**

The Theory of **Distortion** in **Screen-Grid Valves** [Mathematical Investigation, and Application to Design of Screen-Grid Valves, particularly of Variable-Mu Type].—R. O. Carter, **p. 587.**

An **Electromagnetically** Controlled Three-Electrode Vacuum Tube.—F. B. Haynes, **p. 168.**

Simple Method for the Measurement of Very Low Grid Currents in "**Electrometer**" Valves.—L. Sutherlin, **p. 97.**

An **Electrometer Triode.**—Curtiss : Leprince-Ringuet, **p. 642.**

A Valve with Sudden Fall of **Emission** at **End of Life, p. 641.**

A Method of Measuring **Emission Current** of an Electron Tube [Short-Period Application of Anode-Voltage to avoid Damage in Overloading].—E. Iso and H. Ikushima, **p. 350.**

The **Energy Distribution** of Electrons [Extracted from a Cold Tungsten Filament by means of a High Electrical Field] in Field Current Emission.—J. E. Henderson, **p. 588.**

The **Equilibrium Distribution** of Potential and of Electrons Outside the Surface of a Conductor.—A. T. Waterman, **p. 97.**

Recording the **Equipotential Lines** of the Field in a Valve.—McArthur, **p. 463.**

Accommodation Coefficient of Hydrogen : a Sensitive Detector of Surface Films [on Tungsten **Filaments**].—K. B. Blodgett and I. Langmuir, **p. 410.**

Filaments.—See also Cathodes.

The **Flash-Arc** [" Rocky Point Effect "] in High-power Valves.—B. S. Gossling, pp. 409 and 528.
The Upper **Frequency Limit** of Oscillator Valves [Theoretical Treatment].—C. Matteini, p. 642.
Development of Valves in **Germany**.—Urtel, p. 641.
Control of the **Glow Discharge** on a Grid Cathode by means of a Third Electrode behind the Cathode.—A. Güntherschulze and F. Keller, p. 227.
Thermionic Valve with Fall of Potential across the **Grid**.—A. Lo Surdo, p. 38.
Control Conditions of **Grid-Controlled** Gas Discharges—Ion Control Valves [e.g., Thyratrons].—Klemperer and Lübcke, p. 359.
The **Heptode**—a Novel Thermionic Valve [Push-Pull H.F. Amplifying Valve for Short Wave Control].—E. J. C. Dixon, p. 227.
A Heavy-Duty **Industrial** Amplifier Tube [Type RJ-563, Amplification Factor 4, Anode Current 0.20 A as D.C. Amplifier, 0.10 A as A.C. Amplifier].—C. B. Upp : Westinghouse Company, p. 463.
Amplifier Tubes for **Industrial** Applications.—L. R. Harness, p. 588 : see also Phototube Circuits.
Insulator Developments point to Noiseless A.C. Tubes.—H. L. Crowley, p. 587.
Ionisation in Vacuum Tubes [and the Advantage of the Buckley Method of Checking Gas Content].—R. de Cola : Buckley, p. 410.
Investigation of the Thermionic Emission of **Iron**.—G. Siljeholm, p. 97.
Konel—a Substitute for Platinum [and the Use of Nickel for Filaments].—E. F. Lowry., p. 227.
A New **Low Noise** Vacuum Tube.—G. F. Metcalf and T. M. Dickinson, pp. 409 and 587.
Purification of **Magnesium**.—W. Kaufmann and P. Siedler, p. 98.
Eccentric Split-Anode **Magnetron** for Generation of Type A Oscillations.—Okabe, Isida and Hisida, p. 586.
The **Mains** Valve.—W. T. Cocking, p. 38.
Modern **Manufacture** of Radio Tubes.—J. B. Nealey : Grigsby Grunow Company, p. 39.
Costs in Radio Tube **Manufacture**.—T. E. Conway, p. 588.
Manufacturing Spray Shield Tubes.—Lewis : Grigsby-Grunow Company, p. 98.
Vacuum Tube Performance versus **Manufacturing Tolerances**.—W. Charton, p. 350.
On the Electron Theory of **Metals**.—L. Nordheim, p. 97.
The " **Micromesh** " Valve.—I. T. and T., p. 286.
Broadcast Receivers using the " **Micromesh** " Valves.—Standard Telephones and Cables, p.. 462.
On **Micropyrometry**, especially on an Objective Micropyrometer [for Temperature Measurements on Filaments, etc.].—G. Lewin, W. W. Loebe and C. Samson, p. 642.
The **Mobility** of Caesium Atoms Absorbed on Tungsten.—I. Langmuir and J. B. Taylor, p. 463.
Negative Grid Polarisation in a Triode [particularly in a Triode with a Weakly Emitting Cathode].—S. A. Obolensky, p. 286.
Development of a Circuit for Measuring the **Negative Resistance** of Pliodynatrons.—E. N. Dingley, Jr., p. 97.
A **New** Group of Receiving Tubes [Types 56, 57 and 58].—p. 587.
More **New** Tubes [Pentode with Low Hum Level, Oscillating Detector, Detector or Volume Control Valve, Two-Volt Pentode, Detector-Amplifier, Diode, Automobile Output Pentode, and Low Noise-Level Valve P.J. 11].—L. Martin, p. 587.
New Electron Tubes—Facts and Rumours, p. 98.
New Tubes—Detectors, Rectifiers, Amplifiers [Triple-Twin, Class B Amplifier Valve, Wunderlich Detector, etc.], p. 349 : see also Progress, Recent.
Technical Data on **New Tubes** [Heater-Type Power Pentode 4 Double-Diode Triodes 55 and 85, Triple-Grid Power Amplifier 89, and Heavy-Duty Full-Wave Rectifier 83], p. 641.
On the Calculation of an Electron Tube **Oscillator** [Nomograms for the Barkhausen Formula $V_s = (10.i_s)^{2/3}$].—G. A. Kiandsky, p. 286.
On the Calculation of Electron Tube **Oscillators** [based on Anode Dissipation].—Joffe, p. 283.
The **Output Power** of the Final Stage.—Benz, p. 349.
Photocell Control of Temperature for Filament-Coating **Ovens**.—W. P. Koechel, p. 463.
Thermionic Emission and Electrical Conductivity of **Oxide** Cathodes.—A. L. Reimann and L. R. G. Treloar, p. 96.
Strengthening of Interference Colours of Thin **Oxide** Layers [on Valve Metals].—A. Güntherschulze and F. Keller, p. 410.
Phenomena in **Oxide Coated** Filaments. II. Origin of Enhanced Emission.—J. A. Becker and R. W. Sears, p. 227.
Space-Charge Currents in **Oxide-Coated** Cathodes.—A. Gehrts, p. 348.
The Apparent Conductivity of **Oxide** Coatings used on Emitting Filaments.—R. H. Fowler and A. H. Wilson, p. 642.
Photoelectric and Thermionic Properties of **Palladium**.—L. A. Du Bridge and W. W. Roehr, p. 228.
The Photoelectric and Thermionic Properties of **Palladium**.—W. W. Roehr and L. A. Du Bridge, p. 463.
Researches on the **Penetration Coefficient** or Mutual Controllance of Receiving Valves.—F. Greve, p. 167.
The Radio-Frequency **Pentode** : a New Use of the Suppressor Grid.—E. W. Ritter, p. 285.
Pentode Tubes Used as Triodes.—J. R. Nelson, p. 97.
Power Detection Characteristics of **Pentode** Tubes.—H. A. Brown and C. T. Knipp, p. 349.
Variable-Mu Radio-frequency **Pentode** Type 39 [6-Volt D.C. Heater-Type].—L. Martin, p. 409.
Pentode with Extra Electrode for Detection, p. 409.
A New 6-Volt Output **Pentode** [Eveready Raytheon LA], p. 587.
Pentode with Second Screen Grid replacing Usual Outer Grid, p. 641.
The **Pentode** in the Output Stage [and the Use of a Frequency Filter to prevent Non-Linear Distortion of the Higher Frequencies and to improve the Sound Pressure Characteristic].—P. Cornelius, p. 641.
A New Industrial Amplifier Tube for **Phototube Circuits** [Westinghouse RJ-550].—L. Sutherlin, p. 409 : see also Industrial.
The **Positive-Grid** Tube [working as a Class B Amplifier and giving 20 Watts Undistorted Output].—L. Martin, p. 349.
The Action of **Positive Ions** of Caesium on a Hot Nickel Surface.—P. B. Moon, p. 97.
The Emission of **Positive Ions** from Cu and Ag.—H. B. Wahlin, p. 169.
The Emission of **Positive Ions** from Metals.—H. B. Wahlin, p. 228.
A Theory of the Emission of **Positive Ions** from Glowing Metals.—N. Morgulis, p. 410.
The Surface Ionisation of **Potassium** by [Hot] Tungsten.—P. B. Moon and M. L. E. Oliphant, p. 588.
Progress in **Tubes**, p. 587.
Recent Trends in Receiving Tube Design.—J. C. Warner, E. W. Ritter and D. F. Schmit, p. 641 : see also New, Progress.
Resistance of an Oscillating Triode.—S. I. Ziltinkevitch, p. 286.
On the Variation of the **Resistance** of Thermionic Valves at High [and Ultra-High] Frequencies.—S. K. Mitra and B. C. Sil, p. 463.
Valve **Resistance** in Oscillation Generators.—McLachlan, p. 459.
The Characteristic Surfaces of the **Russian** Valve Type J-1.—W. Patruschew, p. 168.
Choosing a **Screen-Grid** Tube [and the Failure of Transconductance as an Index to the Operating Characteristic].—R. de Cola, p. 349.
Distortion in **Screen-Grid** Valves : with Special Reference to the Variable Conductance Type.—R. O. Carter, p. 409.
The Mode of Action of **Screen-Grid Transmitting Valves** [based on the Philips' Company's Valves].—C. J. de L. de la Sablonière : Philips' Company, p. 527.
The Characteristics of Two **Screen-Grid Valves** Coupled Directly to Each Other.—T. Amishima, p. 409.
Indirectly Heated **Screen-Grid Variable-Mu** Valves, Types V.DS and V.MS4, for D.C. and A.C. respectively.—General Electric Company, p. 587.
Measurement of [Control] Grid-Anode Capacity of **Screened Tubes**.—E. G. Momot, p. 286.
On the Effect of **Secondary Electrons** on the Statical Working Condition of the Single Grid Valve.—S. A. Obolensky, p. 228.
Total **Secondary Emission** of Electrons from Metals as a Function of Primary Energy.—P. L. Copeland, p. 410.
The **Shot Effect** on the Quantum Mechanics [Theoretical Investigation].—H. Fröhlich, p. 97.
Shot Effect in Space Charge Limited Currents.—E. W. Thatcher and N. H. Williams, p. 286.
On the Reduction of **Shot Effect** Fluctuations by Electron Space Charge.—E. W. Thatcher, p. 410.
Shot Effect and Thermal Noise in the Photo-cell Amplifier.—von Orbán, p. 642.
British **Standard Specification** for the Dimensions of Radio Valves and Valve-Sockets, p. 463.
Surface Heating by Neutralised Positive Rays before and after Return to Normal State.—M. C. Johnson, p. 410.
Special **Symmetrical R.F. Amplifier Valve**.—Angwin, p. 97.
Universal Tube **Test Equipment**.—O. H. Brewster and K. F. Mayers, p. 97.
Valve **Test Standards**.—American Standardisation Committee, p. 286.
An Automatic **Testing and Sorting Machine** for Amplifier Valves.—W. Traub and F. Menzler, p. 97.
An Experimental Study of the **Tetrode** as a Modulated Radio-Frequency Amplifier [particularly for Radiotelephone Transmission on Frequencies of and above 500 kc.].—H. A. Robinson, p. 168.
On **Thermal Electronic Agitation** in Conductors.—N. H. Williams and E. W. Thatcher, p. 410.
The Investigation of the **Thermal Inertia** of a Filament by means of a Three-Electrode Kerr Cell.—Rohde and Schnetzler, p. 588.
On **Thermionic Currents** Limited by Pure Electron Space Charge.—E. W. Thatcher, p. 588.
Thermionic Emission from a Plane Electrode.—R. S. Bartlett, p. 97.
On the Theory of **Thermionic Emission**.—N. H. Frank, p. 227.
Thermionic Emission and **Space Charge**.—N. H. Frank, p. 410.
Transmission of Electrons through Potential Barrier of **Thoriated Filament**.—W. B. Nottingham, p. 228.
Evaporation and Migration of **Thorium** on Tungsten.—W. H. Brattain, p. 588.
Special **Three-Grid** Valve for Alternative Purposes [Pentode, Class A and Class B Triode], p. 463.

A Self-Stopping D.C. **Thyratron** Circuit [using a Glow-Discharge Tube].—H. J. Reich, **p. 168.**

B.T.H. Mazda **Thyratron,** Type BT.1, **p. 98.**

Thyratrons.—See also Grid-controlled, and under "Subsidiary Apparatus."

Dynamic **Transconductance Meters.**—R. de Cola, **p. 588.**

A 500 kW [**Transmitting**] Wireless Valve, **p. 39.**

The 500 kW Demountable [**Transmitting**] Valve.—Angwin, **p. 98.**

500 Kilowatt Demountable [**Transmitting**] Valves.—Metropolitan-Vickers Company, **p. 349.**

A Giant [**Transmitting**] Tube for Radio Transmission.—A. Dinsdale, **p. 409.**

Transmitting Valves of 300 Kilowatts Output.—Telefunken Company, **p. 528.**

A German 150 kW Niobium-Cathode [**Transmitting**] Valve, **p. 168.**

A New Water-Cooled Power Vacuum [**Transmitting**] Tube [with Water-Cooled Grid consisting of a Column of Molybdenum Discs].—I. E. Mouromtseff: Westinghouse Company, **p. 528.**

Two Sets of Elements in One Tube [the **Triple-Twin** Valve and Circuit].—C. F. Stromeyer, **p. 285.**

An Improved 120-Volt D.C. Audio Amplifier [**Triple Twin** Type 291 Valve].—C. F. Stromeyer, **p. 463.**

Triple-Twin Tubes.—C. F. Stromeyer, **p. 587.**

Vacuum Tubes as [**Ultra**] **High-Frequency** Oscillators [including G.E.C. Water-cooled Triode for 1.5 to 5 Metres].—McArthur and Spitzer, **p. 93.**

Characteristics of the UV-858 Power Tube [Radiotron Triode, Water-Cooled] for High [and **Ultra-High**] **Frequency** Operation.—M. A. Acheson and H. F. Dart, **p. 348.**

Investigations on Valves Producing **Ultra-Short** Waves.—Collenbusch, **pp. 403-404.**

Special Valve for **Ultra-Short** Waves (5 Watts at 3-Metre Wavelength).—Telefunken Company, **p. 463.**

Transmitting Valve for **Ultra-Short** Waves.—Telefunken Company, **p. 642.**

Multiple Valves for Semi-Aperiodic R.F. Amplification of **Ultra-Short** Waves.—von Ardenne: Loewe Company, **p. 642.**

Transmitting Valves for the Generation of **Ultra-Short** Waves of 1 Metre and Under.—L. Rohde, **p. 586.**

The Advantages of the **Variable-Mu** Valve.—W. T. Cocking and W. I. G. Page, **p. 97.**

On the Connection between "Durchgriff" [Penetration Coefficient] and Emission Law in "**Variable Mu**" Valves.—G. Jobst, **p. 226.**

Variable-Mu Valves.—W. I. G. Page, **p. 463.**

The **Variable Slope** Valve.—L. Chrétien, **p. 528.**

Variation of the Resistances and Inter-Electrode Capacities of Thermionic Valves **with Frequency.**—L. Hartshorn: W. E. Benham, **pp. 168** and **228.**

On One Kind of Variation of Thermionic Emission from **Wehnelt Cathode.**—Y. Takamura, **p. 463.**

Welded Transmitting Valves.—Philips Lamp Works, **p. 98.**

A New Method of Determining Thermionic **Work Function** by Photoelectric Cell.—Harris, **p. 233.**

Notes on the **Wunderlich Tube** [for Grid Leak Power Detection].—F. E. Terman: Wunderlich, **p. 349.**

Further Description and **Characteristics** of the **Wunderlich** Radio Tube.—F. E. Terman, **p. 587.**

The RCA-46, a **Zero-Bias** Output Valve for Class B Operation in an A.C. Mains Receiver.—Barton, **p. 587.**

A New **Zero-Bias** Output Tube [Type ER-49, for Class B Operation in 2-Volt Receivers].—J. R. Nelson: Raytheon Corporation, **p. 587.**

DIRECTIONAL WIRELESS.

S.F.R Compensated Night Effect Radiogoniometer [**Adcock** Aerials with Air-Core Transformers].—Soc. Franç. Rad:élec., **p. 410.**

The Performance of the Marconi-**Adcock** Direction Finder.—N. E. Davis, **p. 588.**

Electricity **in Aerial Navigation, p. 39.**

Progress in **Aeronautic** Radio Research [Equi-Signal Beacon Receivers, etc.], **p. 410.**

Two-Way Five-Metre Telephony **Aeroplane** Tests.—Lyman and Keily, **p. 411.**

Five-Metre **Aeroplane** [to Ground Stations] Tests Overwhelmingly Successful.—Lyman, **p. 588.**

Radio Direction Finding Applied to **Air Lines** [and in particular the Suppression of Night Effects and "Aeroplane Effect," leading to a description of the "Aéropostale" Opposed Frame Radiogoniometer].—Serre, **pp. 39** and **98.**

Radio Communication on the International [Pan American] **Air Lines.**—H. C. Leuteritz, **p. 287.**

Radio Aids to **Air Navigation.**—L. A. Sweny, **p. 287.**

New **Aircraft** Beacon: Visual Type [Equi-Signal] Course Indicator for Croydon Aerodrome.—Marconi Company, **p. 98.**

Acoustic Sounding by Echoes on board Noisy **Aircraft.**—C. Florisson, **p. 350.**

The "Askania" Telecompass for **Aircraft** [with Air Transmission], **p. 411.**

Long-Wave Communication **for Aircraft.**—Eisner, **p. 644.**

Prevention of **Aircraft Collisions** by Infra-Red Rays and the Fournier-Céma Cell, **p. 350.**

Airplane Receiving Equipment for Visual Radio Range-Beacons.—Note from the U.S. Bureau of Standards, **p. 410.**

A Simultaneous Radiotelephone and Visual Range Beacon for the **Airways.**—F. G. Kear and G. H. Wintermute, **p. 350.**

The Radio of the [Pan-American] **Airways.**—H. C. Leuteritz, **p. 588.**

Direction Finding for **Aviation,** especially for the Luft-Hansa Line.—E. Schwandt, **p. 169.**

Wireless Engineering in connection with **Aviation.**—H. Fassbender and others, **p. 644.**

Radio Direction Finding Experiments with **Aurora.**—B. Düll, **p. 643.**

Systems of Radio **Beacon** [particularly Besson's "Associated Loop-and-Aerial" or "Symmetrical Cardioids" System used at La Pallice].—P. Besson, **p. 39.**

Equi-Signal **Beacon on Lorry.**—C. J. Madsen, **p. 643.**

New Developments in Radio **Beacons** [Visual Reception, and the Use of Ultra-Short Waves].—E. Kramar: Lorenz Company, **p. 642.**

On the **Bearing Breadth in** Direction-Finder Receivers [and Its Dependence on Signal Strength and Background Noise Level].—P. Hermanspann, **p. 528.**

Landing **Blind** [use of a Series of Concentric Cables to give Position and Approximate Height].—F. Celler, **p. 350.**

Electrical Aids to **Blind Flying.**—A. Klemin, **p. 40.**

An Electrical Method of Indicating the Limits of a Landing Ground, to assist **Blind Landings.**—H. Gromoll, **p. 644.**

Australian R.R.B. Results with the **Cathode Ray** Direction Finder, **p. 158.**

Coastal and Harbour Wireless Services.—Marconi Company, **p. 39.**

Electronic Direction Finder [**Compass**].—P. Schwerin, Perriman Electric Company, **p. 350.**

New Method for **Distance Finding** [Combination of Radio Signal and Fog Horn Blasts], **p. 644.**

The Natural Electromagnetic Oscillation of a Rod-Shaped Conductor at the Surface of Separation of Two Media with Different Dielectric Constants [Application to Direction Finding **Errors** caused by Resonance with the Ship's Hull].—H. Ruprecht, **p. 287.**

Airplanes See Through **Fog** with New Photocell Device.—Langmuir and Westendorp, **p. 169.**

Echoes from Danger Points Guide Boat Through **Fog** [Sonic Locator, using 3 000-Cycle Whistle].—C. W. Rice, **p. 350.**

Fog-penetrating Properties of Infra-red and Ultra-violet Rays.—S. H. Anderson, **p. 98.**

Receiving **Frame Aerials** for Low-frequency Alternating Magnetic Fields [for Loth Systems].—C. Bourgonnier and M. Durepaire, **p. 350.**

Directional Observation of **Low-frequency** Waves.—E. Yokoyama, T. Nakai and I. Tanimura, **p. 350.**

The Development and Application of **Marine** Radio Direction Finding by the U.S. Coast Guard.—C. T. Solt, **p. 287.**

Radiogoniometers for **Marine Work** [Comparison of Fixed Loop and Rotating Frame Receivers], **p. 98.**

The Use of Radioelectric Waves in **Maritime** Signalling.—Besson, **p. 528.**

Marconi Direction Finder Type D.F.G.9b [for **Naval Purposes,** using Small Shielded Frame Aerial], **p. 588.**

Direction Finder Type D.F.G.9a [particularly for **Naval Work**].—Marconi Company, **p. 410.**

Navigation by Wireless.—C. G. Phillips, **p. 528.**

Directional Records [on several spaced Direction Finders] of **Night Effect.**—M. Dieckmann, **p. 287.**

Night Errors and the Polarisation of Down-Coming Waves.—Appleton, **p. 169.**

The Causes of **Night Errors** in Direction Finding.—B. Düll, **p. 643.**

Portable [Equi-Signal] Beacon Transmitter for the [U.S.] Army, **p. 287.**

Diagram for **Position Finding** by Long Distance Bearings and for Finding the Bearing of One Point from Another.—T. J. Richmond, **p. 98.**

Position Location at Sea.—R. Naismith, **p. 98.**

Theory of Design and Calibration of Vibrating **Reed Indicators** for Radio Range Beacons.—G. L. Davies, **p. 169.**

Direct-Reading **Stroboscopic** Radio Direction Finder.—R. Hardy and Bertrand-Lepaute, **p. 642.**

An Experimental Direction-Finder for Use on **Ultra-Short** Waves.—Smith-Rose and McPetrie, **p. 39.**

Ultra-Short Waves.—See also Beacons.

Variation of Bearings observed in Short-Wave Direction-Finding [on a Small Rotating Frame].—M. Asukai and T. Hayasi, **p. 169.**

A **Watch Compass** for Navigational Direction Finding [for use on Rotating Loop Beacon Signals].—S. J. Matthews, **p. 98.**

New **Wireless Compass, p. 39.**

ACOUSTICS AND AUDIO-FREQUENCIES.

A New Industry—Manufacture of Sound **Absorbing Materials.**—Bureau of Standards, **p. 647.**

The **Absorption** of Sound in Acoustic Tubes and Horns.—Y. Rocard, **p. 647.**

The Acoustic **Absorption** Band of Carbon Dioxide.—E. Grossmann, **p. 290.**

Measurements of High Frequency Sound **Absorption** in Gases.—E. Grossmann, **p. 466.**

Application of Norris-Andree Method of Reverberation Measurement to Measurements of Sound **Absorption.**—R. F. Norris, **p. 352.**

An Automatic Reverberation Meter for the Measurement of Sound **Absorption.**—W. F. Snyder, **p. 588.**

Some of the Factors which Affect the Measurement of Sound **Absorption** [Effect of Absorption by Moist Air, and Choice of Initial, Average or Final Slope of Decay Curve].—V. L. Chrisler and C. E. Miller, **p. 647**; see also Humidity.

Equipment for Simple and Rapid Measurement of Sound-**Absorption** Properties of Materials.—A. L. Albert and W. R. Bullis, **p. 40.**

A Simplified Instrumental Method of Measuring Sound **Absorption** Coefficients.—J. F. Mackell, **p. 40.**

The Precision of Measurement of **Absorption** Coefficients by Reverberation Methods.—P. E. Sabine, **p. 171.**

The Determination of **Absorption** Coefficients for Frequencies up to 8000 Cycles.—F. L. Hopper, **p. 352.**

Objective Measurement and Subjective Observation of **Acoustic** Phenomena.—F. Trendelenburg, **p. 99.**

Recent Developments in **Acoustics,** particularly Applied Acoustics (Continued).—F. Trendelenburg, p. 99.

The Effects of Interior **Acoustics** in the Recording and Reproduction of Sound.—F. Trendelenburg, **p. 288.**

Studies on the Room-**Acoustics,** Part I [Comparison between Results with Sustained and Impulsive Sounds: the Equivalent Sphere representing a Room].—A. Hirayama, **p. 647.**

Modern Treatment of Broadcasting **Acoustics.**—S. K. Wolf, **p. 288.**

Acoustics of a Building Improved 25% by the Audience Standing Up.—S. K. Wolf, **p. 171.**

Bibliography of the **Acoustics of Buildings.**—F. R. Watson, **p. 171.**

Papers on the **Acoustics of Buildings.**—E. Michel: F. R. Watson, **p. 288.**

Correction of the **Acoustics of Buildings** [Some New Sound-Insulating Materials], **p. 229.**

The **Acoustics of Halls.**—P. M. Prache, **p. 529.**

Acoustics of Very Large Auditoriums do not conform with Customary Methods of Analysis and Correction.—S. K. Wolf, **p. 99.**

On the **Admittance** of Linear Oscillating Systems [Application to Loud Speaker Cones].—Strutt, **p. 33.**

On the Circulations Caused by the Vibration of **Air** in a Tube.—E. N. da C. Andrade, **p. 100.**

On the Groupings and General Behaviour of Solid Particles under the Influence of **Air** Vibrations in Tubes.—E. N. da C. Andrade, **p. 647.**

On the Determination of Pressure in Impulsive **Air Waves.**—W. Schneider, **p. 290.**

Acoustic Altimeter for **Aircraft.**—Florisson, **p. 350.**

The DVL Audimeter used in Measuring Background Noise of **Aircraft** Receivers.—Brintzinger and Viehmann, **p. 529.**

A Note on the Sound Generated by a Rotating **Airscrew.**—E. T. Paris, **p. 229.**

Some Properties of the Sound Emitted by **Airscrews.**—C. F. B. Kemp, **p. 466.**

Audio Frequency **Amplification** [and the Use of a Special Transformer-coupled Amplifying Circuit].—L. A. Meyerovitch and P. A. Lossizky, **p. 466.**

D.C. Gramophone **Amplifier** [with Undistorted 5 Watt Output].—R. A. Fereday, **p. 589.**

The Measurement of Power in **Amplifiers** [the Burstyn " Audimeter " for Sound Film Apparatus].—P. Hatschek: Burstyn, **p. 646.**

Contributions to the Design Calculations of **Amplifiers** for Multiple Address Systems.—H. Reppisch, **p. 590.**

A Simple Harmonic **Analyser.**—Nicholson and Perkins, **pp. 416-417.**

A New Method of Sound Frequency **Analysis** [Hot-Wire Resistance Method using a Valve Filament].—T. Theodorsen, **p. 229.**

A Valve Voltmeter Method of Harmonic **Analysis.**—W. Greenwood: Suits, **p. 465.**

A Simple Method of Harmonic **Analysis.**—F. Nachtikal, **p. 589.**

Sound **Analysis** by the Control of the Saturation Current of a Two-Electrode Valve.—J. Diebitsch and H. Zuhrt, **p. 644.**

Sound **Analysis** by Use of Brightness Fluctuations of an Incandescent Bulb Filament, registered by a Photoelectric Cell.—Diebitsch and Zuhrt, **p. 645.**

Transmission of Sound through **Apertures** [Confirmation of Lamb's Predictions].—E. Ritchie, **p. 352**; see also Openings.

Articulation in Telephonic Communications.—P. Chavasse, **p. 44.**

An Automatic Device for Recording, Correcting and Analysing **Articulation** Results.—J. Collard, **p. 287.**

Articulation Tests in English, German and French using Esperanto Pronunciation, **p. 99.**

The Connection between **Auditory Sensation** and the Effective Value of the Exciting Sound Pressure, and Its Influence on the Audibility of Distortions.—W. Janovsky, **p. 172.**

The **Bechstein-Siemens-Nernst " Grand "**: a New Universal Instrument [Small Grand Piano with Amplifiers and Timbre-Selecting Damping, etc.].—Schultz: Noack, **p. 101.**

Further Study of [**Biological**] Effects of Intense Audio-Frequency Sound.—N. Gaines and L. A. Chambers, **p. 466**; see also Sterilisation.

Measurement of **Capacities** at Audio-Frequencies by Double-Beat Method.—Colebrook, **p. 171.**

Bell-less Electric **Carillon** [at Camden, N.J.; Reed Vibrations amplified by 1 Kilowatt Audio-Amplifier].—RCA Victor Company, **p. 646.**

Acoustical and Electrical Power Requirements for Electric **Carillons** [and the Use of the Sound Measuring Meter].—A. N. Curtiss and I. Wolff, **p. 413.**

The Use of the **Cathode-Ray Oscillograph** in the Study of Distortion, Phase-Relations, etc.—Zworykin, **p. 99.**

A Method of [Audio-] Frequency Measurement with the **Cathode Ray Oscillograph** [used as Source of Comparison Frequency and as Indicator].—L. A. Wood, **p. 589.**

Three Simple Investigation Methods [based on **Chladni Figures**] for Experimental Acoustics.—N. Andrejew, **p. 100.**

Audio-frequency **Compensation** Methods.—J. G. Aceves, **p. 99.**

Theory of the Acoustic **Conductivity** of Simple and Composite Partitions.—E. Wintergerst, **p. 466.**

Curves of Equal Sound Strength.—R. Berger, **p. 647.**

On the Sound Radiation from a Circular **Diaphragm** vibrating with Nodal Lines.—M. J. O. Strutt, **p. 169.**

Air Column Resonances and Symmetrical Modes of Truncated Conical Shells (Loud Speaker **Diaphragms**).—N. W. McLachlan, **p. 230.**

Nodal Lines on Vibrating **Diaphragms.**—N. W. McLachlan, **p. 41.**

The Behaviour of Conical **Diaphragms** used in Acoustic Apparatus for the Reproduction of Speech and Music.—N. W. McLachlan and G. A. V. Sowter, **p. 41.**

The Effective Mass of Flexible Discs and Conical **Diaphragms** Used for Sound-Reproduction.—N. W. McLachlan, **p. 169.**

Measurement [by Ultra-Micrometric Method] of the Static and Dynamic Displacements of Telephone **Diaphragms.**—G. Sacerdote and E. Gotta, **p. 42.**

The Law of Similarity for the Natural Frequencies of Elastic Bodies and Particularly Loud Speaker **Diaphragms.**—E. Spenke, **p. 169.**

Sound **Diffraction** by Rigid Circular Plate, Square Plate and Semi-Infinite Screen.—L. J. Sivian and H. T. O'Neil, **p. 645.**

A **Direct-Indicating Acoustic Measuring Equipment** [using the Hollmann-Schultes " Room Acoustic " Relaxation Oscillations].—H. E. Hollmann and Th. Schultes, **p. 171.**

Directive Audition in Space.—J. L. Van Soest and P. D. Groot, **p. 40.**

On the Sound Field in the Neighbourhood of an Oscillating Plane **Disk.**—R. Ruedy, **p. 41.**

The **Dispersion** of High Frequency Sound Waves in Carbon Dioxide Gas.—H. O. Kneser, **pp. 229 and 467.**

On Acoustic **Dispersion** Theory.—H. O. Kneser, **p. 229.**

Percentage Harmonic **Distortion.**—Greenwood: Bedford: Callendar: Scroggie, **pp. 100 and 230.**

Distortion in Microphones and Loud Speakers.—C. A. Hartmann, **p. 289.**

Audio-frequency **Distortion** Measurements [Grützmacher Analyser: Failure of " Klirrfactor " to give Distortion as heard by **Ear**: Another Method giving Combination Tones throughout Entire Audible Range] —Hoffmann, **p. 645.**

Distortions, Audibility of.—See Auditory Sensation.

Doppler Effect with Piezo-Quartz Crystals.—H. Müller and T. Kraefft, **p. 466.**

Differential Pitch Sensitivity of the **Ear.**—E. G. Shower and R. Biddulph, **p. 230.**

Remarks on the Theory of the Most Favourable **Echo Duration** in Large Rooms.—G. v. Békésy, **p. 40**; see also Reverberation.

On the Calculation of Mechanical Vibrating Systems by the Use of the **Equivalent Electrical Circuits.**—Forstmann, **p. 221.**

Papers on L.F. **Feed-Back** in Radio Receivers.—Bouck: Brooke, **p. 230.**

The Delusiveness of **Filtering** Compound Sounds.—M. F. Meyer, **p. 590.**

Precision Methods Used in Constructing Electric Wave **Filters** for Carrier Systems.—Harris, **p. 417.**

On Acoustic **Filters.**—E. Waetzmann and F. Noether, **p. 466.**

The Theory of Acoustic **Filtration** in Solid Rods.—R. B. Lindsay and F. E. White, **p. 466.**

A New Method of Measuring **Frequencies** [using Johnsen-Rahbeck Effect].—Makower and Makower, **p. 104.**

Bass Drum and Tympani—the 5000 Cycle [**Frequency**] Limit, **p. 344.**

A Tachometer-Type **Frequency Meter** for Loud Speaker Testing and Other Purposes.—E. Thielmann: Dornig: Lenzola Company, **p. 412.**

A Sound Transmitting and Reproducing Equipment with a Wide **Frequency Range** [30 to over 10000 Cycles per Second].—W. Willms, **p. 288.**

What the Ear Hears [**Frequency Range** for Faithful Reproduction], **p. 464.**

Higher Fidelity Standards are Here! [Increased **Frequency Ranges**], **p. 463.**

Audible **Frequency Ranges** of Music, Speech and Noise.—W. B. Snow, **p. 98.**

An Improved Audio-frequency **Generator.**—E. G. Lapham, pp. 44 and 287.
A Beat Frequency **Generator** for Frequencies from 30 to 10 000 c/s, p. 465.
An Adjustable Frequency **Generator** for the Voice Range [Valve-controlled Three-phase Motor Generator Set].—J. R. Power, p. 287.
Generator of Electrical Oscillations at Musical Frequencies [Musical Heterodyne].—Soc. Franç Rad:élec., p. 413.
Correction to "Measuring Frequency Characteristics with the Photo-Audio **Generator.**"—J. H. O. Harries: Schäffer and Lubszynski, p. 352.
The "Numan" Circuit as a Valve Note **Generator** (Valve Hummer). —W. Muchlinsky, p. 100.
Investigations on the "Howl" **Generator.**—W. L. Barrow, p. 229.
"Howl" **Generators.**—H. von Hartel, p. 413.
Generators.—See also Oscillators.
Acoustic Properties of **Glass Sheet.**—E. Meyer, p. 647.
The Steel Band [Insulated and Wound into a Spiral] as **Gramophone** Disc.—F. Noack: Stille, p. 413.
Frequency Characteristics and Record-Wear of **Gramophone** Pick-Ups.—M. Kluge, p. 646.
Photomicrographs of **Gramophone** Records [and the Use of a Thin Coating of Immersion Oil].—A. Morris Thomas, p. 171.
Reproduction de Luxe: Inauguration of New Branch of the **Gramophone** Company, Limited, p. 43.
Electrical **Gramophone** Recording and Reproduction.—A. Forstmann, p. 43.
The Home-Recording of **Gramophone Discs.**—E. Nesper, p. 529.
Improved "Mid-Odi" Long-Playing **Gramophone Needle,** p. 101.
Gramophones.—See also Phonographs, Recording, Reproduction, Talking Machines, Vertical Cut.
Eliminating **Harmonics** in Bridge Measurements.—R. F. Field, p. 287.
A Device for Separating the **Harmonics** of Complex Waves, with Special Application to the A.C. Potentiometer [Extension of Joubert Contact Maker].—D. C. Gall: Messrs. Tinsley, p. 589.
Binaural **Hearing.**—G. W. Stewart, p. 464.
Sound and **Hearing.**—N. F. Cave-Brown-Cave, p. 413.
Theories of **Hearing.**—H. Hartridge, p. 647.
On the Theory of **Hearing** with Sound Received by Conduction through Bone.—G. v. Békésy, p. 413.
The **Heating of Liquids** by the Absorption of Sound, and Its Relation to the Energy of Intense High-frequency Sound Waves.—W. T. Richards, p. 100.
High Audio Power from Relatively Small Tubes: Discussion.—R. A. Heising: Barton, p. 44.
The Relation of Relative **Humidity** to the Absorption of Supersonic Waves in Various Mixtures of CO_2.—H. H. Rogers, p. 647.
Humidity: see also Absorption.
A Method of Measuring Acoustic **Impedance.**—P. B. Flanders, p. 589.
The Study of Sound-**Insulating** Building Materials by Means of Electrical Measuring Apparatus.—Cellerier, p. 171.
The **Insulation** of Sound [Tests on Cork, Kapok, Bamboo Tissue, Newsprint, etc.].—R. Moens, p. 352.
Sound **Intensity** Measurements by the Method of "Acoustic Twinkling."—F. Canac, p. 288.
The Acoustic Resonator **Interferometer.**—J. C. Hubbard, pp. 171 and 647.
Multiple Peaks in Supersonic **Interferometry.**—W. D. Hershberger, p. 529.
The Müller Metallic Membrane **Light-Control** Device.—Müller: Mey, p. 529.
The Principles of the **Light Valve.**—T. E. Shea, W. Herriott and W. R. Goehner, p. 646.
Effects of Optical Slits in **Light-Valve Sound Recording.**—J. P. Livadary, p. 43.
Dynamic [**Loud**] **Speaker** Design.—A. R. Barfield, pp. 464 and 645.
A **Loud Speaker** without Baffle.—Bethenod, p. 42.
Measurement of the Phase and Amplitude Curves of Electrodynamic **Loud Speakers.**—W. Binder, p. 229.
A Device for Rapidly Plotting **Loud-Speaker** Response Curves.—F. H. Brittain, p. 412.
Loud Speaker ensuring Low Note Fidelity.—Charlin and Toulon, p. 42.
A Novel **Loud-Speaker** Movement [Eddy-Current Drag from Rotating Disc].—Gladenbeck, p. 589.
Dynamic **Loudspeaker** Design [of Magnetic Circuit].—J. E. Goeth, p. 42.
The Calculation of **Loud Speakers** with Rigid Disc Membranes.—W. Hähnle, p. 170.
New Dual **Loud Speaker.**—H. A. Hartley, p. 645.
The Determination of the Efficiency of **Loud Speakers** [by a purely Acoustic Method.—W. Heimann, p. 645.
Improved Fidelity of Two- [**Loud**] **Speaker** Radio Receivers.—H. S. Knowles, p. 464.
The **Loud Speaker** Coil of Optimum Mass.—N. W. McLachlan: Strafford, pp. 351 and 464.
Electro-Mechanical Rectification [and Its Effect on **Loud Speaker** Reproduction].—N. W. McLachlan: P. K. Turner, pp. 464 and 589.
On the Symmetrical Modes of Vibration of Truncated Conical Shells; with Applications to **Loud-Speaker** Diaphragms.—N. W. McLachlan, p. 411.
Radio **Loud Speakers.**—N. W. McLachlan, p. 230.
Building-Up and Decay Processes in Electrodynamic **Loud Speakers** with Strong Magnetic Fields.—H. Neumann, p. 170.
The Inductor Dynamic **Loud Speaker.**—D. A. Oliver, p. 100.
Loud Speakers with Independent Control added to Radio Receivers. —W. L. Parsons, p. 589.
Loud Speakers in Opera Production.—R. Raven-Hart, p. 412.
The **Loud Speaker** Equipment of the Stadium of the Darmstadt Technical College.—F. Schilgen and C. Starkloff, p. 170.
The Influence of the Resistance of the Current Source [Output Valve Stage] and Parallel Capacity on the Frequency Characteristic of a **Loud Speaker.**—F. Söchting and W. Nowotny, p. 351.
The Theory and Application of the Horn **Loud Speaker** [and the Superiority of the Exponential Horn].—H. Stenzel, p. 170.
The Horn **Loud Speaker.**—H. Stenzel, p. 289.
Moving Coil **Loud Speakers** of Midget Design.—F. R. W. Strafford, p. 290.
The **Loud Speaker Coil** of Optimum Mass.—F. R. W. Strafford: McLachlan, p. 412.
On the Amplitude of Driven **Loud Speaker** Cones: Discussion.—M. J. O. Strutt: N. W. McLachlan, p. 101.
On the Equivalent Mass of Driven **Loud Speaker** Cones.—M. J. O. Strutt, p. 350.
Effective Mass of **Loud Speaker** Cones.—G. A. V. Sowter: Strutt, p. 411.
Extension of the Frequency Range faithfully reproduced by **Loud Speakers** [Combination of Several Loud Speakers with Different Characteristics, Several Amplifiers and Corresponding Filters, for Sound Film Reproduction].—P. Toulon: Établissements Charlin, p. 350.
The Moving Iron **Loud Speakers.**—S. J. Tyrell, p. 100.
The Singing Condenser [Electrostatic **Loud Speakers,** especially the Double-Sided **Oscilloplane** with Aluminium-Magnesium Alloy Diaphragm].—H. Vogt, p. 42.
The Generation of Sound by the Electrostatic Field and the "Statophone" and "Oscilloplane" **Loud Speakers.**—H. Vogt, p. 170.
Calculation of **Loudspeaker** Efficiency.—I. Wolff, p. 351.
The Use of Two **Loud Speakers** in a Single Set, in U.S.A., p. 464.
Loud Speakers Under Test.—p. 101.
Loud Speakers.—See also Admittance, Diaphragms, Disks, Distortion, Frequency, Networks, Plate, Radiation (Resistance), Radiators, Rochelle Salt, Tone Control.
The Apparent Reduction of **Loudness.**—D. A. Laird, E. Taylor, and H. H. Wille, Jr., pp. 352 and 589.
The **Loudness of Sound.**—N. W. McLachlan, p. 590.
The Importance of the **Magnetic Bias** in Electromagnetic Telephones [and Loud Speakers].—L. Draub, p. 645.
Moving Coil **Magnets**: Precision Measurements of the Gap Flux Density.—C. E. Webb, p. 290.
The **Measurement** of [Low Audio-frequency] A.C. Potentials by means of Dry-Plate Rectifiers [a Method independent of Wave-Form and Frequency].—Focaccia, p. 473.
Absolute **Measurement** of Sound-Amplitudes and Intensities.—E. N. da C. Andrade, p. 590.
The "Phonic Tester" for the **Measurement** of the Mechanical Intensity of Sounds.—J. F. Cellerier, p. 413.
Some Acoustic and Telephone **Measurements** [British Post Office: including Loud Speaker Tests].—H. R. Harbottle, pp. 413 and 589.
Acoustic **Measuring Instruments.**—C. V. Drysdale, p. 590.
The Dynatron Audio-Frequency **Meter.**—J. Kahan, p. 529.
Technique of **Microphone** Calibration.—S. Ballantine, p. 412.
Boutonnière **Microphone** for Broadcasting Speeches, in place of Array of Fixed Microphones.—Bell Telephone Laboratories, p. 43.
New Moving Coil **Microphone.**—A. Dinsdale, p. 101.
Carbon **Microphones** [A Defence of Their Transmission Quality].—S. T. Fisher, p. 170.
The Development of the **Microphone.**—H. A. Frederick, p. 43.
Microphone Technique in Radio Broadcasting.—O. B. Hanson, p. 170.
An Efficient Miniature Condenser **Microphone** System.—H. C. Harrison and P. B. Flanders, p. 589.
The Lapel **Microphone** [for Public Address Speakers].—W. C. Jones, p. 289.
A Moving Coil **Microphone** for High Quality Sound Reproduction. —W. C. Jones and L. W. Giles, p. 289.
A Method of Calibrating the Condenser **Microphone** by the Use of a Periodically Varying Substitution Condenser.—W. Lange, p. 412.
A New Carbon **Microphone** [with a Good Frequency Characteristic]. —M. Marinesco, p. 43.
The Ribbon **Microphone.**—G. S. Mitchell, p. 42.
A New Ribbon **Microphone** with Plane of Zero Reception, for Sound Film Recording.—H. F. Olson, p. 43.
The Calibration of **Microphones.**—H. F. Olson and S. Goldman, p. 43.
Researches on a **Microphone** for Broadcasting [Development of a Radio-frequency Circuit for Use with the Wente Condenser

Microphone in place of the usual **Amplifying** Circuit].—A. H. Reeves, **p. 42.**

A Sensitive Moving-Coil **Microphone** of High Quality: Adapting the Moving-Coil Microphone to Commercial Use: Mountings, Connectors and Amplifier for Moving-Coil Microphone.—Thuras: Giles: Leuvelink, **p. 589.**

All German Broadcasting Stations to Use Condenser **Microphone** (Neumann Type) in place of Reiss Marble-Block Microphone.—**p. 465.**

Microphones.—See also Distortion, Moving Coil, Rochelle Salt.

An Analysis of the Series Type **Mixing Control** [for several Microphones].—L. B. Hallman, Jr., **p. 43.**

Moving Coil Microphone and Loud Speaker of Special Type.—G. Giulietti, **p. 412.**

Moving-Coil Telephone Receivers and Microphones.—E. C. Wente and A. L. Thuras, **pp. 43** and **101.**

Additional Experiments on **Moving Coil** Reproducers and on Flexible Discs.—N. W. McLachlan, **p. 169.**

Electrical **Music.**—O. Vierling, **p. 352.**

The New **Music** of Electronic Oscillations: the Latest Instruments of Theremin, Ranger and Miessner, **p. 352.**

Electrical **Music** and the Building-Up of Tones.—F. Trautwein: Backhaus, **p. 465.**

Musical Requirements for Note-Modulated Scanning [Television of Music].—F. W. Winckel, **p. 529.**

The Electrical **Musical** Instrument: the Generation of Vibrations by Thermionic Valves [Comprehensive Survey, with List of Papers and Patents].—O. Vierling, **p. 529.**

Electrical [**Musical**] **Instrument** gives Piano and Organ Effects.—B. F. Miessner, **p. 44**: see also Bechstein-.

The Electrical **Musical Instrument**: the Generation of Vibrations by Mechanical-Electrical Methods.—Vierling, **p. 646.**

The Sound Spectra of **Musical Instruments.**—E. Meyer, **p. 172.**

The Sound Spectra of **Musical Instruments.**—E. Meyer and G. Buchmann, **p. 646.**

High Frequencies Necessary for Correct Reproduction of Certain **Musical Instruments.**—Stokowski, **p. 646.**

Circuit Matching in **Networks** for Radio Distribution [to Loud Speakers].—Six and Vermeulen, **p. 299.**

Noise.—N. W. McLachlan, **p. 413.**

The Measurement of **Noise**: a New Service of Electrical Research Products.—S. K. Wolf: Acoustic Consulting Service, **p. 288.**

Measuring *versus* "Judging" Loudness of **Noise** [The Cube Root Law of Perceived Intensities].—E. E. Free: Parkinson and Ham, **p. 288.**

Measurements on **Noise** and Din.—G. Bakos and S. Kagan, **p. 288.**

The **Noise** Survey of the Rapid Transit Lines of New York City.—G. T. Stanton and J. E. Tweeddale, **p. 352.**

On the Loudness of **Noise.**—H. B. Marvin, **p. 352.**

Noise Recorder for Comparing Street-Car Sounds, **p. 413.**

Measures for Preventing the Transmission of **Noise** in Ventilating Systems.—J. Lindner, **p. 466.**

Measurement of **Noise.**—G. W. C. Kaye, **p. 466.**

The Measurement of **Noise** [**Barkhausen** Noisemeter: Eisenberg's Modification: the Dold-Thiele Integrating Meter using Evolution of Gas], **p. 529.**

The Measurement of **Noise.**—A. H. Davis, **p. 590.**

Testing Motor Tyres for **Noise**, **p. 647.**

On the Use of Acoustic Filters as **Noise Absorbers.**—K. Schuster and M. Kipnis, **p. 646.**

Noise and its Measurement.—G. W. C. Kaye, **p. 41.**

Noises.—K. W. Wagner, **p. 529.**

Methods for Measuring Interfering **Noises.**—Lloyd Espenschied, **p. 100.**

Report on **Noises** and Their Measurement.—P. Chavasse, **p. 466.**

Analysis of **Noises and Musical Sounds.**—E. Meyer, **p. 590.**

Acoustic **Nomenclature and Definitions** [Phon and Decibel].—C. F. Kemp: G.W.O.H., **pp. 466** and **589.**

The Passage of Sound through Small **Openings** [Badly Closing Doors, Keyholes, etc.].—E. Wintergerst and W. Knecht, **p. 647**: see also Apertures.

Electronic **Organ**, Coupleux-Givelet System, at the Church of Villemomble, near Paris, **p. 413.**

A Neon Tube Audio-Frequency **Oscillator.**—D. Pollack, **p. 229.**

String **Oscillator.**—J. Zahradniček and Z. Žák, **p. 413.**

An Audio **Oscillator** of the Dynatron Type.—Don Hale, **p. 465.**

Oscillators.—See also Generators.

Oscillograms as a Logical Form of Written Speech [and Musical Composition].—L. Stokowski, **p. 287.**

The Rapid Record **Oscillograph** in Sound Picture Studies.—Curtis, Shea and Rumpel, **p. 418.**

Graphical Determination of the Maximum **Output** of Single- and Multiple-Grid Valves for a Given Anode Potential and Full Modulation of the Working Characteristic in the Negative Region.—J. Kammerloher, **p. 43.**

Calculation of the Necessary Power **Output** of the Final Stage of a Sound Reproducing Apparatus [for Any Given Room].—F. Aigner, **p. 411.**

Capacitive **Output Coupling** [between Output Valve and Acoustic Load: Improvement of Frequency Curve by Suitable Choice of Capacity].—Sims, **p. 456.**

The Determination of the **Output Power** of Amplifiers.—F. Benz, **p. 352.**

The Problem of **Pentode Output Fidelity.**—L. Tulauskas, **p. 44.**

The **Pentode in the Output Stage** [and the Use of a Frequency Filter to prevent Non-Linear Distortion of the Higher Frequencies and to improve the Sound Pressure Characteristic].—Cornelius, **p. 646.**

Some Overlooked Opportunities for Electrical **Phonographs.**—V. Karapetoff, **pp. 412** and **413.**

Practical Units in Acoustics, and **Phonometric** Measurements. A New Phonometer for All Frequencies [using a Neon Tube Generator].—A. Bernini, **p. 352.**

Determination of the Resolving Power of **Photographic Layers.**—H. Frieser, **pp. 171** and **288.**

The Production of [**Photographic**] Negatives with Finer Grain than that of the Original Emulsion, by Development with Paraphenylene-Diamine.—A. Lumière and A. Seyewetz, **p. 101.**

Optical Methods for Reducing the Effects of **Photographic Plate Graininess.** With Special Reference to Special Line and Star Image Measurements.—F. E. Wright, **p. 43.**

The Natural Vibrations of Open **Pipes.**—H. P. Leopold, **p. 467.**

Transverse Vibrations of an Annular **Plate** of Variable Thickness.—J. Ghosh, **p. 645.**

The Forced Vibrations of a Circular **Plate.**—W. Flügge: Elsas, **p. 414.**

The Vibrations of a Circular **Plate.**—R. C. Colwell, **p. 414.**

The Mathematical Theory of Chladni **Plates.**—R. C. Colwell, **p. 414.**

Diagonal Symmetry in Chladni **Plates.**—R. C. Colwell, **p. 645.**

The Vibrations of Rods and **Plates.**—R. C. Colwell, **p. 645.**

A New Sound **Pressure Rectifier** [for the Direct Measurement of Sound Pressures of 50–8000 Bars].—F. Ribbentrop, **p. 645.**

The Dollar Cost of Tone **Quality.**—W. R. McCanne, **p. 44.**

The Calculation of the **Radiation** at the Edges of Stretched Membranes, and the Derivation and Use of General Formulae for the Radiation Resistance.—H. Stenzel, **p. 289.**

On the **Radiation Resistance** in connection with the Vibrations of a Cone-Shaped Membrane.—A. Th. Van Urk, **p. 42.**

The Acoustic Radiated Power of **Radiator** Groups, particularly the Circle and Sphere Groups [Application of a Rayleigh Formula].—F. A. Fischer, **p. 464.**

High Power **Radiators** for Frequencies below 100 Cycles per Second.—E. W. Kellogg, **p. 170.**

The Definition of the Titles "Pressure" and "Motion" **Receivers.**—K. Schuster, **p. 589.**

A **Reciprocal Theorem** in the Theory of Diffraction [Application to Theory of Loud Speakers and Aerial Arrays].—F. D. Smith, **p. 645.**

A Simple Stylus and Rotating Drum Speech **Recorder**, from a Loud Speaker Movement.—Ketterer, **p. 101.**

Glow-Lamp Noiseless **Recording.**—E. H. Hansen, **p. 101.**

Sound **Recording** on Unsensitised Back of Picture Film by Variations in the Thickness.—Brachet: Huguenard, **p. 101.**

The **Recording** of Sound and its Use in Broadcasting [particularly the Huguenard System of Inscription on Celluloid].—Huguenard, **p. 646.**

The A.E.G. Home **Recording** Outfit.—A.E.G., **p.101.**

Recording of Long Programmes or Books: an **Austrian** Device.—I. J. Saxl: Thirring and Richtera, **p. 351.**

A New Method of **Recording** Sound and Vibrations [Photographic Version of the Hydraulic Microphone].—H. Greinacher, **p. 351.**

The Sound **Recording** Camera [Sound-on-Film Recording Systems].—W. H. O. Sweeny, **p. 465.**

Physics in Sound **Recording.**—A. Whitaker, **p. 170.**

The **Recording and Reproducing** of Sound (Cantor Lecture).—A. G. D. West, **p. 41.**

Frequency Characteristics in Film **Recording and Reproducing.**—G. Lewin, **p. 352.**

Electro-Mechanical **Rectification**: A Moving Coil L.S. Phenomenon.—N. W. McLachlan: Turner, **pp. 464** and **589.**

The Use of the Dry-Plate **Rectifier** in Audio-frequency Measuring Technique.—W. Wolman and H. Kaden, **p. 41.**

Phase-Sensitive "**Rectifier Bridge**" for Measuring a Desired Component in an A.C. Potential.—Walter, **p. 589.**

The Use of the **Rectifier Bridge** in Test Room Technique [as Phase-Sensitive Indicator, Frequency Analyser, etc.].—Walter, **p. 645.**

The **Reflection** of Sound Waves in Thin Anisotropic Plates.—A. Seiffert, **p. 530.**

Measurements of Sound **Reflection Coefficients** of Materials for Defined Sound-Field Ratios.—L. Casper and G. Sommer, **p. 172.**

On the Construction of Sound **Reflectors** [for Pulpits, etc.].—A. D. Fokker, **p. 288.**

"Room-Acoustic" **Relaxation Oscillations.**—H. E. Hollmann and Th. Schultes, **p. 99**: see also Direct-Indicating.

Broadcast **Reproduction.**—H. A. Hartley, **p. 464.**

Modern Apparatus for the **Reproduction of Speech and Music.**—N. W. McLachlan, **p. 101.**

The Bottle-Pipe **Resonator.**—A. E. Bate, **p. 44.**

The Volf **Resonator and Modulator, p. 351.**

Wattless **Retroaction** [and its Application to Electro-mechanical Systems such as Tuning Forks and Various Resonators].—Braude, **pp. 337-338.**

A Circuit whose **Retroaction** is Independent of Frequency.—Brillouin and Lévy, **p. 338.**
Reverberation Measurements with a Completely Automatic Apparatus.—M. J. O. Strutt, **p. 529.**
The Acoustics of Famous European Concert Halls, and the Optimum **Reverberation Time** for Rooms of Various Size and for Various Types of Music.—V. O. Knudsen, **p. 40.**
A Simple Time-Integrating Device [especially for **Reverberation Time** Measurement].—A. G. Granston Richards, **p. 40.**
Reverberation Time Measurements in Coupled Rooms.—C. F. Eyring, **p. 229.**
A Bridge Arrangement for Measuring **Reverberation Times** with Pure Notes.—H. E. Hollmann and Th. Schultes, **p. 40.**
Reverberation Times.—See also Echo.
A "Whisper" Microphone of **Rochelle Salt.**—Möller: Heinrich Hertz Association, **p. 289.**
Piezoelectric Loud-speakers and Microphones [**Rochelle Salt**: the Development of the Bimorph Principle].—A. L. Williams, **p. 464.**
Piezoelectric Properties of **Rochelle Salt** Crystals.—Schulwas-Sorokin, **p. 467.**
On a Characteristic Temperature Point in **Rochelle Salt** Crystals.—Schulwas-Sorokin, **p. 595.**
The Use of **Rochelle Salt** Crystals for Electrical Reproducers and Microphones.—C. B. Sawyer, **p. 101.**
The Electrical Properties of **Rochelle Salt** Mixed Crystals.—B. Kurtschatow and M. Ermejew, **p. 589.**
Sound Films and Television in **Russia.**—G. E. Roth, **p. 646.**
The Transmission of Sound Through **Sea Water.**—H. G. Dorsey, **p. 466.**
The Use of Copper Oxide Rectifying Elements for Protecting Operators from Acoustic **Shocks.**—Collet, **p. 530.**
The Action of Oscillating Piezoelectric Quartz on **Solutions and Suspensions** of Colloids.—N. Marinesco, **p. 467.**
Sound Film Engineering in 1931: a Retrospect.—P. Hatschek, **p. 465.**
Physical Properties and Construction of [Alkali] Photoelectric Cells for **Sound-Film** Purposes.—W. Kluge, **p. 171.**
Papers on AEG **Sound-Film** Work.—Hehlgans and Lichte: AEG, **p. 288.**
A New Method of Blocking Out Splices in **Sound Film**: The Surface Treatment of Sound Film: Photographic Characteristics of Sound Recording **Film**: The Measurement of Density in Variable Density Sound Film: Apparatus for the Analysis of Photographic Sound Records.—Crabtree, Ives, Sandvik, Jones, Tuttle, McFarlane, **p. 412.**
Rhythmography—a New **Sound-Film** Production Process [rendering into Foreign Speech].—H. Dillge: Blum, **p. 646.**
Controllable Light Sources for **Sound-on-Film** Recording.—F. Skaupy, **p. 589.**
The Present Position of Photographic Technique in **Sound-on-Film** Recording.—J. Eggert, **p. 171.**
Light Sources for **Sound-on-Film** Recording [and in particular the "Lichtspritze" Lamp].—H. Ewest, **p. 171.**
Researches on the Figure of Merit of Recording in **Sound-on-Film** Records [including an Objective Method of Testing It]: The Measurement of Sensitivity in Sound-on-Film Recording.—A. Küster and R. Schmidt, **p. 170.**
Investigations on Non-linear Distortion in **Sound-on-Film** Systems on the Intensity Principle.—A. Narath, **p. 288.**
The Distribution of Light in the Recording Slit in the Black-and-White [Amplitude: **Sound-on-Film**] Process [including a Description of the Räntsch—Siemens and Halske—Optical System].—H. J. Eilers, **p. 171.**
The Reproduction of **Sound-on-Film** Records [particularly the "Stellor" Reproducing Equipment].—P. Toulon, **p. 352.**
The Types of Distortion in **Sound-on-Film** Records.—F. Fischer, **p. 288.**
Optical System for **Sound-on-Film** Reproduction, comprising a Straight-Filament Lamp, a Cylindrical Objective, and an Ordinary Objective, **p. 230.**
Studio Practice in "Noiseless" [**Sound-on-Film**] **Recording.**—G. Lewin, **p. 43.**
The Connection between Gradation and Frequency Characteristic in **Sound-on-Film Recording** by the Intensity Process.—R. Schmidt, **p. 43.**
The Recording of **Sound Films** in the Tobis and Kerr-Karolus (Klangfilm) Systems, **p. 170.**
The Development of the Loud Speaker for **Sound Films.**—H. Warncke, **p. 646.**
The Technique of **Sound Films.**—H. Kotte, **p. 529.**
[The Intimate Connection between] **Sound Films and Television.**—R. Thun, **p. 465.**
Sound Films, Motion Pictures.—See also Recording, Reproduction, Talking, Vertical Cut, Vowels, and below.
Physical Factors Affecting the Illusion in **Sound Motion Pictures.**—J. P. Maxfield, **p. 170.**
Some Acoustical Problems of **Sound Picture** Engineering.—W. A. MacNair, **p. 40.**
Supply and Cost of 16-mm. Film for the Home [for **Sound-Picture** Equipment].—F. S. Irby, **p. 43.**
Acoustic Power Levels in **Sound Picture** Reproduction.—S. K. Wolf and W. J. Sette, **p. 43.**
New Talkie **Film** [**Sound**] **Printer.**—Bell and Howell Company, **p. 529.**
Sound Printer compensating automatically for Shrinkage of Negative.—J. S. Watson and R. V. Wood, **p. 101.**
Noisy Audience Limits **Sound-Proofing** of Theatre.—S. K. Wolf and J. E. Tweeddale, **p. 465.**
Soundproof Partitions.—Notes from the U.S. Bureau of Standards, **p. 171.**
Soundproof Partitions [of Cinder Block and Clay Tile], **p. 413.**
Sound Rays as Extremals.—Bateman, **p. 455.**
Sound Waves, Effects on Liquids, etc.—See Biological, Heating.
Echo **Sounding**; The Advisability of Using Continuous Recording.—P. Marti, **p. 101.**
Echo **Sounding**: British Admiralty Gear, Type 752: Submarine Signal Corpn. Universal Fathometer, Type 432, **p. 101.**
Sonic **Sounding** by the Fessenden System "Fathometer," **p. 44.**
Echo **Sounding** for Aircraft and Ships: A Direct-Reading Chronograph for the Exact Measurement of Short Time Intervals.—Dubois and Laboureur, **p. 414.**
Sounding the Ocean Depths, **p. 290.**
Reflection [**Sounding**] Methods of Measuring the Depth of the Sea.—J. A. Slee, **p. 290.**
Portable **Speech-Input Equipment.**—E. G. Fracker, **p. 101.**
Sterilisation of Milk by High-Pitched Sound Waves.—N. Gaines and L. A. Chambers, **p. 172**: see also Biological.
The Acoustical Problems of Broadcasting **Studios.**—N. Ashbridge, **p. 40.**
The Design and Acoustics of Broadcast **Studios.**—S. J. Ebert, **p. 288.**
Planning the NBC **Studios** for Radio City.—O. B. Hanson, **p. 647.**
New Optical Properties of Liquids submitted to **Supersonic** Waves. R. Lucas and P. Biquard, **p. 530.**
Action of **Supersonic** Waves on Isolated Cells in Suspension.—E. and H. Biancani and A. Dognon, **p. 530.**
Supersonic.—See also Ultrasonic, Biological and Sterilisation.
Supersonic Satellites and Velocity.—W. H. Pielemeier, **p. 100.**
Contributions to a Methodical Valuation of **Talking Machines** and **Sound Records.**—L. Hajek, **p. 43.**
Development and Use of **Talking Motion Pictures** [General Description].—H. M. Wilcox, **p. 646.**
An Analytical Theory of the **Telephone** [and Allied Electromagnetic Instruments] and Its Significance for Experiment.—H. Hecht, **p. 42.**
The Subscriber Output Amplifier: Part I.—Considerations on the Fundamental Design Calculations of **Telephone Sets with Loud Speaker Equipment.**—R. Winzheimer and H. Reppisch, **pp. 465 and 590.**
A Working Calibration Standard for **Telephones** [the Setem].—C. A. Hartmann and E. Döring, **p. 44.**
A **Terminology** for Acoustics: A Suggestion for a Proper System analogous to that of Optics.—J. B. Pomey, **p. 413.**
On the Influence on the Audition **Threshold** of Distortion of the Sound Field caused by the Head and Auditory Passages.—G. von Békésy, **p. 647.**
Investigations on Acoustic **Threshold Values.** I. On the Measurement of the Threshold of Sensation of Hearing with Resonance Telephones.—E. Waetzmann and H. Heisig, **pp. 42 and 99.**
The **Time Factor** in Telephone Transmission.—O. B. Blackwell, **p. 290.**
Amplifier **Tone Control** Circuits [Suggestion of Simplified Mathematical Treatment].—R. H. Nisbet: Scroggie, **p. 351.**
The **Tone Control** Adjustment, a New Component for Better Broadcast Reproduction.—E. Schwandt: Rhein, **p. 590.**
Amplifier **Tone-Control** Circuits.—M. G. Scroggie, **p. 230.**
Tone Correction and Distortion.—McLachlan, **p. 460.**
"**Tone Equalisers**" in Broadcast Receivers, **p. 351.**
Interspaced [Audio-frequency] **Transformer** Windings [and the Production of Flat Response Curves without the use of Special Core Material or Change of Mass of Core or Copper].—W. J. Leidy, **p. 172.**
On the Dependence of the Equivalent Iron Loss Resistance of a [Telephone] **Transformer** on the Current.—G. A. Tschaianov, **p. 466.**
The Significance of **Transient** Processes in Acoustics.—H. Backhaus, **p. 289.**
The **Transient** Current in a Rejector Circuit [and Application of Results to Telephonic Filters].—Pomey, **p. 457.**
The Recording of **Transients** by the C.-R. Oscillograph.—Hollmann, **p. 170.**
Transients and Telephony.—T. S. E. Thomas, **pp. 42 and 230.**
A Balance Method of Measuring Sound **Transmission.**—A. E. Knowler, **p. 40.**
Transmission of Sound through Partitions [Measurements at the National Physical Laboratory].—A. H. Davis, **p. 229.**
Two Speakers from One Set, p. 645.
On the Application of Hot Wires to Measurements in the **Ultrasonic** Region—Preliminary Communication.—H. Müller and T. Kraefft, **p. 467.**
Ultrasonic Absorption in Gases.—J. C. Hubbard, **p. 647.**
Ultrasonics: Some Properties of Inaudible Sound.—F. Ll. Hopwood, **p. 100.**

Pick-Up Amplifier **Valve with Photo-sensitive Cathode and External Electrostatic Control Electrode, p. 647.**
Sound **Velocity in** Reactive Mixtures of Real Gases.—D. G. C. Luck, **p. 466.**
Velocity of Propagation of Ultra-Acoustic Oscillations in Cylindrical Rods.—K. Röhrich, **p. 466.**
A Direct Method of measuring the **Velocity** of Sound in Paper.—D. A. Oliver, **p. 645.**
A New Method for Measuring the **Velocity** of Sound in Various Materials [depending on Stereo-acoustic Observations].—G. Veenekamp and H. Schmidt, **p. 229.**
Asymmetry of Sound **Velocity** in Stratified Geologic Formations.—B. McCollum and F. A. Snell, **p. 466.**
Velocity of Sound in Tubes at Audible and Ultrasonic Frequencies.—C. B. Vance, **p. 290.**
Velocity of Sound in Cylindrical Rods.—G. S. Field, **p. 229.**
Velocity of Longitudinal Vibration in Solid Rods (Ultrasonic Method) with Special Reference to the Elasticity of Ice.—R. W. Boyle and D. O. Sproule, **p. 229.**
Advantages of **Vertical Cut** Sound Records.—H. A. Frederick, **p. 101.**
Some Observations on **Vibrating Tubes** [and Their Use in Detecting and Measuring High Audio-Frequencies].—H. Kröncke, **p. 414.**
The Natural History of the **Vibrato.**—C. E. Seashore, **p. 172.**
The **Vibrometer.**—H. Subra, **p. 351.**
A Voice and Ear for Telephone Measurements.—A. H. Inglis, C. H. G. Gray and R. T. Jenkins, **p. 413.**
Voice Training on a Scientific Basis.—D. Stanley, **p. 44.**
Voices Beautified for Radio by Ingenious Mechanisms.—O. H. Caldwell, **p. 590.**
Vowel Characteristics.—A. Stefanini, **p. 172.**
The Nature of the **Vowels** [Investigation by Sound-on-Film Technique].—E. W. Scripture, **p. 590.**
The Physical Nature of Japanese **Vowels.**—M. Takahashi and G. Yamamoto, **p. 647.**

PHOTOTELEGRAPHY AND TELEVISION.

An Attempt to Detect High Photoelectric **Absorption** in Caesium Vapour at Double the Series Limit.—E. T. S. Appleyard, **p. 291.**
Photoelectric **Absorption** in Hydrogen-Like Atoms.—P. A. M. Dirac and J. W. Harding, **p. 470.**
Secondary Phenomena Following the Primary Photoelectric Effect in Caesium Atoms **Adsorbed** by Salt Layers.—J. H. de Boer and M. C. Teves, **p. 355.**
The Displacement towards the Red of the Photoelectric Ionisation of Alkali Atoms by **Adsorption** at Negatively Charged Salt Surfaces.—J. H. de Boer and M. C. Teves, **p. 291.**
On the Retrogression Effect in **Alkali Cells.**—A. E. H. Meyer, **p. 46.**
Spectral Photoelectric Sensitivity of Thin **Alkali Metal Films** at Room Temperature and at the Temperature of Liquid Air.—R. Suhrmann and H. Theissing, **p. 354.**
Electron Diffraction and Photoelectric Effect at **Alkali Metal Surfaces.** Part I. Method of Investigation.—W. Kluge and E. Rupp, **p. 649.**
Photoelectric Properties of Thin Films of **Alkali Metals** [in conjunction with Silver].—S. Asao, **p. 292.**
New Method for the Study of the Photoelectric Effect of **Alkali Vapours.**—J. Kunz, **p. 470.**
An **Amplifier** (Loftin-White Circuit) for use with Photoelectric Cells.—Bressi, **p. 470.**
Papers on the Resistance-Coupled **Amplifier** and its Behaviour to Transients.—Schlesinger, **p. 47.**
Resistance-Capacitance Coupled **Amplifier** in Television.—H. M. Lane, **p. 415.**
A Resistance-Coupled **Amplifier** for Television [and the Tracing and Compensation of Losses at the Higher Frequencies].—C. Bradner Brown, **p. 647.**
A New Industrial **Amplifier Tube** for Phototube Circuits [Westinghouse RJ-550].—Sutherlin, **p. 409.**
Automatic Mean Amplitude Control in L.F. **Amplifiers.**—G. Krawinkel and E. Perchermeier, **pp. 47 and 470.**
The Input Circuit of Photoelectric Current **Amplifiers.**—H. Lux, **p. 47.**
Attenuating Layer.—See Barrier Layer.
On the Effect of Polarised Light on **Barrier Layer** Photoelectric Cells.—L. Bergmann, **p. 291.**
Barrier-Layer Photoelectric Cells [Siemens and Halske Copper Oxide Cell and Its Use in Photometry].—A. Dresler, **p. 414.**
On the **Barrier-Layer** Photoelectric Effect.—E. Duhme, **p. 290.**
The **Barrier Layer** in Lead Sulphide.—F. Heineck, **p. 469.**
A Physical Model of **Barrier Layer** Photoelectric Cells.—F. v. Körösy and P. Selényi, **p. 231.**
Photoelectric Cell and Light Element [**Barrier Layer** Photoelectric Cell].—F. v. Körösy and P. Selényi, **p. 469.**
Report on the Conference on "**Barrier-Layer** Photoelectric Cells and Rectifiers."—I. Kurtschatow, **p. 649.**
Investigation of the **Barrier-Layer** Photocell.—I. Kurtschatow and C. D. Sinelnikow, **p. 649.**
The Variation with Temperature of the **Barrier-Layer** Photoelectric Effect.—B. Lange, **p. 232.**
The Becquerel Effect as a Special Case of the **Barrier-Layer** Photoelectric Cell.—R. H. Müller and A. Spector, **p. 649.**
New Results with **Barrier-Layer** Photoelectric Cells.—E. Perucca, **p. 232.**
Is the **Barrier-Layer** Photoelectric Effect a Hallwachs Effect?—E. Perucca and R. Deaglio, **p. 232.**
Magnetic Control of the Photoelectric Current in **Barrier-Layer** Cells.—E. Rupp, **p. 354.**
On Variation of Resistance of **Barrier-Layer** Photoelectric Cells and Crystal Cells, due to Magnetic Fields.—E. Rupp, **p. 531.**
Conductivity and Photoelectric Effects at **Barrier Layers.**—W. Schottky, **p. 232.**
The Constancy of Action of the Commercial **Barrier-Layer** Photoelectric Cell.—Schwarz, **p. 469.**
The Becquerel Effect in Copper Oxide as a **Barrier-Layer** Photoelectric Effect.—F. Waibel, **p. 532.**
Some New Observations on the **Barrier-Layer** Photoelectric Effect.—F. Waibel and W. Schottky, **p. 649.**
The Electrostriction of **Benzene.**—M. Pauthenier and P. Delahaye, **p. 414.**
A Mechanically Controlled **Bolometer** and Its Use as a Highly Sensitive Quantitative Relay and as a Quantitative D.C. Amplifier [applicable to Photocell Currents].—H. Sell, **pp. 415 and 535.**
The Electrical Behaviour of **Boundary** Layers.—H. Teichmann, **p. 468.**
On the Photoelectric Properties of **Cadmium,** and in Particular the Influence of Gases thereon.—H. Bomke, **p. 102.**
Power Input and Dissipation in the Positive Column of a **Caesium** Discharge.—F. L. Mohler, **p. 591.**
Ionisation of **Caesium Vapor** by Light.—F. W. Cooke, **p. 103.**
Spot Brightness Control in **Cathode-Ray** Tubes, with Special Reference to a New Method [Combination of Electrostatic Deflection on and off Anode Aperture, Deflection Compensation by a Second Deflecting Plate, and Post-Concentration by Cylinder].—M. von Ardenne, **p. 468.**
Investigations on Gas-Filled **Cathode-Ray** Tubes.—von Ardenne, **p. 648.**
Increasing the Brightness of **Cathode-Ray** Television by Using the Ray as a Mobile Conductor making Contact with Different Conducting Points, **p. 531.**
Long Distance Television Tests with the **Cathode-Ray** Receiver [London and Berlin to Dresden: Comparison of Cathode-Ray and Nipkow Disc Receivers].—E. Busse, **p. 353.**
A New **Cathode-Ray** Tube with Small Ray Velocity.—Dobke: AEG, **p. 648.**
A New Sweep-Circuit Device for the **Cathode-Ray** Oscillograph.—Field, **p. 648.**
Particulars of American **Cathode-Ray** Television Systems [Zworykin "Kinescope" and Farnsworth "Oscillite" Systems.]—H. Hewel: Zworykin, Farnsworth, **p. 45.**
Spot Brightness Control in **Cathode-Ray** Tubes [and the German P.O. Methods].—E. Hudec, **p. 531.**
The **Cathode-Ray** Television Apparatus of the German Post Office.—E. Hudec and E. Perchermeier, **p. 45.**
The German Post Office **Cathode-Ray** Television System.—E. H. Traub: Hudec and Perchermeier, **p. 231.**
The **Cathode-Ray** Tube for Television.—E. Hudec and E. Perchermeier, **p. 468.**
The Distortions in the **Cathode-Ray** Oscillograph at High Measuring Velocities.—Klemperer and Wolff, **p. 596.**
The Limits of Performance in **Cathode-Ray** Television.—H. Peters, **p. 45.**
On the Suitability of Various **Cathode-Ray** Oscillograph Tubes for Television Transmissions [particularly a Comparison between Magnetic and Gas Concentration].—H. Peters, **p. 531.**
Improvements in **Cathode-Ray** Tube Design ["Kinescope."]—Zworykin, **p. 106.**
The Structure Analysis of Photoelectric **Cathodes** by Means of Electron Interference.—W. Kluge and E. Rupp, **p. 232.**
Photoelectric **Coagulation** of Sodium in Rock Salt.—E. Rexer, **p. 291.**
Photoelectric and Thermionic Emission from **Cobalt.**—A. B. Cardwell, **p. 234.**
The Applicability of Photoelectric Cells to **Colorimetry.**—H. E. Ives and E. F. Kingsbury, **p. 46.**
Transmission of **Colour Pictures, p. 648.**
Experimental Investigations of the Current **Conduction** in Dielectric Fluids at High Fields.—Nikuradse, **p. 479.**
Conductivity of Dielectric Fluids [Summarising Report].—A. Nikuradse, **p. 650.**
The Electrical **Conductivity of Acetone** [and **Nitrobenzene**] for Direct Current.—Garrigue, **p. 103.**
The Rôle played by the Nature of the Electrodes in **the Conductivity of Semi-Conducting Liquids** [Nitrobenzene].—J. Sambussy, **p. 471.**
Contact Potential Differences between Iron and Nickel and their Photoelectric Work Functions.—G. N. Glasoe, **p. 102.**
On the Electric and Photoelectric Properties of **Contacts** between a Metal and a Semiconductor.—J. Frenkel and A. Joffé, **p. 290.**
The Sensitivity of **Copper Oxide** Photoelectric Cells with Copper Grids: Comparison with the Optical Absorption and Photo-Conductivity of Copper Oxide.—L. Dubar: Auger and Lapicque, **p. 46.**
Structural Investigation of the **Copper Oxide** Rectifier: Contribu-

tion to the Crystal and Attenuating Layer Photoelectric Effect.—K. Scharf and O. Weinbaum, **p. 469.**
On the Composition of the Oxide in **Copper Oxide** Rectifiers and Photoelectric Cells.—Dubar, **p. 419.**
On the Photoelectric Effect in the **Cuprous Oxide–Copper** Rectifier.—E. Perucca and R. Deaglio: von Auwers and Kerschbaum, **p. 103.**
Copper Oxide Photocells.—See also Rectifiers.
A **Crystal** Photoelectric Cell [using Cuprite, Proustite and other Crystals].—H. Dember, **p. 232.**
On the Theory of the **Crystal** Photoelectric Effect.—H. T. Wolff, **p. 650.**
The Current/Voltage Relation in the Photoelectric Conductivity in **Crystals.**—W. Flechsig, **p. 232.**
On the Dependence of the Maximum Velocities and Work Function of Photo-Electrons at Fractured Surfaces of Single Zinc **Crystals** on the Direction of the Surface.—A. Nitzsche, **p. 650.**
On the Mechanism of the Primary Photoelectric Current in Insulating **Crystals.**—K. Hecht, **p. 649.**
[Certain Rare Types of] **Diamonds** Yield Electricity when Bathed with Light, **p. 649.**
The Effect of the **Diffused Light** on Photoelectric Measurements.—T. D. Gheorghiu, **p. 470.**
A Stroboscopic Method of Measuring Electrical **Double Refraction.**—R. Lucas and M. Schwob, **p. 471.**
The C.C.I.T. Standard and Alternative **Drums.**—Ritter, **p. 467.**
The [**Electrolytic**] Distribution of Silver and Sodium between Glass and Nitrate- or Bromide-Enamels in the State of Equilibrium.—A. Güntherschulze and O. Mohr, **p. 592.**
Electrons and Light Quanta.—Fleming, **p. 478.**
Telecinema Transmitters and Receivers for a Large Number of Picture **Elements.**—G. Schubert, **p. 45.**
Number of **Elements** and Element Frequency [and the Use of Screens with Persistence of Glow].—G. G. Reissaus, **p. 45.**
The Inertia of the **Eye.**—G. G. Reissaus, **p. 533.**
Note on **Facsimile** Transmission from the **Air** to Earth and *vice versa*.—U. Guerra, **p. 230.**
Photographic-Type **Facsimile** System for Tactical Work in connection with National Defence.—L. R. Philpott, **p. 648.**
Measurement of **Fidelity** in Television Systems.—A. F. Murray, **p. 46.**
A Method of Measuring the Integrated Light from Short **Flashes** of High Intensity [Photoelectric Tube Charging a Condenser in Grid Circuit of Thyratron].—L. R. Koller, **p. 103.**
The Measurement of **Fluorescence** by means of the Photoelectric Cell.—R. Toussaint, **p. 103.**
The **Frequencies** in Television Signals [The **Failure** of the " Dot " Theory, etc.].—E. G. Bowen, **p. 416.**
A Further Study of **Galvanoluminescence** [Development of Light at Aluminium and other Anodes at Passage of Current through the Electrolyte].—R. R. Sullivan and R. T. Dufford, **p. 174.**
Field and Ion Concentration near the Cathode of a **Glow Discharge** Tube.—W. de Groot, **p. 103.**
Glow Discharge Tubes and Their Technical Applications.—F. Michelssen, **p. 293.**
Glow Discharge Lamps for the Generation of " Kipp " Oscillations.—von Hartel, **p. 536.**
Measurements [of **Infra-Red** Radiation] with the Photoelectric Relay.—Barnes and Matossi, **p. 474.**
On Conducting and Photo Electrons in **Insulators and Semi-Conductors.**—B. Gudden, **p. 173.**
High Voltage **Kerr Cell.**—H. M. Dowsett, **p. 353.**
Contributions to the Physics of the Nitrobenzol **Kerr Cell.**—F. Hehlgans, **pp. 47, 103** and **471.**
Investigation of the Distribution of Strong Alternating Electric Fields in the Nitrobenzene **Kerr Cell.**—F. Hehlgans, **p. 234.**
Resonance Effects in **Kerr Cells** using Bipolar Substances in Nitrobenzene.—C. E. G. Bailey, **p. 353.**
Some Principles governing the Design of **Kerr Cells.**—W. D. Wright, **p. 414.**
The **Kerr Constant** of Nitrobenzol.—R. Möller, **p. 47.**
The Electro-Optical **Kerr Constant** of Liquid and Dissolved Substances, and the Nature and Cause of the Mutual Influence and Orientation of the Molecules in the Liquid State.—G. Briegleb, **p. 292.**
Phenomena accompanying the Electro-Optical **Kerr Effect** in a High-Frequency Field.—H. Hoyer and L. Pungs, **p. 591.**
The Validity of **Kerr's Law** for Nitrobenzene under Strong A.C. Electric Fields.—F. Hehlgans, **p. 234**: see also Conduction, Conductivity, Liquid, Nitrobenzene.
New Development of the Gaseous Discharge **Lamp** for Television.—H. Ewest, **p. 292.**
The Development of the Sodium Vapour **Lamp** for Television.—G. Schubert, **p. 292.**
A New Crater-Tube [**Lamp**] Development, **p. 414.**
The U-shaped Osram Sodium Vapour **Lamp, p. 591.**
Sources of Light for Television [Modern Flat Plate and Crater **Lamps**].—A. E. Lyle, **p. 591.**
On the Forward Motion of Electrons under the Action of **Light.**—H. Dember, **p. 291.**
Television on a **Light Beam.**—E. F. W. Alexanderson: G. E. C., **p. 352.**
Sensitive **Light Control** by Mirror Membrane.—C. Müller: Mey, **p. 354.**
A New **Light Control** Device by C. Müller [Thin Reflecting Metal Membrane].—S. Wagener: Müller and Mey, **p. 533.**
Simplicity Extends **Light Control** Possibilities [Burgess Radiovisor Bridge], **p. 47.**
On Momentary Frequency Analysis of **Light Fluctuations** using Rotating Discs.—T. von Nemes, **p. 533.**
New Sodium **Light Source** of High Luminous Intensity.—M. Reger, **p. 354.**
The " Positive Column " **Light Source.**—Fernseh A.G., **p. 231.**
The " Lichtspritze " (Light-Spray) Lamp with Oxide-Coated Filament, and other **Light Sources.**—Ewest, **p. 174.**
Controllable **Light Sources** for Sound-on-Film Recording.—Skaupy, **p. 589.**
[Highway] **Lighting** in Holland.—Philips' Company, **p. 650.**
Cyclical Line-Shift Process.—Hudec. See Physiology.
The Breakdown of the **Liquid Dielectric** [Influence of Pressure, Temperature, Purity, Frequency, Electrode Form, etc.: the Various Hypotheses].—A. Nikuradse, **p. 650.**
The Behaviour of Absorbed Air in the Breakdown of **Liquid Dielectrics.**—F. Koppelmann, **p. 47.**
Variation of the **Magnetic Susceptibility** of Paramagnetic Ions under the Influence of Light.—O. Specchia, **p. 174.**
Papers on the **Magneto-Optical Effect** of Thin Iron Films.—Cau: Pogány, **pp. 471** (two) and **533.**
The Construction and Operation of Capillary **Mercury Arcs** [free from Decrease of Intensity and Deterioration of Quartz].—R. H. Crist, **p. 47.**
Number of Elements, Image Dimensions and Brightness with the **Mirror Helix.**—F. von Okolicsanyi, **p. 45.**
New Types of **Mirror Wheel** for Television Reception.—R. Schadow, **p. 231.**
Model for Demonstrating Television and for Testing Characteristics of Amplifiers, etc.: Model for Illustrating the Fundamental Principles of Television.—R. Wilson and A. A. Waters: R. W. Corkling, **p. 468.**
Series **Modulation** for Television Transmitters.—C. Bradner Brown, **p. 648.**
A New Method of Measuring the After-Glow of Discharges in Gas [and the Limitations of the **Neon Lamp** in Television].—L. Rohde and K. Schnetzler, **p. 591.**
Neon Tube with Metallic Coating on Wall as Positive Electrode, **p. 47.**
" **News** " by Television: A Marconi Development.—H. M. Dowsett, **p. 530.**
The Optical Properties of **Nitrobenzene** in Thin Layers submitted to an Electrostatic Potential.—A. Cotton and H. Mouton, **p. 354**; see also Kerr.
The Mirror **Oscillograph** in Television.—K. O. Kiepenheuer, **p. 47.**
Photoelectric and Thermionic Properties of **Palladium.**—L. A. Du Bridge and W. W. Roehr, **p. 234.**
The Photoelectric and Thermionic Properties of **Palladium.**—W. W. Roehr and L. A. Du Bridge, **p. 470.**
On the Thermo-Electric Forces of **Palladium Iron and Palladium-Silver** Alloys with Adsorbed Hydrogen.—R. Nübel, **p. 47.**
Photo- and Thermo-Electric Effect in **Palladium-Silver** and Palladium-Gold Alloys with Adsorbed Hydrogen.—F. Schniedermann, **p. 532.**
New High-Efficiency **Photocell.**—Lorenz Company, **p. 292.**
A Vacuum **Photo-Cell Type** of [**Television**] **Transmitter.**—C. E. C. Roberts, **p. 231.**
Photo Cells: the Valves Which Operate by Light.—C. C. Paterson, **p. 354.**
Thermionic Emission in Caesium-Oxide **Photocells** at Room Temperatures.—Kingsbury, **p. 228.**
Some Experiments with Gas-filled Cs-O-Ag **Photo Cells.**—K. H. Kingdon and **H. E.** Thomson, **p. 291.**
Photocells and Their Applications in Optical Technique [Survey and Bibliography of Recent Work].—H. Singer, **p. 532.**
Lag in Gas-Filled **Photocells.**—F. Ollendorff, **p. 592.**
Manufacture of Caesium Silver-Oxide **Photocells.**—W. H. Nickless, **p. 648.**
Time-Lag in **Photo-Cells** and the Townsend Discharge.—N. R. Campbell, **p. 648.**
The Fournier-Céma **Photoelectric Cell, p. 354.**
Silver-Selenium (on Iron-Nickel Alloy) **Photoelectric Cell.**—Western Elec. Instrument Company, **p. 554.**
A **Photoelectric Cell** Circuit [Special Modification of Hull Circuit for Wide Linear Response: Mathematical Analysis].—G. A. Woonton and R. G. Elson, **p. 592.**
The Caesium-Oxygen-Silver **Photoelectric Cell.** An Investigation of the Relations in a Composite Photoelectric Surface.—C. H. Prescott, Jr., and M. J. Kelly, **pp. 592** and **648.**
The " Patina " **Photoelectric Cell.**—F. Noack: Lorenz Company, **p. 470.**
Constancy of Emission of Gas-Filled **Photoelectric Cells** after a Momentary Glow Discharge.—W. R. G. Atkins, **p. 173.**
The Construction of **Photoelectric Cells** with Large Cathode Surfaces.—R. Fleischer, **p. 292.**
Experiments on the Behaviour of [Gas-filled] **Photoelectric Cells** with Varying Frequency of Illumination.—P. Fourmarier, **p. 46.**

A Study of Sluggish Response in Gas-Filled **Photoelectric Cells.**—P. Fourmarier, **p. 233.**
The Response of a Gas-Filled **Photoelectric Cell** to a Sudden Illumination.—P. Fourmarier, **p. 648.**
The Application of **Photoelectric Cells** Sensitive in the Infra-Red to Stellar Photometry [and the Reduction of the "Dark Current" in Caesium-Oxide-on-Silver Photocells].—J. S. Hall, **p. 592.**
Characteristic Constants of **Photoelectric Cells.**—S. N. Kakurin, **p. 354.**
Photoelectric Cells for Sound-Film Work.—Kluge, **p. 173.**
Modern Alkali **Photoelectric Cells.**—W. Kluge: AEG, **p. 470.**
Some New Facts observable with Ordinary **Photoelectric Cells.**—Q. Majorana, **p. 355.**
The Glow in **Photoelectric Cells.**—Rayleigh, **p. 648.**
Further Progress in **Photoelectric Cells.**—H. Kröncke: Sewig, **p. 292.**
Photoelectric Cells with Cathodes of Thin Layers of Alkali Metals.—R. Sewig, **p. 469.**
Sensitised Potassium **Photoelectric Cells** [and Their Selective Emission].—R. Suhrmann, **p. 173.**
Photoelectric Cells and Their Use.—H. Simon and R. Suhrmann, **p. 470.**
Vacuum **Photoelectric Cells** of High Sensitivity.—M. C. Teves, **p. 172.**
Investigations on the Lower Limit of Sensitivity of Commercial Potassium **Photoelectric Cells** and their Suitability for the Photoelectric Measurement of α [Ray]-Preparations.—G. A. Teves, **p. 649.**
Current Increase in **Photoelectric Cells** due to Gas Discharge.—P. W. Timofeev and N. S. Chlebnikow, **p. 233.**
Gas-filled **Photoelectric Cells.**—P. W. Timofeev and N. S. Chlebnikow, **p. 592.**
Photoelectric Cells with Silver/Silver Bromide Electrodes in Potassium Bromide Solution.—B. Vanselow and S. E. Sheppard, **p. 292.**
Photoelectric Cells.—See also Alkali, Barrier, Boundary, Cathodes, Copper Oxide, Crystal, Lag, Photocells, Photo-sensitive, Selenium, Silver, Ultra-Violet, Weston.
Photoelectric Currents in Gases between Parallel Plates as a Function of the Potential Difference.—N. E. Bradbury, **p. 532.**
On a New **Photoelectric Effect.**—L. Bergmann, **p. 232.**
Contribution to the Knowledge of the Crystal and Attenuating Layer **Photoelectric Effect.**—W. Bulian and H. Schreiber, **p. 592.**
Internal and External **Photoelectric Effect** [from γ-rays].—H. Casimir, **p. 103.**
The Selective **Photoelectric Effect** and Absorption of Light.—R. Fleischmann, **p. 47.**
Absorption of Light and the Selective **Photoelectric Effect.**—H. Fröhlich, **p. 470.**
The External **Photoelectric Effect** in Liquids. Determination of the Long-Wave Limit in Water.—P. Görlich, **p. 533.**
On the External **Photoelectric Effect** with Phosphorescent Materials [Alkaline Earth Sulphides] and its Mode of Dependence on the Excitation Condition.—H. Göthel, **p. 47.**
The **Photoelectric Effect** for γ-Rays [Theoretical Investigation].—H. R. Hulme, **p. 103.**
The Vectorial **Photoelectric Effect** in Thin Films of Alkali Metals.—H. E. Ives, **p. 102.**
The **Photoelectric Effect** from Thin Films of Alkali Metal on Silver.—H. E. Ives and H. B. Briggs, **p. 102.**
The Distribution of Electrons in the **Photo-Effect by Röntgen Rays,** Classically Treated [Theoretical Investigation].—J. Kunz, **p. 649.**
Correlating the Selective **Photoelectric Effect** with the Selective Transmission of Electrons through Crystalline Surface Structures.—A. R. Olpin, **p. 233.**
An Interpretation of the Selective **Photoelectric Effect** from Two-Component Cathodes.—A. R. Olpin: W. H. Zachariasen, **p. 233.**
The **Photoelectric Effect** in Thin Metallic Films [Theoretical Investigation].—W. G. Penney, **p. 46.**
On the Influence of Plastic Deformation on the Internal **Photoelectric Effect** in Rock Salt Crystals.—M. N. Podaschewsky, **p. 649.**
On the Atomic **Photoelectric Effect** for Very Hard Exciting Radiation [Theoretical Investigation].—F. Sauter, **p. 103.**
On the Atomic **Photoelectric Effect** in the K-Ring on Dirac's Relativistic Wave Mechanics.—F. Sauter, **p. 234.**
Causes of the Selective **Photoelectric Effect.**—R. Suhrmann, **p. 173.**
New Observations on Field- and **Photoelectric-Effects** at Outer Border Surfaces ["Mono-Layers"].—R. Suhrmann, **p. 233.**
Some Remarks on the Theory of **Photoelectric Effect** in Metals.—Ig. Tamm, **p. 291.**
Temperature Dependence of **Photoelectric Effect** in Metals.—L. A. Young and N. H. Frank: Fowler, **p. 103.**
Photoelectric Efficiencies in the Extreme Ultraviolet.—F. H. Spedding, **p. 233.**
The Physico-chemical Composition of the Metallic Surface in the Selective **Photoelectric Electron Emission** from the Alkali Metals.—R. Suhrmann, **p. 291.**
A Further Experimental Test of Fowler's Theory of **Photoelectric Emission.**—L. A. Du Bridge, **pp. 291 and 470.**
Photoelectric Emission from Cadmium and Mercury.—D. Roller and M. Zenov, **p. 470.**
Dependence of the **Photoelectric Emission** from Potassium on the Arrangement of Atomic Hydrogen and Potassium Films on its Surface.—P. I. Lukirsky and S. Rijanoff, **p. 532.**
Photoelectric Emission from Different Metals.—H. C. Rentschler, D. E. Henry and K. O. Smith, **p. 649.**
Additional Experimental Verification of Fowler's **Photoelectric [Emission]** Theory.—G. B. Welch, **p. 470.**
Photoelectric Effect and Emission.—See also Photo-thermionic, Selenium, Semi-Conductors, Surface Changes, Surface Electrons.
A More Rigid Proof of the **Photoelectric Law.**—N. R. Campbell, **p. 416.**
A New **Photoelectric Phenomenon** [Increase of Resistance of Thin Films of Silver, Gold, Platinum, etc., on Glass, produced by the Action of Light].—Q. Majorana, **p. 592.**
The **Photoelectric Properties** of Films of Beryllium, Aluminium, Magnesium and Thallium.—H. de Laszlo, **p. 470.**
Photoelectric Properties of Thin Films of Rubidium and Caesium on Silver.—J. J. Brady, **p. 291.**
Some New **Photoelectric Researches.**—Q. Majorana, **pp. 173** (two) **and 291.**
Papers on **Photoelectric Technique** in Various Applications, **p. 47.**
Angular Distribution of **Photoelectrons.**—A. Sommerfeld, **p. 173.**
The Resemblance between the Longitudinal Asymmetry of the Classical Field of an Accelerated Electron and the Distribution of Scattered **Photoelectrons.**—L. Simons, **p. 648.**
The Depth of Origin of **Photoelectrons.**—H. E. Ives and H. B. Briggs, **pp. 416 and 532.**
Photoelectrons and Negative Ions.—E. M. Wellish, **pp. 102 and 173.**
Photoelectrons and Negative Ions.—J. L. Hamshere, **p. 173.**
Photoelectrons and Negative Ions.—V. A. Bailey, **p. 234.**
Optimum Outputs of **Photo-Sensitive** Devices.—E. D. Wilson, **p. 173.**
Modern **Phototelegraphy** [Bartlane System].—R. C. Walker, **p. 467.**
Phototelegraphy with Cliché Reception [Guth "Radiotype" System on the "Bremen"].—Guth, **p. 531:** see also Radiotype.
On the **Photo-Telephony** [Successful Use of Incandescent Electric Lamp at Transmitter].—Kujirai, **p. 540.**
On the Nature of a **Photo-thermionic Effect** due to Red and Infra-Red Radiation.—I. Ranzi, **p. 355.**
Influence of the Electrolytes on **Photovoltaic** Phenomena.—R. Audubert, **p. 174.**
Photovoltaic Properties of Cadmium Sulphide.—R. Audubert and C. Stora, **p. 470.**
Some **Photovoltaic** Properties of Cu : $Cu_2O/Pb(NO_3)_2$ Solution/Cu : Cu_2O Photocells.—W. E. Meserve, **p. 650.**
Discontinuous Variation of the E.M.F. of **Photovoltaic Cells** with Coloured Liquids.—A. Grumbach and F. Taboury, **p. 103.**
On the Law of Equidistance in **Photovoltaic Cells.**—A. Grumbach and F. Taboury, **p. 174.**
The Part Played by Water in **Photovoltaic Cells.**—R. Audubert, **p. 46.**
The Rôle of Photoconductance Phenomena in the **Photovoltaic Effect.**—R. Audubert and J. Roulleau, **p. 46.**
On the **Physiology** of Television [and the Cyclical Line-Shift Process].—E. Hudec, **p. 172.**
Echo Signals in Transatlantic **Picture Telegraphy** [and Results in S-N Direction, Cape Town to Somerton].—Dowsett, **p. 216.**
Half-Tone **Picture Telegraphy** on Short Waves [Telefunken "Channel-Change" System].—F. Schröter: Schriever: Ilberg, **p. 230.**
The Transmission of Half Tone **Pictures** by Short Waves.—F. Schröter, **p. 290.**
Difficulties encountered in Transmitting **Pictures** over Telephone Circuits.—E. S. Ritter, **p. 467.**
The Transmission of **Pictures and Facsimiles.**—I. T. and T. Laboratories, **p. 44.**
Piezoelectric-Photoelectric Amplifier for Electric Current Variations.—A. Thomas, **p. 470.**
Plane Waves of Light: Absorption by Metals.—T. C. Fry, **p. 533.**
The Photo-ionisation of Atomic **Potassium.**—M. Phillips, **p. 291.**
Directional Distribution of the Electrons Emitted from the **Potassium** Atom under the Action of Polarised Ultra-Violet Light.—A. Kraus, **p. 649.**
Photo-ionisation Probabilities of Atomic **Potassium.**—M. Phillips, **p. 355.**
The Importance of the **Programme** for the Success of a Television Transmission.—R. Thun, **p. 530.**
On the Way to **Projected** Television.—F. Kirschstein: Sanabria, **p. 467.**
Television Turns to **Projection.**—A. Dinsdale, **p. 44.**
Tables for Planck's **Radiation Formula.**—W. de Groot, **p. 103.**
Printed Page by Radio ["**Radiotype**" System on the "Bremen"].—Radiotype and Debeg Radio Companies, **p. 591:** see also Phototelegraphy.
Photoelectricity and Rectification in **Cuprox Rectifiers.**—V. Brazzoduro, **p. 592.**
Photoelectricity and Rectifiers: Comparison between Cuprox and Selenium **Rectifiers.**—R. Deaglio, **p. 592.**
Reflection of Electrons by a Special Potential Field.—E. L. Hill, **p. 173.**
Symmetrical Relaxation Oscillations and Their Synchronisation.—H. E. Hollmann: Frühauf, **p. 45.**

The **Rome** Television Transmitter.—R. Möller, p. 531.
Sound Films and Television in **Russia**.—G. E. Roth, p. 530.
The Part Played by **Russian** Workers in the Development of Electrical Television.—B. L. Rosing, p. 415.
Peck Scanning System for Television.—W. H. Peck, p. 353.
Suggested Slow-Speed Survey of Object superimposed on usual Detail **Scanning** [making use of Continuity of Partial Observation].—G. E. Land, p. 353.
New **Scanning** Method [Irregular Strip Sequence].—Toulor, p. 352.
A **Scanning** Suggestion [Superimposing an Oppositely Curved Scanned Area, by Two Partial Spirals on same Disc, put into action Alternatively].—G. E. Land, p. 45.
Design of Lens **Scanning** Systems for Television.—I. Bloch, p. 591.
Problems of Brightness in Television Transmitters [Quantitative Treatment, including Comparison of Various **Scanning** Methods].—R. Möller, p. 468.
The Lens [**Scanning**] Disc.—E. Busse, p. 468.
New **Scanning** Method [Subdivision into Squares, Corresponding Elements being Scanned in Successive Squares].—Toulon, p. 468.
Television depending on **Brightness** Modulation, and on **Scanning Speed** Modulation.—R. Thun, p. 44.
The Use of **Screens** with Persistence of Glow.—See Elements.
Secondary Emission from Nickel by Impact of Metastable Atoms and Positive Ions of Helium.—M. C. Harrington, p. 102.
Progress in the Construction of **Selenium** Photoelectric Cells.—S. German Apparatus Works, p. 354.
A New **Selenium** Tube: an Application of Modern Vacuum Technique.—G. F. Metcalf and A. J. King, p. 173.
Manufacture of Stable **Selenium Sulphide**, p. 650.
Catalysis and Photo-Conductors [Effect of Added Substances on the Resistance Variation of **Selenium** produced by Light].—F. H. Constable and A. F. H. Ward, p. 649.
Photo-E.M.F. of **Selenium**.—V. Brazzoduro, p. 592.
Measurements on **Selenium** Barrier Layer Photoelectric Cells.—L. Bergmann, p. 591.
Selenium.—See also Rectifiers, and under "Subsidiary Apparatus and Materials."
Papers on **Semi-Conductors**.—Wilson: Leo, p. 108.
On a Photoelectric Effect in **Semi-Conductors**.—L. Bergmann, p. 291.
Television on **Short** [70-Metre] **Waves**.—W. Federmann, p. 45.
The **Shot Effect** in Photoelectric Currents.—B. A. Kingsbury, p. 102.
The Small-**Shot Effect** in Photoelectric Currents.—B. A. Kingsbury, p. 233.
Shot Effect and Thermal Noise in the Photocell Amplifier.—F. von Orbán, p. 649.
Thin Films of Alkali Metals [in conjunction with **Silver**].—S. Asao, p. 292.
[The Intimate Connection between] **Sound Films** and Television.—R. Thun, p. 468.
The **Storage of Light** in Television Apparatus.—W. Friedel: Jenkins, p. 468.
Submarine Television.—Hartmann, p. 353.
Submarine Television [for Exploring the Depths of the Sea], p. 353.
Television Reception with the **Superheterodyne**.—R. W. Tanner, p. 44.
An Advanced Television and Short-Wave **Superheterodyne** Receiver [avoiding Motor-Boating and other Reaction Troubles by Use of Carborundum Detectors in Both Stages].—R. W. Tanner, p. 591.
The Effect of **Surface Changes** on the Photoelectric Emission of Silver and Gold.—T. E. Clarke, p. 292.
The **Surface-Electrons** [Application to Photoelectric Effect].—J. E. Nyrop, p. 355.
Synchronised Mechanically Oscillating System for Television Synchronisation.—R. Barthélémy, p. 531.
A New **Synchronising** System for Television.—T. Sone, p. 353.
The Photoelectric Properties of **Tantalum**.—Cardwell, p. 234.
Television Receiver with Brighter Image.—W. H. Peck, p. 353.
A New Method of Studying and Regulating a **Television** Transmission.—M. Robert, p. 415.
Progress in **Television**: Television Progress from an Engineering Viewpoint.—J. Dunsheath: P. G. Weiller, p. 353.
The Problem of **Television** Transmission—Baird, Lyon and Stoyanowsky System.—E. Labin: Baird Company, p. 591.
Technical Problems in Connection with **Television**.—C. O. Browne, p. 45.
New **Television** System [Variable Scanning Speed].—Von Ardenne: Thun, p. 416.
The Fundamental Optical Equation for **Television** Apparatus.—R. Thun, p. 468.
A Contribution to the Calculation [and Specification] of **Television** Apparatus.—R. Thun, p. 590.
The **Television** System of the Fernseh Company using an Intermediate Film Stage.—G. Schubert, p. 530.
The Influence of the Nature of the Subject, as regards Contrast, and of the Analysing System, on **Television** Transmission.—E. Busse, p. 530.
Television in America.—A. Dinsdale, p. 415.
Television in U.S.A., p. 103.
Some Notes on **Television** in the U.S.A. [with Comparative Data of Jenkins, Westinghouse (KDKA), Bell Telephone Laboratories, and Baird (English) Systems].—J. H. O. Harries, p. 231.
Television at the 1931 Berlin Radio Exhibition [with Comparative Data of German P.O., Fernseh A.G., Tekade (Telehor) and Loewe (von Ardenne) Systems].—E. H. Traub, p. 231.
Television at the 1931 Berlin Radio Exhibition.—G. Kette, p. 45.
Unsuccessful Test of **Television** between New York and Berlin, p. 45.
Multi-Channel **Television**.—C. O. Browne: Gramophone Company, pp. 231 and 353.
Two-Way **Television** [in Paris].—Baird Television Corporation, p. 467.
Inauguration of a "Visiotelephony" [**Television**] Service [between Galéries Lafayette and the Offices of "Le Matin," Paris].—Lyon and Stoyanowsky: Baird Company, p. 467.
Television in the U.S.S.R.—P. Shmakov, p. 468.
90 Years of **Television**: On the History of Television, p. 531.
The Present State of **Television** in England.—E. H. Traub: Haskell, p. 468.
Recent Advances in **Television**.—H. J. Barton Chapple, p. 468.
Television—Seven Years of Research and Investigation.—R. W. Corkling, p. 468.
The Peck **Television** System.—W. H. Peck, p. 590.
New **Television** Home Receiver with Mirror Wheel, Larger Screen and Special Kerr Cell.—Baird Company, p. 590.
A New **Television** System [including an Improved Mirror Drum Scanner throwing Picture directly on to Screen].—R. W. Tanner, p. 321.
Bibliography on **Television** [Partial, up to 1931].—p. 648.
Television Apparatus [at the British Association Meeting].—Marconi Company, p. 648.
"Reading" by **Television** [Equipment for Transmitting and Recording Script or Type].—H. J. Barton Chapple, p. 648.
Recent Developments in **Television**.—H. J. Barton Chapple, p. 45.
The Derby by **Television**.—Baird Television Co., p. 467.
Television Now on Schedule.—D. E. Replogle: Jenkins Corporation, p. 45.
An Early [1922] **Television and Picture** Transmission Proposal.—J. L. McQuarrie and W. W. Cook, p. 45.
Television Projector with Transparent Scanning Disc using Spark Decomposition of Acid Film.—C. F. Jenkins, p. 353.
A New Method of Determining **Thermionic Work Function** by Photoelectric Cell.—R. E. Harris, p. 233.
The Use of the Turner Kallirotron Circuit as a **Trip Relay**.—Hollmann and Schultes, p. 103.
A New Dynatron **Trip Relay** Circuit and Pulse Generator.—Fucks, p. 103.
The Determination of the Photoelectric Threshold for **Tungsten** by Fowler's Method.—A. H. Warner, p. 234.
Ultra-Short Waves and Television.—G. von Arco, p. 103.
Television Tests [German P.O.] on **Ultra-Short Waves**.—G. Krawinkel and K. Ziebig, p. 467.
Results obtained in the Calibration of Cadmium [Photoelectric] Cells [for **Ultra-Violet** Light].—F. Levi, p. 648.
Intensity Measurements in the **Ultra-Violet** by Photoelectric Cells Sensitised by Sodium Salicylate.—A. Chevallier and P. Dubouloz, p. 233.
Vision and Sound on One Wave.—Columbia Broadcasting System, p. 591.
Intensity, Area, and Distance of **Visual Stimulus**.—E. Freeman, p. 533.
Discussion, on the Lines of **Wave Mechanics**, of the Conductivity and Photoelectric Effects.—F. Bloch, p. 234.
Light Sensitive Cell for Direct Relay Operation [**Weston Photronic Cell** giving 5 mA in Direct Sunlight].—p. 46.
Characteristics of the **Weston Photronic Cell**, p. 470.
On the Directional Distribution of the Photoelectrons from High Frequency **X-Radiation**.—E. Lutze, p. 103.
Lateral Space Distribution of **X-Ray** Photoelectrons.—P. Kirkpatrick, p. 234.
The **X-Ray** Televisor.—F. Levy-Michel, p. 471.
A New Method of Measuring **X-Ray** Intensities Employing an Electronic Photocell.—P. R. Gleason, p. 470.
Spectral Distribution of the Depolarising Current in the Photoelectric Conducting Effect of Rock-Salt under the Action of **X-Ray**.—N. Kalabuchow and B. Fischelew, p. 649.
The Compound Photoelectric Effect of **X-Rays** in Light Elements.—G. L. Locher, p. 471.

MEASUREMENTS AND STANDARDS.

On **Absorption** Measurements in Pure Liquids and Electrolyte Solutions in the Region of Short Electric Waves, by a New Method.—J. Malsch, p. 474.
Valve **Ammeter** for Small Alternating Currents from 25 to 6×10^6 Cycles/Second.—Messrs. Tinsley: Barlow, p. 416.
Singing Conditions in Two-Wire Amplifiers, and their Application to a New **Amplification Measuring** Method.—Weinitschke, p. 105.
A Valve Voltmeter Method of Harmonic **Analysis**.—Greenwood, pp. 465-466.
Attenuation Measurements on Telephone and Telegraph **Lines**.—J. W. Horton, p. 236.
A High Sensitivity Power Factor Bridge [modified Schering Bridge:

with Analytical Theory].—W. B. Kouwenhoven and A. Banos, Jr, **p. 236**.
A Nernst **Bridge** Arrangement for the Highest Precision [Reduction of Input Energy and Amplification of Output].—J. Hadamard, **p. 534**.
A **Bridge** for Capacitance and Low Power-Factor Measurements.—H. W. Bousman, **p. 535**.
The Sensitivity of Null Instruments in **Bridge** Circuits for the Measurement of Alternating Voltages.—W. Spielhagen, **p. 594**.
Some Aspects of the Valve **Bridge** with a Description of a New Compensated Valve-Voltmeter.—A. S. McFarlane, **p. 650**.
An A.C. Wheatstone **Bridge** for Audio- and Radio-Frequency Measurements.—A. Hemingway and J. F. McClendon, **p. 535**.
Conditions of Equilibrium in the Wheatstone **Bridge** for Measurements of Audio- and Radio-Frequency.—A. Marino : Wagner, **p. 175**.
What are the Uses of the " Glow Discharge **Bridge** " and How is It Arranged ?—Geffcken and Richter : Huth, **p. 651** : see also Capacity.
A Precision **Bridge** for Resistance Measurement at Speech Frequencies [New Method of Avoiding Capacity Effects].—P. Klaudy, **p. 651**.
Refinement of the **Bridge** Method for Measuring Electrolytic Resistances at High Frequencies.—W. Geyer, **p. 651**.
Two Precision Condenser **Bridges**.—A. Campbell, **p. 47**.
Visible Null Indicator for A.C. **Bridges** [Combination of A.C. Microammeter or Galvanometer and Triode].—E. H. W. Banner, **p. 594**.
Brownian Motion as the Limit of the Technique of Measurement.—M. Czerny, **p. 651**.
A Method of Measuring Small **Capacitance** [e.g., $5\mu\mu$F].—R. Barton, **p. 357**.
The Measurement of **Capacities** by Means of Valves and a Seconds Clock.—L. Sesta, **p. 48**.
Measurement of Small **Capacities** [Substitution Equipment for D.C. Mains Operation].—V. V. Sathe and T. S. Rangachari, **p. 48**.
A Method of Comparing Small **Capacities** [Oscillating Neon Tube Method].—M. Durepaire, **p. 534**.
A Method for Measuring Small **Capacities** [Vibrating Contacts Device, Second Method].—J. A. Van den Akker, **p. 472**.
Capacitance and Power Factor of a Mica **Capacitor** as measured at the Bureau of Standards and the National Physical Laboratory.—H. L. Curtis, C. M. Sparks, L. Hartshorn and N. F. Astbury, **p. 534**.
A Standard of Small **Capacity** Differences.—A. C. Bartlett, **p. 48**.
The Electroscope **Capacity** Balance [for Measuring Capacities of a Few Micro-microfarads.—E. S. Brown, **p. 357**.
The Double Beat Method of Frequency Adjustment : Applications to the Measurement of **Capacity and Inductance**.—F. M. Colebrook, **p. 175**.
Oscillating Glow-Discharge Tube **Capacity Meter** for Small Capacities [50–11 000 cm, with an Accuracy of 1%].—Geffcken and Richter, **p. 175** : see also Bridge.
The Measurement of the Self-Inductance of Iron-Cored **Chokes** [with or without D.C. Polarisation : a Simple Method].—H. Teuchert, **p. 357**.
Slow Motion Motor Will Run Indefinitely [for **Clock** Frequency Integrator, etc.], **p. 595**.
Gearless **Clock** [Synchronous Motor with Four Moving Parts, Slowest revolving Twice per Day, Fastest Once per Second : Vernier Cascade Principle].—L. W. Watts : Chubb, **p. 595**.
Synchronisation of the Balance Wheels of **Clocks**.—Salmon-Legagneur and Bertrand-Lepaute, **p. 595**.
High Frequency Coil Measurements.—W. D. Oliphant, **p. 356**.
Calculation of Reactance **Coils** with Open Iron Cores.—Buchholz, **p. 477**.
The Design of Single Layer **Coils**.—R. T. Beatty, **p. 651**.
A Method of Measuring the Leakage Resistance of a **Condenser**—Neon Tube Circuit.—Decaux and Le Corbeiller, **p. 48**.
Absolute Measurement of the High-Frequency **Conductivity** of Liquids at 3 m Wavelength.—H. Schaefer, **p. 651**.
A New Method [Vibrating Condenser] of Measuring **Contact Potential Differences** in Metals.—W. A. Zisman, **p. 594**.
Rectifier Circuits for Measurement of Small Alternating **Currents** [Ripple in an H.T. Circuit].—J. A. Darbyshire, **p. 356**.
Measurements of Small **Currents** using Photron Tubes.—L. R. Hafstad, **p. 594**.
A Through [Ring] Type Current Transformer and Amplifier for Measuring Alternating **Currents of a Few Milliamperes**.—W. B. Kouwenhoven, **p. 105**.
The Experimental Determination of the **Damping Couple** of an Oscillator.—J. Haag, **p. 355**.
A **Delay** Recording Equipment using a Steel-Band Telegraphone, for the Measurement of Transit Time Effects in Communication Systems.—H. Decker, **p. 175**.
A New Method of **Dielectric Constant** Measurement [Gases] at Radio Frequencies.—H. L. Andrews, **p. 294**.
The **Dielectric Constant** of Water and Its Temperature Coefficient as determined by a Resonance Method.—E. P. Linton and O. Maass, **p. 651**.
Measurement of the **Dielectric Constants** of Salts.—P. Schupp, **p. 474**.
The **Dielectric Constants** of a Number of Oxides [in particular Al_2O_3].—A. Güntherschulze and F. Keller, **p. 474**.
Measurement of **Dielectric Constants** of Liquids by Means of a Crystal-Regulated Resonance Apparatus.—H. Ulich and W. Nespital, **p. 651**.
A Proposal to Abolish the Absolute Electrical **Dimension** Systems.—E. Weber, **p. 452**.
The Direct Measurement by **Diodes** of the Mean and Maximum Values of an Alternating Quantity.—Vecchiacchi, **p. 235**.
Dipole Moments and Molecular Structure. Part I. A Simple Resonance Method for the Measurement of Dielectric Constants [of Solutions].—J. W. Smith, **p. 652**.
The [Siemens and Halske] **Distortion** Meter for Telegraphic Signals.—A. Jipp and O. Römer, **p. 535**.
A New Apparatus for Measuring the Resistance of **Earth** Connections.—J. Gerstbach : Masa, **p. 652**.
Earth Resistance Measurement [Megger and MEG Earth Testers].—Evershed & Vignoles, Ltd, **p. 652**.
An Instrument for Measuring the Resistances of **Earths**.—L. Triau : Siemens & Halske, **p. 473**.
Principles of a New Portable **Electrometer**.—R. Gunn, **p. 473**.
A New Tilted **Electrometer** [Quartz Fibre " **Leaf** " in Hydrogen].—H. Carmichael, **p. 474**.
A New **Electrometer** [Small, with " Multi-needle " Moving Element, giving 1 600 Divisions to the Volt with 1 Second Period].—Kerr Grant, **p. 293**.
The Principles of a New Portable **Electrometer**.—R. Gunn, **p. 651**.
The Formulae of Three Torsion **Electrometers** [Quadrant, Binant and Duant].—G. Nadjakoff, **p. 293**.
How **Electron-Coupled Oscillators Make Still Better Frequency Meters** : Constructional Details of Two New Models.—R. B. Parmenter : G. D. Meserve, **p. 651**.
Field-Strength Measuring Equipments for Broadcasting Wavelengths, and their Calibration.—R. Thomson, **p. 105**.
Marconi Portable **Field Strength** Measuring Equipment [14 to 2 000 Metres], **p. 593**.
On the Measurement of Electrical **Field Strength** at the Surface of Conductors.—H. Jenss, **p. 594**.
Plotting the **Form** of an Alternating Voltage by means of Diodes [a Simple Method for Certain Cases].—F. Vecchiacchi, **p. 356**.
New Method of Determining the Ratio of the R.M.S. to the Mean Value of an Alternating Voltage [**Form Factor**].—F. Vecchiacchi, **p. 356**.
Report of the Work and Researches of the **French National Laboratory** of Radio-electricity during 1931.—C. Gutton, **p. 474**.
An Objective Method of Calibrating [High] Alternating **Frequencies**.—A. Wainberg and L. Segebart, **p. 234**.
A New Method of Measuring **Frequencies** [using Johnsen-Rahbeck Effect].—A. J. Makower and W. Makower, **p. 104**.
Notes on Generation of Absolute **Frequencies**.—T. Kujirai and S. Fujitaka, **p. 174**.
The Service Available from the Standard-Frequency Transmissions of the Bureau of Standards.—J. H. Dellinger, **p. 174**.
Radio Dissemination of the National Standard of **Frequency**.—J. H. Dellinger and E. L. Hall, **p. 594**.
The Accuracy of the Primary **Frequency** Standard of the Bureau of Standards.—C. G. McIlwraith, **p. 174**.
A Method of [Audio-] **Frequency** Measurement with the Cathode-Ray Oscillograph [used as Source of Comparison Frequency and as Indicator].—L. A. Wood, **p. 593**.
The Precision **Frequency** Measuring System of R.C.A. Communications, Inc.—H. O. Peterson and A. M. Braaten, **593**.
A Source of Error in the Capillary-Wave Method of Measuring **Frequency**.—M. Katalinić : Schultze, **p. 473**.
International **Frequency** Measurements. The Production of Standard Frequencies by means of Piezoelectric Oscillators.—A. Scheibe and U. Adelsberger, **p. 473**.
Frequency Comparison at Great Distances [including Italian Measurements of U.S. Bureau of Standards' Standard Frequency Transmissions].—F. Vecchiacchi, **p. 534**.
Radio **Frequency** Standard Established at the Electrotechnical Laboratory.—S. Kanzaki, **p. 356**.
A Device for Accurate Measurement and Checking of the **Frequency** of a [Distant] Radio Station.—N. K. Titov and A. J. Weinberg, **p. 293**.
Constant **Frequency** by Electronic Coupling.—Dow, **p. 235**.
Visit to Foreign Laboratories for the International Comparisons of **Frequency**.—B. Decaux, **p. 174**.
Frequency Measurement in the British Post Office.—F. E. Nancarrow, **p. 48**.
P.O. **Frequency** Measurements.—Angwin, **p. 104**.
Radio Problems [P.O. Work on **Frequency** Measurement].—A. S. Angwin, **p. 103**.
Frequency Measurement and Control : I.E.E. Wireless Section, Chairman's Address.—A. S. Angwin, **p. 174**.
Frequency Measuring Circuit, **p. 651**.
Frequency Measuring Outfit for Checking Wavelengths of French Transmitters [at the Noiseau Receiving Station], **p. 651**.
The **Frequency** Stability of the Triode Oscillator.—Matteini, **p. 342**.
Frequency.—See also Wavelength, Wavemeter.

The Coupled Steel [**Frequency Standard**] **Oscillator.**—C. H. Becker, p. 104.
On the Theory of the **Frequency Variation** of an A.C. Measuring Circuit with D.C. Apparatus and Dry-Plate Rectifiers.—Cremer, p. 340.
Frequency (Stabilisation, Standards, etc.).—See also Magnetostriction, Multivibrators, Oscillators, Plates, Quartz, Rochelle Salt, Rods, Tourmalin, Ultra-, and under "Transmission."
The **Gain Control and the Decibel.**—H. Stanesby, p. 294.
A Portable String **Galvanometer** for Use at Moderate Frequencies.—E. W. Marchant, J. K. Burkitt, and A. H. Langley, p. 50.
An Aperiodic **Impedance** Measuring Set.—A. T. Starr, p. 534.
A Method of Measuring Acoustic **Impedance.**—Flanders, p. 589.
Measurement of **Impedances.**—H. F. Trewman : Starr, p. 594.
A Cathode-Ray Oscillographic Method of Measuring **Inductance.**—G. I. Finch and R. W. Sutton, p. 357.
The **Inductance** of Linear Conductors of Rectangular Section.—A. H. M. Arnold, p. 474.
Measurement of **Inductance :** the Cathode-Ray Oscillograph Method.—G. I. Finch and R. W. Sutton, p. 293.
Inductance.—See Choke, **Coil.**
Electrodynamic Arrangement for the Measurement of Small Mutual **Inductances.**—Guillet, p. 361.
High **Insulation** Testing and Surface Leakage.—D. C. Gall, p. 175.
Sensitive **Insulation** Tester [using Grid Volts/Anode Current Characteristic of a Triode].—T. A. Ledward, p. 535.
The Measurement of Radio **Interference** [High Frequency Spectra of Disturbances from Motors, Rectifiers, etc.].—Alexander, p. 652.
Impedance Characteristics of Loaded **Lecher Systems.**—Tonks, p. 280.
Formation of Standing Waves on **Lecher Wires.**—A. Mohammed and S. R. Kantebet, p. 175.
Measurement at High Frequencies [10 to 6 400 kc/s] of the **Loss Angles** of Dielectrics.—M. Boella, p. 356.
A New Method of Measuring the **Loss Angles** of Dielectrics, particularly Insulators in Series.—A. M. Angelini, p. 356.
Losses in Liquid Dielectrics at Radio Frequencies [and the Meissner "Immersion" Method of Measuring the **Self-Capacity** of Coils].—Jackson, p. 298.
A [Mercury Thermometer] Method of Measuring an Alternating **Magnetic Field** of High Frequency.—F. Esclangon, p. 105.
The Damping of **Magnetostriction** Resonators.—E. A. Kopilowitsch, p. 355.
On the **Magnetostriction** of Iron-Nickel Alloys.—Y. Masiyama, p. 293.
Theory of **Magnetostriction.**—A. Perrier, p. 49.
Improved **Magnetostriction** Oscillator.—Comp. Thomson-Houston, p. 50.
On the Transverse Effect of **Magnetostriction.**—A. Esau, p. 49.
The **Magnetostriction** of Ferromagnetic Materials.—G. Dietsch, p. 49.
Magnetostriction and Hysteresis.—W. N. Bond, p. 49.
Composite-Coil Electrodynamic [**Measuring**] **Instruments.**—F. B. Silsbee, p. 356.
Indicating Electrical [**Measuring**] **Instruments.**—C. V. Drysdale, p. 651.
Radio **Measuring** Instruments : Types and Applications.—E. H. W. Banner, p. 594.
A Universal **Meter** for Laboratory and Workshop : the "Mavometer" with Its Auxiliary Attachments, p. 50.
Hot-Wire **Meter** with Automatic Zero Error Compensation.—Estab. Brion, Leroux, Jeanno et Cie., p. 50.
I.E.E. **Meter and Instrument** Section : Chairman's Address.—F. C. Knowles, p. 105.
The Variation with Temperature of **Meters** with Dry-Plate Rectifiers, and Its Compensation.—H. Kaden, p. 416.
Frequency Correction in **Meters** with Dry-Plate Rectifiers.—H. Kaden, p. 473.
Meters and Instruments : Remote Indication and Earth Measurement Devices.—F. C. Knowles, p. 105.
The Thermionic Valve **Microvoltmeter.**—E. Wöhlisch, p. 235.
A Stroboscopic Method of Measuring Frequency- and Phase-**Modulation :** The Fourier Analysis of Modulated High Frequency Currents.—Heilmann : Grützmacher, pp. 93 and 94.
A Direct Reading **Modulation** Meter.—Cooper and Smith, pp. 162-163.
Moving-Coil Meter and Copper Oxide Rectifier for Measuring **Modulation** Ratio.—Lepeshinskaja-Krakau, p. 356.
Multiples and Sub-Multiples of Ten [German Proposals], p. 474.
The Adjustment of the **Multivibrator** for Frequency Division.—V. J. Andrew, p. 175.
Dissymmetrical **Multivibrators.**—F. Vecchiacchi, p. 355.
On the Theory of Beats [Application to the Calibration of **Multivibrators**].—Gabel, p. 280.
Development of a Circuit for Measuring the **Negative Resistance** of Pliodynatrons.—Dingley, p. 97.
The Use of a **Neon Lamp** in Determining the Amplitude of a Periodically Varying Voltage.—S. Franck, p. 175.
The **Nomenclature** of the Fundamental Concepts of Electrical Engineering.—G. W. O. Howe, p. 106.
A Recent Development in Vacuum Tube **Oscillator** Circuits [Constant Frequency by Electronic Coupling].—Dow, p. 93.
The Crystal Monitor : a Multi-frequency Crystal-Controlled **Oscillator** [with 6.25 kc Steps].—J. L. Reinartz, p. 104.
Improved Radio-Frequency Measurements [including **Oscillator** with Output Transformer having Special Material for Core, giving Constant Output from 100 to 1 500 kc/sec.].—Wigand : Siemens Company, p. 473.
A New Treatment of Electron Tube **Oscillators** with Feed-Back Coupling.—Jen, p. 163.
Constant Frequency **Oscillators.**—Llewellyn, p. 163.
The Isochronism of a **Pendulum** actuated by Impulses after passing through the Vertical.—Ch. Féry and N. Stoyko, p. 293.
An Unrecognised Property of the Reversible **Pendulum.**—P. R. Heyl, p. 595.
Measurements [of Infra-Red Radiation] with the **Photoelectric** Relay.—R. B. Barnes and F. Matossi, p. 474.
The Design of Temperature Control Apparatus for **Piezo Oscillators.**—V. J. Andrew, p. 595.
The Temperature of a **Piezoelectric** Crystal as a Function of Its Oscillatory Régime.—A. de Gramont and D. Beretzki, p. 473.
A **Piezoelectric Oscillator** of Improved Stability [using a Screen-Grid Valve and giving a Constancy within 4.9 × 10^{-6}].—J. K. Clapp, p. 595.
An Interpretation of the Effect of **Piezoelectric Oscillations** on the Intensity of X-Ray Reflections from Quartz.—B. E. Warren, p. 49.
The Electric Network Equivalent of a **Piezoelectric Resonator.**—K. S. Van Dyke, p. 595.
Piezoelectric Wattmeter for Rapidly Varying Powers.—Aerlikon, p. 236.
Piezoelectricity [and the Testing of Various Crystals].—G. Greenwood and D. Tomboulian, p. 595.
The Forced Vibrations of a Circular **Plate.**—W. Flügge, p. 416.
The Elastic Equilibrium of a Thick Rectangular **Plate.**—B. Galerkin, p. 105.
The Elastic Displacement, Normal to the Surface, of Thin Rectangular **Plates** Subjected to Variable Forces.—Sonier, p. 235.
A Capacitive **Potential Divider** for High Frequency Measurements.—K. Schlesinger, p. 48.
The Measurement of A.C. **Potentials** by means of Dry-Plate Rectifiers.—B. Focaccia, p. 473.
The Wenner **Potentiometer** [reducing EMFs and Resistance Variations at the Contacts].—L. Behr : Wenner, p. 356.
Theory and Technique of Valve **Potentiometers** for the Measurement of E.M.F.—F. Müller, p. 175.
A Simple Method for Measurements of Residual Inductance on **Potentiometers and Four-Terminal Resistance Coils.**—N. F. Astbury, p. 48.
On the Method of Measuring A.C. **Power** [and Power Factor] with a Triode.—A. Okitsu, p. 594.
[Photometric] Dosimeter for Determining the **Power** in H.F. Circuits of Frequency 1 Megacycle and Over.—K. Heinrich, p. 236.
Power Measurement with Electronic Valves.—H. Lange, p. 650.
Power Factor Measurement by the Capacitance Bridge.—R. P. Siskind, p. 236.
The Absolute Measurement of High Electrical **Pressures.**—W. M. Thornton and W. G. Thompson, p. 652.
Determination of **Quality** as a Basis for Commodity Standards.—F. W. Reynolds, p. 595.
Examination, by Immersion, of Large **Quartz** Crystals [Detection of Faults, Determination of Rotatory Power, etc.].—A. Arnulf, p. 473.
Vibrations of **Quartz** Plates.—U.S. Bureau of Standards Notes, p. 104.
The Vibrations of **Quartz** Plates [Chladni Plates Investigation].—R. C. Colwell, p. 533.
Experimental Study of Parallel-Cut Piezoelectric **Quartz** Plates.—G. W. Fox and W. G. Hutton, p. 533.
The Variation with Temperature of the Piezoelectric Constant of **Quartz.**—V. Fréedericksz and G. Michailow, p. 534.
On the Series Law of the Free Elastic Vibration Frequencies of **Quartz** Rods. Part I : Elongation Oscillations.—E. Giebe and A. Scheibe, p. 48.
Notes on the Frequency Stability of **Quartz** Plates.—L. B. Hallman, Jr., p. 293.
Quartz Plate Mountings and Temperature Control for Piezo Oscillators.—V. E. Heaton and E. G. Lapham, pp. 49 and 293.
Discussion on "**Quartz** Plate Mountings and Temperature Control for Piezo-Oscillators" [Sputtered Film replaced by Soft Metal Rubbed On : Suggested Possibility of Obtaining Zero Frequency/Temperature Coefficient by Compensating Holder Pressure].—V. J. Andrew : Heaton and Lapham, p. 595.
The Use of Supersonic Interferometry in Studying the Modes of Vibration of **Quartz** Crystals.—Hershberger, p. 534.
Piezoelectric **Quartz :** Its Applications to Wireless Telegraphy and Telephony [A Survey].—A. Houot, p. 355.
A New [**Quartz**] Oscillator for Broadcast Frequencies [Type 700-A].—O. M. Hovgaard, p. 104.
Micrography of Piezoelectric **Quartz.**—P. T. Kao, p. 49.
Longitudinal Vibrations of Thin Circular **Quartz** Plates.—I. Koga, p. 49.

On the Temperature Coefficient of Frequency of Y-Wave in X-Cut **Quartz** Plates.—S. Matsumura and S. Kanzaki, **p. 533.**

Physical Properties of Piezo-**Quartz** Plates in connection with their Accurate Manufacturing for a Given Frequency.—E. S. Muchkin. **p. 293.**

An Interferometer Method of Studying the Vibrations of an Oscillating **Quartz** Plate.—H. Osterberg, **p. 235.**

The **Quartz** Oscillator.—T. D. Parkin, **p. 594.**

Silvering Electrodes on **Quartz** Crystals [Brashear Process].—G. S. Parsons, **p. 355.**

Silvering Electrodes on **Quartz** Crystals: a Warning.—Parsons, **p. 595.**

On the Connection between the Optical and Piezoelectrical Properties of Oscillating **Quartz** Plates.—V. Petržilka, **p. 105.**

Anomalous Variation of the Electrical Conductivity of **Quartz** with Temperature at the Transformation Point.—H. Saegusa and S. Shimizu, **p. 105.**

A Preliminary Report on the Anomalous Variation of the Electrical Conductivity of **Quartz** with Temperature.—S. Shimizu, **p. 473.**

Electrical Conductivity of Loaded Piezo-**Quartz** Crystals.—F. Seidl, **p. 473.**

A New Method of Investigating the Modes of Vibration of **Quartz** Crystals.—J. A. Strong, **p. 174.**

A Method of High-Frequency Stroboscopy [for Observance of Density Changes within a Vibrating **Quartz** Crystal].—J. A. Strong, **p. 235.**

The Origin of the Third Fundamental Frequency of Piezoelectric **Quartz** Oscillators.—E. P. Tawil, **p. 48.**

Piezoelectric **Quartz** in Vibration [Interferometer Study of Surface Vibrations].—G. Wataghin and G. Sacerdote, **p. 595.**

Quartz Oscillator Wave Constants.—E. G. Watts, **p. 48.**

Some Experimental Studies of the Vibrations of **Quartz** Plates [0° and 30° Cut].—R. B. Wright and D. M. Stuart, **p. 104.**

Frequency Stabilisation to 5×10^{-6} by **Quartz Crystal** and Bolometer Combination.—German P.O. (Harnisch), **p. 174.**

Natural Observation Limit of Radiometric **Measurements.**—C. H. Cartwright, **p. 651.**

The Campbell-Shackleton Shielded **Ratio** Box.—L. Behr and A. J. Williams, Jr., **p. 594.**

Quantitative Investigations of Broadcast **Receivers.**—Harnisch, **p. 94.**

Developments in the Testing of Radio **Receivers.**—Thomas, **p. 524.**

The Use of the **Rectifier Bridge** in Test Room Technique [as Phase-Sensitive Indicator, Frequency Analyser, etc.].—C. H. Walter, **p. 651.**

A [Balanced] **Rectifier Measuring Circuit** [Phase-Sensitive "Rectifier Bridge" for Indicating or Measuring a Desired Component in an Alternating Potential, particularly suitable for Audio-frequency Use].—C. H. Walter, **p. 593.**

The Measurement of **Reflection Coefficients** for Oblique Incidence [by Spreading the Material on the Metal Receiver of a Thermopile].—H. E. Beckett, **p. 652.**

A Method of Measuring the Effective **Resistance** of a Condenser at Radio Frequencies, and of Measuring the Resistance of Long Straight Wires.—E. B. Moullin, **p. 593.**

The Measurement of Electrical **Resistance** in Terms of a Mutual Inductance and a Period.—H. R. Nettleton and F. H. Llewellyn, **p. 357.**

High **Resistance** Measurement [with the G.E.C. Low Grid Current Valve Type FP-45].—F. A. Lidbury, **p. 356.**

Application of the Electrometer Triode to the Measurement of High **Resistance.**—J. A. C. Teegan and N. Hayes, **p. 416.**

A Method for Measuring Very High Values of **Resistance** [up to 10^{17} Ohms].—G. M. Rose, **p. 175.**

Design of **Resistors** [Resistance Boxes and Fixed Standards] for Precise High-Frequency Measurements.—L. Behr and R. E. Tarpley, **p. 593.**

Piezoelectric Properties of **Rochelle Salt** Crystals.—R. D. Schulwas-Sorokin, **p. 355.**

On a Characteristic Temperature Point in **Rochelle Salt** Crystals.—R. D. Schulwas-Sorokin, **p. 595.**

Low Frequency Vibrations in **Rochelle Salt and Quartz** Plates.—W. G. Cady, **p. 474.**

On the Forced Vibration of an Elastic **Rod** [taking into account the Internal Friction].—S. Higuchi, **p. 175.**

Measurement of the **Selectivity** of Beat-Note Receivers.—Lamb, **p. 594.**

Self-Capacity.—See Losses.

Conductivity Measurements on Powders [of **Semi-Conductors.**]—P. Guillery, **p. 236.**

On the Current Compression in Cylindrical Tube Conductors [**Skin Effect** Formula].—E. Grünwald, **p. 594.**

Skin-Effect in a **Ring** of Circular Cross Section [and the Calculation of **Self-Inductance**].—V. Fock, **p. 636.**

The Natural Frequencies of Single-Layer **Solenoids**: Determination by taking Elementary Sections and applying a System of Elliptical Co-ordinates.—G. Zuhrt, **p. 474.**

British **Standard** Letter Symbols for Use in Electrotechnics, **p. 106.**

The Effect of Pressure upon the E.M.F. of the Weston **Standard Cell.**—T. C. Poulter and C. Ritchey, **p. 474.**

International Comparison of Electrical **Standards.**—G. W. Vinal, **p. 594.**

Stroboscopy.—See Quartz.

On the Crystalline Structure of **Thin Layers** of Metals [sputtered on Quartz and Mica].—Z. Debinska, **p. 293.**

A Chronograph for the Very Accurate Recording of **Time.**—P. Lejay, **p. 49.**

Talking Clocks for the Distribution of **Time** over Telephone Networks (Sound-on-Film System).—E. Esclangon, **p. 356.**

The **Time** Services of the U.S. Naval Observatory: Time Services of the Telegraph Companies: Synchronous Electric Time Service.—Hellweg: Janson: Warren, **p. 235.**

The Necessity for a Standard **Time** Measurement, and My Results up to the present in Creating a Standard of Time.—M. Schüler, **p. 235.**

On the Possibility of Constructing an Arrangement for the Measurement of **Time** which shall be Independent of the Accelerations of Its Support.—P. Le Rolland, **p. 174.**

Papers on the Precise Measurement of **Time**: Shortt Clocks, Loomis Chronograph, Bell Telephone Crystal Oscillator.—Loomis: Brown and Brouwer, **p. 49.**

Modern Developments in Precision **Time-keepers.**—A. L. Loomis and W. A. Marrison, **p. 595.**

Photoelectrically-Controlled **Time Signals** at Bandoeng.—W. F. Einthoven: Vening Meinesz, **p. 474.**

Communication of Standard **Time Signals** [U.S.A. Naval Observatory].—M. M. Dupré, **p. 474.**

Symposium on **Time-Signals**: U.S.A. Naval Observatory Time-Service: Time-Signals for Electrical and Physical Measurements: Time-Signal Needs for Geodetic Work: Establishment of World-Time.—Hellweg: Wenner: Brown: Lee, **p. 174.**

Tourmalin Crystals for Waves under 50 Centimetres.—Leithäuser: Heinrich Hertz Association, **p. 293.**

A **Tourmalin** Oscillator for Wavelengths down to 1.2 Metre.—Straubel, **p. 174.**

Fundamental Crystal Control for Ultra-High Frequencies: **Tourmalin** Oscillators for Wavelengths Down to 1.2 Metres.—H. Straubel, **p. 355**; see also Ultra-short.

The **Triode** and the Tracing of the Hysteresis Cycle of Iron.—F. Vecchiacchi, **p. 235.**

The **Triode** and the Determination of the Instantaneous Integrals of a Periodic Alternating Quantity.—F. Vecchiacchi, **p. 235.**

The **Triode** and the Measurement of the Phase Angles of Condensers by the Method of Substitution in the Resonant Circuits.—F. Vecchiacchi, **p. 356.**

Some Observations on Vibrating **Tubes** [and Their Use in Detecting and Measuring High Audio-Frequencies].—Kröncke, **p. 414.**

The Measurement of **Ultra-High-Frequency** Currents.—H. Schwarz, **p. 471.**

Measuring Technique and Apparatus for the **Ultra-Short-Wave** Zone.—K. Schlesinger, **p. 650.**

Field-Strength Measurements on **Ultra-Short Waves.**—Sohnemann, **p. 30.**

Direct Piezoelectric [Tourmalin] Control for **Ultra-Short Waves.**—H. Straubel, **p. 235**; see also Tourmalin.

Electric and Magnetic **Units.**—V. Karapetoff, **p. 652.**

Choice of a System of Electromagnetic **Units** [and the Selection of the Fourth Fundamental Unit].—D. Germani, **p. 652.**

Dimensions of Fundamental **Units.**—W. Cramp, **p. 652.**

Three Superfluous Systems of Electromagnetic **Units.**—G. A. Campbell, **p. 652.**

Electromagnetic Equations and Systems of **Units.**—Leigh Page, **p. 652.**

Magnetic **Units.**—A. E. Kennelly, **p. 652.**

On the Structure of Systems of **Units** and the Definition of Magnitudes in Electrical Technique.—C. Budeanu, **p. 652.**

On the Question of Electrical and Magnetic **Units.**—A. Blondel, **p. 652.**

A System of Practical **Units** with Four Fundamental Dimensions.—E. Bodea, **p. 652.**

A Standard Microvolter using Second Harmonic Principle [for Generating and Measuring Very Weak R.F. **Voltages** for Calibrating Signal Generators, Obtaining Performance Data on Receivers, etc.]—W. F. Diehl, **p. 594.**

Using the Vacuum-Tube **Voltmeter** [for Radio Servicing, etc.]—B. B. Bryant, **p. 594.**

A Linear Electronic **Voltmeter.**—J. L. McLaughlin, **p. 594.**

Electron Tube **Voltmeter.**—F. N. Trotsevitch, **p. 356.**

A New Type of Valve **Voltmeter** [using Space-Charge Grid Valve].—L. Medina, **p. 356.**

A New Thermionic **Voltmeter** [for Peak Potentials 200–2 000 Volts up to Very High Frequencies].—J. Thomson, **p. 472.**

Comparing Oscillatory Peak Factors by a Special Thermionic **Voltmeter.**—Thomson, **p. 473.**

An Electrostatic **Voltmeter** [possessing Several Unique Features].—W. W. Nicholas, **p. 293.**

A Generating **Voltmeter** for the Measurement of High Potentials.—P. Kirkpatrick and I. Miyake, **p. 293.**

[Portable] Vacuum Tube **Voltmeter** of High Sensitivity.—H. J. Reich, G. S. Marvin, and K. A. Stoll, **p. 50.**

An Electrostatic **Voltmeter** for Measuring High Voltages at High Frequency.—E. Wilkinson, **p. 175.**

On Temperature Compensation in A.C. Low-Tension **Voltmeters** with Copper-Oxide Rectifiers.—V. Rozhdestvensky, **p. 651.**

Voltmeters.—See also Diodes, Measuring, Meters, Micro-, Neon, Potentials, Standard Cell.
A New **Wattmeter** [for A.C. and D.C.] based on the Principle of the Hall Effect.—S. Fukuda, p. 474.
A Precision Method of Measuring Short and Ultra-Short **Wavelengths.**—W. Fehr, p. 293.
Wide Wave Band Precision **Wavemeter** (10–300 Metres, with Neon Tube Oscillator for Reception Measurements).—Soc. Franç. Rad. élec., p. 473.
The Station Finder [Buzzer **Wavemeter**].—A. L. M. Sowerby, p. 293.
A Simplified Method of Interpolation by High-Frequency Measurements [Interpolation Formula for **Wavemeter**].—I. B. Selutin, p. 293.
An Experimental Machine for Measuring Fine **Wire.**—F. H. Rolt and C. O. Taylerson, p. 595.
Young's Modulus for Two Directions in a Steel Bar.—G. A. Wedgwood, p. 175.

SUBSIDIARY APPARATUS AND MATERIALS.

On the **Absorption** of Dipole Liquids and Electrolyte Solutions in the Region of Short Electrical Waves [of lengths 76 m, 48 m, and 28 m].—J. Malsch, p. 298.
Absorption in Liquids.—See also Dispersion.
A New Iodine **Accumulator.**—F. Boissier, p. 420.
New Storage Battery [**Accumulator**] using Iodine.—Boissier, p. 538.
Articles on the Drumm **Accumulator.**, p. 597.
The Rapid Charging of **Accumulator** Batteries.—A. E. Lange, p. 597.
The Theory of the Lead **Accumulator.**—C. Liagre, p. 51.
On Local Action and the Theory of the Lead **Accumulator.**—L. Jumau: Féry, p. 51.
Some Factors affecting the Performance and Life of Lead **Accumulators**: Part III.—J. T. Crennell and A. G. Milligan, p. 477.
Characteristics of Lead **Accumulators** under Reduced Atmospheric Pressure [Improved Capacities under 13 mm Pressure].—S. Makio, p. 477.
Accumulators for Broadcast Receivers.—R. Albrecht, p. 177.
Papers on Air **Cell** Batteries and their Use for Radio Receivers, p. 284.
An Electrostatic **Alternator** [giving Pure Sine Wave and Various Special Wave Forms].—C. A. Culver, p. 598.
The Effects of Iron on the Electrical Conductivity and Tensile Strength of **Aluminium.**—M. Kuroda, p. 298.
Characteristic Curves of the **Aluminium Rectifying** Cell.—L. L. Barnes, p. 296.
Study of an **Amplifier** for Continuous Potentials.—A. Bressi, p. 475.
The Very Sensitive Valve **Amplifier** throws light on the Problems of Nuclear Physics: Transmutation, and the Penetrating and Cosmic Radiations.—L. Leprince Ringuet, p. 475.
A Vacuum Tube **Amplifier** for Feeble Pulses [and an Electrometer Valve after Leprince-Ringuet].—L. F. Curtiss, p. 654.
A New **Amplifier** for Direct and Alternating Currents.—H. Peek, p. 535.
A Stable Laboratory **Amplifier** [for Bridge, Photoelectric Cell, and other Work].—C. T. Burke, p. 239.
Increasing the Charge Sensitivity of Vacuum Tube **Amplifiers.**—G. F. Metcalf, p. 297.
Amplifiers for Precise Oscillographic Measurements.—S. K. Waldorf, p. 536.
One-Tube Balanced Circuit for D.C. Vacuum Tube **Amplifiers** of Very Small Currents.—W. Soller, p. 654.
Automatic Curve **Analyser.**—C. G. Abbot, p. 177.
A Simple Harmonic **Analyser.**—M. G. Nicholson and W. M. Perkins, p. 416.
Discussion on "A Simple Method of Harmonic **Analysis** for Use in Radio Engineering Practice."—J. R. Ford: Roder, p. 358.
A Simple Method of Harmonic **Analysis.**—Nachtikal, p. 589.
An Air-Bubble Method of Measuring Very Small **Angles of Rotation**—down to 0.27 Sec.,—G. Siadbei, p. 598.
Anode Supply for Automobile Receivers from Car Storage Battery.—A. B. Bedrossyan, p. 239.
Papers on **Attenuating Layer** Photoelectric Cells.—Körösy and Selényi: B. Lange: Perucca, p. 239
The **Attenuating Layer** in Lead Sulphide.—Heineck, p. 469.
Conductivity and Photoelectric Effects at **Attenuating Layers.**—Schottky, p. 232.
The Electrical Behaviour of **Attenuating Layers.**—Teichmann, pp. 468-469.
Simplified **Attenuation Network** Design.—L. B. Hallman, p. 50.
A Measurement of Boltzmann's Constant by Means of the Fluctuations of Electron Pressure in a Conductor [containing Description of **Attenuator System**].—Ellis and Moullin, p. 588.
The Thermal After-Treatment of **Bakelite** for Precision Uses.—Vogt, p. 177.
Report on the Conference on "**Barrier-Layer** Photoelectric Cells and Rectifiers."—Kurtschatow, p. 654.
Investigation of the **Barrier-Layer** Photocell.—Kurtschatow and Sinelnikow, p. 654.
Primary **Batteries,** Dry and Wet, according to Recent Patents.—L. Jumau, p. 538.
A New **Battery** [Dry Cell with Device for Sealing in the Active Ingredients but Giving Free Exit to Evolved Gases].—Siemens Company, p. 597.
Primary **Battery** Improvements: Ammonium Persulphate as a Depolariser.—A. M. Codd, p. 597.
Development of **B-Battery Devices** for Auto-Radio, p. 420.
An Improved **B Eliminator** for Automobile Receivers [with Automatic Load Delay Circuit for Preventing Burning of Vibrator Contacts before Rectifier Heater reaches Working Temperature]. W. W. Garstang, p. 655.
B Power Supply Devices for Automobile Radio.—H. E. Thomas and L. P. Kongsted, p. 597.
The Elgin-Cartier **Baudot Reproducer** without Rotating Parts.—P. Mercy, p. 110.
Bolometer.—See Relay.
On the Mechanism of Electrical **Breakdown** [in Rock Salt, Mica, etc.].—A. Joffé, p. 655.
Screens for Raising the **Breakdown Voltage in Air.**—H. Roser, p. 418.
Proximity Effect in **Cable** Sheaths.—H. B. Dwight, p. 109.
A New Type of Non-Uniform **Cable** [Impedance per Unit Length Increasing Linearly with Distance].—M. Federici, p. 177.
Attenuation of a Surge along a **Cable.**—W. Fucks, p. 418.
Surges in Continuously Variable **Cables.**—Gemant, p. 218.
A Simple Harmonic Continuous **Calculating Machine.**—J. M. Robertson, p. 295.
Capacitance and Power Factor of a Mica **Capacitor** as measured at the Bureau of Standards and the National Physical Laboratory, p. 534.
The Electrical Conductivity of the Different Varieties of **Carbon.**—R. Cordebas, p. 476.
On the Electrical Resistance of **Carbon.**—Z. Nishiyama, p. 110.
Type II Phosphorescence of the **Carborundum** Detector, Electrical Conductivity of Carborundum and Unipolar Conductivity of Crystal Detectors.—O. W. Lossew, p. 108.
On the Rectifying Action and Luminous Effects of **Carborundum** Crystals.—B. Claus, p. 108.
Delay Circuits for Recording with the **Cathode-Ray Oscillograph** [Comparison between Surge Line Circuits and Condenser Circuits, with Description of a Condenser Circuit with Adjustable Delay Time].—H. Baatz, M. Freundlich and W. Holzer, p. 596.
On the High Voltage Plant of the **Cathode-Ray Oscillograph.**—K. Beyerle, p. 238.
A New Type of **Cathode-Ray Oscillograph** with Cold Cathode and Pre-concentration.—H. Boekels, p. 536.
On Potential Dividers for **Cathode-Ray Oscillographs.**—F. P. Burch, p. 358.
Screen Size and Width of Trace in the **Cathode-Ray Oscillograph.**—K. Buss, p. 475.
Cossor **Cathode-Ray Oscillograph.**—A. C. Cossor, Ltd., p. 536.
Cathode-Ray Oscillograph [Internal] Recording Direct on Photographic Paper.—W. Förster, p. 596.
On Control by Surges, Beam Locking in **Cathode-Ray Oscillographs,** and the Production of Very Short Light Impulses.—W. Fucks, p. 238.
A New **Cathode-Ray Oscillograph** Tube [Type FP-53, giving Visual Observation by a Large Group in Full Daylight].—G. F. Metcalf: G. E. C., p. 475.
The Focusing Coil [in the **Cathode-Ray Oscillograph**] as a Magnifying Lens.—F. Hamacher, p. 358.
A Lecture-Demonstration [**Cathode-Ray**] **Oscillograph** [with Linear Time Scale, using Western Electric Gas-filled Hot-Filament Tube].—W. W. Hansen, p. 536.
A New Glass Discharge Tube [with High Vacuum Jacket] for the **Cathode-Ray Oscillograph.**—F. Hauffe, p. 106.
Recording Non-Periodic Phenomena with the **Cathode-Ray Oscillograph.**—H. E. Hollmann, p. 176.
The Cathode-Ray Oscillograph.—J. B. Johnson, p. 294.
The **Cathode-Ray Oscillograph** [and the Western Electric Tube No. 224].—J. B. Johnson, p. 176.
New Method for the Simultaneous Recording of Phenomena by **Cathode-Ray Oscillograph** and the Determination of the Scale of the Magnitudes Recorded.—K. Kasai, H. Takagishi and B. Tadano, p. 475.
The Distortions in the **Cathode-Ray Oscillograph** at High Measuring Velocities.—H. Klemperer and O. Wolff, p. 596.
The **Cathode-Ray Oscillograph.** Literature to the Middle of 1931: Development up to the Middle of 1931.—M. Knoll, p. 358.
Remark on the Paper "Glass or Metal Discharge Tube" [for **Cathode-Ray Oscillograph**].—M. Knoll and H. Knoblauch: Dicks, p. 358.
The Blackening of Photographic Films in the **Cathode-Ray Oscillograph**—Remark on the Paper by W. Rogowski, E. Flegler and P. Rosenlöcher.—M. Knoll: W. Rogowski, p. 418.
Pre-concentrating Coils and Electron Density in the **Cathode-Ray Oscillograph.**—F. Malsch, p. 358.
Theory of Voltage Dividers and Their Use with **Cathode-Ray Oscillographs.**—M. F. Peters, G. F. Blackburn and P. T. Hannen, p. 596.

The **Cathode-Ray Oscillograph** in Radio Research: Royal Society Demonstration and Lecture.—Radio Research Station, Slough: R. A. Watson Watt, p. 653.
The Limit of Performance of the **Cathode-Ray Oscillograph.**—W. Rogowski, p. 50.
Cathode-Ray Oscillographs.—W. Rogowski, p. 418.
The Blackening of Photographic Films at Low Excitation Voltages of the **Cathode-Ray Oscillograph.**—H. Schäffer, p. 475.
The **Cathode-Ray Oscillograph** and Fluorescent Materials.—A. Schloemer, p. 417.
Cathode-Ray Oscillograph operating on 350 v.—Standard Telephones and Cables, p. 106.
A Sealed-Off **Cathode-Ray Oscillograph** of High Efficiency.—K. Szeghö, p. 418.
The Use of the [von Ardenne] **Cathode-Ray Oscillograph** for Recording the Wave Form of High Voltages.—R. Vieweg and G. Pfestorf, p. 653.
Phase Measurements with the **Cathode-Ray Oscillograph.**—L. A. Wood, p. 50.
Recent Developments in **Cathode-Ray Oscillographs** [Survey with Literature References up to 1931].—A. B. Wood, p. 536.
Cathode-Ray Oscillographs.—See also Amplifiers, Electron, Glow, Oscillographs, Relay, Stroboscopic, Sweep, Time Axis and Base, Timing Axis, Trip, and below.
A Cheap **Cathode-Ray Tube** for 800 Volts Potential, or 2 000 Volts for Photographic Recording.—R. Wigand: G. Budich Company, p. 475.
Improvements in **Cathode-Ray Tube** Design.—V. K. Zworykin, p. 106.
A New **Cathode-Ray Tube** with Small Ray Velocity [Sensitivity around 1 mm/volt with a Working Voltage of 300 v].—G. Dobke: AEG, p. 653.
The Physics of the Braun [**Cathode-Ray**] **Tube.**—M. von Ardenne, p. 653.
The **Cathode-Ray Tube** at Very High Frequencies [up to about 10^{10} c/s].—H. E. Hollmann, p. 652.
Accuracy of Measurements made with Hot-Filament **Cathode-Ray Tubes** of the Gas-Focused Type [with Particular Attention to the Threshold Effect].—J. T. MacGregor-Morris and H. Wright, p. 536.
Investigations on **Cathode-Ray Tubes** containing Gas.—M. von Ardenne, pp. 237 and 653.
Cathode-Ray Tubes and Their Use.—E. Alberti, p. 653.
The Shoft Space-Charge Field of an Auxiliary Discharge as a Collecting Lens for **Cathode Rays.**—B. von Borries and E. Ruska, p. 536.
The Photographic Effect of Moderately Rapid **Cathode Rays.**—A. Becker and E. Kipphan, p. 50.
Demonstration of the Focus and Resolving Properties of a Cylindrical Condenser Field on **Cathode Rays.**—H. Voges, p. 536.
The Dependence of the Brightness of the Light Emitted by Calcium Tungstate under the Impact of Electrons [**Cathode Rays**] on the Energy of the Electrons.—A. Güntherschulze and F. Keller, p. 596.
Relativity Correction of the Laws of Image Formation of a Magnetic Collecting Lens for **Cathode Rays.**—F. Ollendorff and G. Wendt, p. 536.
Registration of **Cathode Rays** by Thin Films of Metals and Metal Compounds.—W. W. Nicholas and C. G. Malmberg, p. 295.
The Photographic Effect of Slow **Cathode Rays.**—V. Weidner, p. 294.
On the Concentration of **Cathode Rays** by means of Gas Particles.—W. Ende, p. 238.
The Important First **Choke** in High-Voltage Rectifier Circuits.—F. S. Dellenbaugh, Jr., and R. S. Quimby, p. 358.
High Inductance Smoothing **Choke.**—H. B. Dent, p. 654.
The Design of Iron Core **Chokes.**—M. G. Scroggie, p. 477.
Utilisation to the Fullest Extent of Iron-Cored **Chokes** carrying Direct Current.—R. Gürtler, p. 477.
Remarks on the Design of Iron-Cored **Choking** Coils.—J. Hak, p. 598.
Chokes.—See also Reactance.
A Direct-Reading Electric **Chronograph** for the Exact Measurement of Very Short Intervals of Time [Condenser-Charging Principle using an "Electrometer" Valve and a Neon Lamp as Relay: Application to Echo Sounding for Aircraft and Ships].—R. Dubois and L. Laboureur, p. 416.
An Application of the **Circle Diaphragm** to the Design of Attenuation and Phase Equalisers.—Rust, pp. 161 and 280.
A Simple **Clamp** for Fine Wires [Low-Current Fuses, etc.; using Press Fasteners].—L. Bainbridge-Bell, p. 239.
The Dielectric Properties of Varnished **Cloth** at Low Voltage Gradients (E.R.A. Report).—L. Hartshorn, p. 476.
The Electrical Properties of Russian **Colophony.**—Bogorodizky and Maigeldinov, p. 109.
A New A.C. Potential **Comparator.**—D. C. Gall, p. 359.
Compound **Compass** for Drawing **Arcs** of Great Radius.—L. W. McKeehan, p. 295.
Measuring **Condenser** Whose Capacity Increases Linearly from an Exact Zero.—K. Kuhlmann, p. 108.
A New Type of High Voltage **Condenser** [replacing Leyden Jars].—H. Wommelsdorf, p. 537.
The Use of the Positive Ion Sheath on an Electrode to give a Variable **Condenser** Effect: Employment of such a Condenser in Signalling by Frequency Change.—Thomson-Houston Company, p. 599.
A Standard of Small Capacity Differences [Variable **Condenser** for Inter-Electrode Capacity Measurements].—Bartlett, p. 48.
On the Theory of the Paper **Condenser.**—M. I. Mantrov, p. 599.
Life Test for [Paper] **Condensers.**—H. W. Houck, p. 109.
Absorption in Electric **Condensers** [Paraffin Wax-Paper Type].—R. E. W. Maddison, p. 655.
Condensers made by Deposition of Metallic Powder by Jet of Acetylene Gas.—Soc. Ducretet, p. 478.
Telephone **Condensers** [Foil and "Mansbridge" Types].—R. E. W. Maddison and S. Chapman, p. 51.
Equivalent Circuits of Imperfect **Condensers.**—C. L. Dawes and W. M. Goodhue, p. 420.
Principle, Construction, and Use [and Testing] of Electrolytic **Condensers.**—W. Hoesch, p. 51.
Measuring the Power Factor of Electrolytic **Condensers,** p. 51.
Methods of Testing Characteristics of Electrolytic **Condensers.**—W. W. Garstang, p. 420.
Electrolytic Variable **Condensers.**—W. W. Garstang, p. 420.
Electrolytic **Condensers** for the Transmitter.—W. M. Bailey, p. 599.
Power Losses in Electrolytic **Condensers**: Film Characteristics of Electrolytic Condensers.—F. W. Godsey, Jr., p. 239.
Mica **Condensers** in High-Frequency Circuits.—I. G. Maloff, p. 420.
Tests on Japanese Standard Mica **Condensers.**—K. Yamaguchi and S. Inoue, p. 420.
Contact-Making [**Metering**] **Instruments.**—F. S. Marcellus and S. W. Spengler, p. 656.
Preliminary Communication on Metallic **Contacts** with an Interposed Very Thin Film of Foreign Material.—R. Holm: Meissner, p. 237.
Investigations on Gold Alloys for **Contacts.** Part I.—C. Benedicks and J. Härdén, pp. 295 and 417.
Behaviour of the **Copper-Cuprous Oxide** Rectifier at High Frequencies.—W. P. Place, p. 597.
Rectifier Effect and Heterogeneous Catalysis in **Copper-Cuprous Oxide** Systems.—Wo. Ostwald and H. Erbring, p. 419.
Structural Investigation of the **Copper Oxide** Rectifier. Contribution to the Crystal and Attenuating Layer Photoelectric Effect.—Scharf and Weinbaum, p. 469.
Current-Voltage and Thermal Characteristics of the **Copper Oxide** Rectifier.—W. B. Pietenpol and G. W. Presnell, p. 478.
On the Composition of the Oxide in **Copper Oxide** Rectifiers and Photoelectric Cells.—L. Dubar, p. 419.
On the Nature of the Attenuating Layer in **Copper Oxide** Rectifiers.—F. Waibel and W. Schottky, p. 419.
Copper Oxide Rectifiers.—K. Singh, p. 107.
The Electronic Conductivity of the **Copper Oxide.**—M. Le Blanc and H. Sachse, p. 238.
Cotton for Insulation.—R. I. Martin, p. 177.
Counter, Automatic.—See Thyratron.
The Oscillating **Crystal** [Crystal Detector] and the Reasons for its Behaviour.—E. Habann, p. 108.
The Oscillating [**Crystal**] Detector.—F. Noack: Habann, p. 538.
The Oscillating **Crystal** and its Technical Form.—E. Habann, p. 659.
On the Nature of Electron Motion in **Crystals** and Its Significance in the Electrical Behaviour of Solids [including Rectifying Action].—L. Nordheim, p. 597.
A Manual Recorder [Manual **Curve Drawing Equipment** developed from the Radio Fading Recorder].—H. S. Wilkins, p. 295.
A Method of Interpreting Static Frequency- or Distribution-**Curves.**—H. C. Plaut, p. 418.
An Auxiliary Appliance for Work with Lucas **Curves**—The Inversion Ruler and Slide Rule [for Graphs of Electrical Networks]. H. Reppisch, p. 478.
On the Theory of **Detector Action.**—L. Nordheim, p. 420.
The Trend in **Dielectric** Research [including a Bibliography].—B. Whitehead, p. 239.
The Constancy of the **Dielectric Constant** at Extremely High Field Strengths.—A. Güntherschulze and H. Betz, p. 51.
The Influence of Electrolytes on the **Dielectric Constant** of Water.—R. T. Lattey and W. G. Davies, pp. 109 and 298.
The **Dielectric Constant and Power Factor** of Some Solid Dielectrics at Radio Frequencies.—W. Anderson, p. 476.
A Beat Method for Determining the **Dielectric Constants** of Liquid Conductors.—W. Graffunder and R. Weber, p. 109.
Discussion on "**Dielectric Phenomena** at High Voltages."—Goodlet, Edwards and Perry, p. 655.
The **Dielectric Strength** of Certain Substances [CCl_4 and CS_2].—H. Eisler, p. 476.
Thermal and Electrical Conductivity of **Dielectrics** [and a Possible Relation between the Two].—M. I. Mantrov, p. 298.
The Amplifier-Oscillograph Applied to the Study of **Dielectrics** with Continuous Potentials.—S. K. Waldorf, p. 596.
The Theory of Thermal Breakdown of Solid **Dielectrics.**—P. H. Moon, p. 109.
The Predetermination of the A.C. Behaviour of **Dielectrics** [by Measurement of Charge and Discharge Currents under Continuous Potential].—J. B. Whitehead and A. Banos, Jr., p. 298.
Ionisation of Solid **Dielectrics** by X-Ray Irradiation [Resulting Conductivity obeys Ohm's Law: at 570 Volts the Ionisation in Sulphur exceeds that in Air].—M. Bender, p. 655.

Measurement of Power Factor and Loss in **Dielectrics** [Liquid, Solid and Composite].—T. J. Mirchandani, G. Yoganandam, S. K. Roy and N. V. Narayanaswami, p. 655.
A Method of Determining the Impedance of Hot Cathode [Neon and Mercury Vapour Arc] **Discharge Tubes**.—W. F. Westendorp, p. 51.
Improvements in Electric **Discharge Tubes** [Reduction of Secondary Emission from Grid by Increasing Heat Radiation].—Philips' Company, p. 598.
Improvements in **Discharge Tubes** with Hot Cathodes: Reduction of Power Consumed in Heating, by Thermal Insulation of Cathode.—Claude, p. 238.
Gas-Filled **Discharge Tubes** with Control Grid—Schottky "Wall Current" Relay Tube and Hull "Thyratron."—E. Lübcke, p. 238.
Control Conditions of Grid-Controlled Gas **Discharges**—Ion Control Valves [e.g., Thyratrons].—H. Klemperer and E. Lübcke, p. 359.
Dispersion Measurements of Liquids, in particular Biological Solutions with Undamped Waves of Length 1 to 4 m.—E. May and H. Schaefer, p. 298.
Constructional Methods for the **Driving of Bands or Tapes** in Apparatus of High Precision.—K. H. Sieker, p. 538.
British Standard Specification for **Ebonite** for Electrical Purposes.—British Engineering Standards Association, p. 51.
The Effect of Sunlight on **Ebonite**.—M. C. Timms, p. 109.
A Three-Dimensional Adjustment of an **Electrode** in Vacuo.—J. L. Miller and J. E. L. Robinson, p. 598.
Voltage Effect in **Electrolytic Solutions** and Cathode Ray Oscillograph.—W. Fucks, p. 295.
New Researches on **Electrolytic Valve Action**.—A. Güntherschulze and H. Betz, pp. 296 and 419.
Electrolytic Valve Action and Electrolytic Rectifiers.—E. Newbery, p. 597.
On the Theory of the **Electrolytic Valve Action**.—W. J. Müller, p. 296.
Contribution to the Geometrical Optics of **Electron Beams**: I and II.—M. Knoll and E. Ruska, p. 418.
Remark on the Form of Stop to be Used with **Electron Beams** in Gases.—H. Seyfarth, p. 536.
Electron Microscopes.—Brüche and Johannson: Knoll and Ruska, p. 653.
Electron Optics and Electron Microscope.—E. Brüche and H. Johannson, p. 476.
Sensitive **Electroscopes** [Three Types].—C. Lukens, p. 598.
On an Effect shown by **Ferromagnetic** Materials in an Alternating Electromagnetic Field.—A. Esau and H. Kortum, p. 477.
The Thermoelectric Properties of **Ferromagnetic Substances**.—L. F. Bates, p. 297.
Symposium on **Ferromagnetism**.—F. Bitter, S. L. Quimby, R. M. Bozorth, K. J. Sixtus, L. Tonks, T. D. Yensen, P. P. Cioffi, S. R. Williams and L. W. McKeehan, p. 477.
Determining **Field Distribution** by Electronic Methods [Recording Field Diagrams by Exploring in Distilled Water and Transferring Position by Pantograph].—E. D. McArthur, p. 475.
The Properties and Calculation of the Multiple Bridge **Filter**.—A. Jaumann, p. 595.
A 24000 Watt **Filter**.—M. Brotherton, p. 106.
Rectifier **Filter Circuits**.—R. Lee, p. 598.
Filter Circuits.—W. Cauer, p. 50.
New Theory and Design of Wave **Filters**.—W. Cauer, p. 537.
Calculation of the Building-Up Time of Band-Pass **Filters**.—J. Labus, p. 537.
An Electrodynamic Band Pass Magnifier as a Substitute for **Filters** and Valve Amplifiers in Note-Frequency Telegraphy.—M. Wald, p. 357.
The Economical Design of Smoothing **Filters**.—F. S. Dellenbaugh, Jr., and R. S. Quimby, p. 419.
Precision Methods Used in Constructing Electric Wave **Filters** for Carrier Systems.—G. R. Harris, p. 417.
The Measurement of **Fluorescence** by means of the Photoelectric Cell.—R. Toussaint, p. 177.
Electrodeposited Metal **Foils**.—H. Kersten, p. 110.
A Method for the Approximate Calculation of a Thermionic **Frequency Changer** [based on Anode Dissipation].—A. I. Joffe, p. 359.
On Resonance Phenomena in **Frequency Division**.—Mandelstam and Papalexi, pp. 279-280.
A Thermionic **Frequency Doubler**.—C. K. Stedman, p. 294.
A Cathode-Ray **Frequency Multiplier** [for Obtaining Ultra-High Frequencies].—Jamison, p. 520.
Automatic **Frequency Regulation**.—H. Martin, p. 359.
Contributions to the Theory of the [Magnetic] **Frequency Transformer**.—F. Gutzmann, p. 294.
The Protection of Potential Transformers by the "RL" Micro-**Fuse**.—R. Loubet, p. 110.
Boric Acid **Fuses** [extinguishing Arc by Water Vapour generated in the Fuse], p. 359.
Saving Instrument Losses by Proper **Fuse** Protection [Oscillographic Investigation; Quick-acting "Littelfuses"].—E. V. Sundt: Kollath, p. 421.
A New Protection for **Galvanometers** [Use of Triode as Overload Bye-Pass].—C. Moerder, p. 478.
An Improved McLeod **Gauge**.—S. D. Dryden, p. 107.
A Clock-Controlled Constant-Frequency [Motor-] **Generator**.—A. B. Lewis, p. 294.
Variation with Frequency and Temperature of the Dielectric Properties of Different Varieties of **Glass**.—M. J. O. Strutt, p. 177.
The Dielectric Constants of **Glasses** and Their Dependence on the Composition.—F. Keller, p. 476.
Glow Discharge Lamps for the Generation of "Kipp" Oscillations.—H. von Hartel, p. 536.
Oscillographic Investigation of Intermittent **Glow Discharges**.—R. Rinkel, p. 239.
A Device for Separating the **Harmonics** of Complex Waves.—Gall, p. 589.
Elimination of **Harmonics** superposed on a Continuous Current, p. 598.
The Limits of Validity of the Steinmetz [**Hysteresis Loss**] Formula.—I. Lucchi, p. 477.
Illium [a New Alloy], p. 598.
Impulse Prolonging Circuits in which the Secondary Time is dependent on the Primary Time.—W. Grube, p. 295.
The Prolongation of **Impulses**.—W. Grube, p. 50.
Iron-Cored **Inductances**, with Air-Gap, carrying a Direct Current Component.—R. Gürtler, pp. 236 and 296.
Trolitul: a Synthetic Material, Transparent, Not Brittle, and Highly **Insulating**, p. 359.
The Behaviour of Rubber-less **Insulating** Moulding Materials under Prolonged Immersion Tests.—W. Zebrowski, p. 109.
A New **Insulating Material**, particularly for Cathode Construction in A.C. Valves.—Crowley, p. 599.
New Steatite as an **Insulating Material** for High Frequencies.—E. Albers-Schönberg and J. Gingold, p. 359.
Properties of Moulded Plaskon [**Insulating Material**], p. 476.
Phenol Plastic [**Insulating Material**] for Moulded Cases for the Tropics.—I. T. and T., p. 298.
The Loss Curve of Air-Containing **Insulating Materials**.—A. Gemant, p. 476.
Dielectric Losses in **Insulating Materials**.—H. H. Race, p. 476.
On the Dielectric Loss of **Insulating Materials** at High [and Ultra-High] Frequencies.—H. Irino, p. 359.
Insulating Materials.—A. R. Dunton, p. 109.
The Survey of Progress in **Insulating Materials**.—A. R. Dunton, p. 476.
Low-Thermal-Expansion Ceramics [**Insulating Materials**].—W. W. Winship, p. 476.
Insulating Materials.—"Formapex" Miocarta: "Linapex," p. 51.
On the Variation with Potential of the Dielectric Loss Angle of Certain **Insulating Materials**.—M. Hirsch, p. 655.
Chemical Research in **Insulating Materials** [a Résumé of Papers].—F. M. Clark, p. 655.
Some **Insulating Materials**.—A. R. Matthis, p. 655.
Tests on Raising the Dielectric Strength of **Insulating Oils** by Filtration through Glass Powder Compositions.—P. H. Prausnitz and F. Obenaus, p. 298.
Dielectric Properties of Some Glycols: Development of Polar Characteristics in **Insulating Oils**.—A. H. White and S. O. Morgan: W. N. Stoops, p. 655.
A Glowing-Wire Instrument for Burning Away **Insulation** during the Wiring of Broadcast Receivers, etc.—AEG, p. 538.
Insulation.—See also Dielectric.
Insulations.—H. Warren, pp. 109, 298 and 599.
The Disc Leading-In **Insulator**.—H. Brülle, p. 476.
The Best Shapes for Condenser Leading-In **Insulators**.—H. Einhorn, p. 477.
On the Surge Testing of **Insulators**.—J. Kopeliovitch, p. 50.
The Shot Effect and Electrical Breakdown in **Insulators**.—R. M. Bozorth and F. E. Haworth, p. 476.
Electro-Mechanical **Integraphs** and the Solution of Differential Equations with Variable Coefficients.—P. Fourmarier: Bush, p. 656.
The Magnetic Susceptibility of **Iron** Powder Compositions, and Its Dependence on Particle Size and Separation.—E. Gerold, p. 654.
Iron.—See also Magnetic, Magnetisation, Permeability.
Isolantite Characteristics [at Frequencies from 246 to 1 375 kc/sec.], p. 476.
Laue Spots from Perfect, Imperfect and Oscillating [Quartz] Crystals.—C. S. Barrett, p. 108.
Losses in **Liquid Dielectrics** at Radio Frequencies [and the Meissner "Immersion" Method of Measuring Self-Capacity of Coils].—W. Jackson, p. 298.
An Improved Permeameter for Testing **Magnet Steel**.—B. J. Babbitt, p. 239.
Relationships Amongst the Magnetic Properties of **Magnet Steels** and Permanent Magnets.—K. L. Scott, p. 297.
Magnet Steels and Permanent Magnets.—K. L. Scott, p. 598.
Russian Papers on the **Magnetic** Behaviour of Iron, Powdered Iron Compounds, etc., in High- and Low-Frequency Fields: including Magnetostriction and Magneton Resonance.—Malov, Volkova, Arkadiew and others, p. 176.
A Theory of **Magnetic Permeability** for Frequencies ranging from the X-Ray Region to Commercial A.C.—W. Arkadiew, p. 177.
Contribution to our Knowledge of **Magnetisation** of Iron by Alter-

nating Currents [chiefly Theoretical Investigation].—H. S. Hallo and R. H. Borkent, **p. 236.**

Barkhausen Effect. III. Nature of Change of **Magnetisation** in Elementary Domains.—R. M. Bozorth and J. F. Dillinger, **p. 654.**

The **Magnetisation of Ferromagnetic Powders** in Weak Fields.—R. Chevallier, **p. 477.**

Magnetisation of Macroscopic Powders in Weak Fields.—R. Chevallier, **p. 477.**

The Influence of the Condition of Elastic Strain on the Value of the Permeability at Low **Magnetising Forces.**—M. Kersten, **p. 176.**

A Vacuum **Make-and-Break Device** for Potentials up to 65 kv.—G. Vaudet, **p. 418.**

Dielectric Losses in **Micanite** Insulation of H.T. Generator Coils: Survey.—W. Boller and M. Wellauer, **p. 239.**

The Permittivity and Power Factor of **Micas**: Discussion.—Dannatt and Goodall, **p. 51.**

Some Electrical Properties of Foreign and Domestic **Micas** and the Effect of Elevated Temperatures on Micas.—A. B. Lewis, E. L. Hall, and F. R. Caldwell, **p. 51.**

The Dielectric Strength of Russian **Micas.**—Florensky, Mantrov and Budnicky, **p. 298.**

Theory of Thermal **Micromanometers.**—M. Matricon, **p. 238.**

The Problem of **Motion Picture** Projection from Continuously Moving **Film.**—F. Tuttle and C. D. Reid, **p. 418.**

Shock-Proof **Mounting** using Air Cushioning.—E. Gehrcke and B. Voigt, **pp. 239** and **655.**

The Effect of Mechanical Disturbance on a **Neon Lamp** [Demonstration].—T. J. Dillon and C. M. Lovett, **p. 176.**

The Series Circuit with **Neon Lamp and Condenser,** giving Train of Flashes.—Decaux and Le Corbeiller, **p. 33.**

Apparatus for Measuring the **Number of Turns,** up to 3 000, in a Winding.—C. Dannatt, **p. 110**: see also Turn.

Elastic Stop **Nut** [with Unthreaded Fibre Collar] Applications in the Radio Industry.—H. B. Thomas, **p. 599.**

Constant Frequency **Oscillators.**—F. B. Llewellyn, **p. 294.**

The Piezoelectric **Oscillograph** [Sensitivity of 200 v/mm and Frequency Range up to 7 500 Cycles/Sec.].—W. von Philippoff, **p. 418.**

The Rapid Record **Oscillograph** in Sound Picture Studies.—A. M. Curtis, T. E. Shea and C. H. Rumpel, **p. 418.**

New Blondel Portable **Oscillograph.**—J. Vassillière-Arlhac, **p. 107.**

The "Osiso" **Oscillograph** Equipment for the Automatic Recording of Random Phenomena [with Device for Rapid Lighting-Up of Recording Lamp].—J. T. Johnson, **p. 654.**

A Vibrating Reed **Oscillograph** [Moving-Coil Loud Speaker Design, Coil held by Reed].—F. J. Shollenberger, **p. 653.**

Characteristics of the **Oscillograph-Galvanometer.** Some Practical Considerations in the Design and Application of the Oscillograph-Galvanometer Vibrator.—V. S. Thomander, **p. 176.**

The Calibration of Oil-Damped **Oscillographs.**—E. L. E. Wheatcroft, **p. 107.**

Contribution to Kerr-Cell **Oscillography.**—E. Trümper, **p. 653.**

A Neon-Tube **Oscilloscope.**—Guerbilsky, **p. 238.**

On the Chemical Nature of the **Oxide Layers** which Form on the Metals Al, Zr, Ti and Ta with Anodic Polarisation.—W. G. Burgers, A. Claassen and J. Zernike, **p. 419.**

The Dielectric Constants of a Number of **Oxides** (in particular Al_2O_3).—Güntherschulze and Keller, **p. 419.**

Potential Distribution Radiation and Electrical Conduction in **Paper.**—E. B. Baker and R. F. James, **p. 298.**

The Electrical Conductivity of Black **Paper.** Applications [to the Making of High Resistances and the Tracing of Equipotential Lines].—L. Grillet, **p. 476.**

Effect of Ionisation on Impregnated **Paper** Insulation.—K. S. Wyatt, **p. 599.**

Modern Loading Equipment [including Coils with **Permalloy Dust Core**—"Stanelec"]—Part I.—J. B. Kaye, **p. 297.**

How the High Frequency **Permeability** of Iron Wires Depends on the Field.—M. Wien, **p. 297.**

The Relative **Permeability** of Iron, Nickel and Permalloy in High Frequency Electromagnetic Fields.—E. M. Guyer, **p. 297.**

Hydrogenised Iron of High **Permeability.**—P. P. Cioffi, **p. 297.**

Permeability of Iron at Ultra-High Frequencies.—Schwarz, **p. 477.**

The **Photoelectric Recorder** [for Electrical Indicating Instruments requiring Small Energy Input].—C. W. La Pierre, **p. 295.**

The Variation with Temperature of **Photographic** Processes [for Light, X- and Alpha-Rays].—J. Eggert and F. Luft, **p. 238.**

Photographic Plates for Use in Spectroscopy and Astronomy.—C. E. K. Mees: Eastman Kodak Company, **pp. 238** and **418.**

A Special **Planimeter** for Measuring R.M.S. Values.—H. Adler, **p. 110.**

[Transmitter] D.C. **Plate Supply** from Ford Spark Coils.—V. Davis, **p. 597.**

A Preliminary Communication on Ferromagnetic **Platinum-Chromium and Platinum-Iridium** Alloys.—E. Friederick, **p. 297.**

VDE Requirements for Wall **Plugs and Sockets,** and Methods of Testing, **p. 656.**

A Combination of Bridge and Potentiometer, and Its Advantages as a **Potential Divider.**—E. Denina, **p. 110.**

The Calculation of a Mains Unit stabilised by the Glow-Discharge **Potential Divider,** for a Given Current Output.—L. Körös and R. Seidelbach, **p. 596.**

The Basis of Current Sources "Stabilised" by the Glow-Discharge **Potential Divider.**—L. Körös and R. Seidelbach, **p. 655.**

A Precision **Potentiometer** of Improved Design [Low-Resistance Type without Slide-Wire, Effect of Contact Resistance Negligible].—F. C. Bobier and L. O'Bryan, **p. 420.**

The New Brown **Potentiometer Recorder.**—T. R. Harrison, **p. 110.**

Multi-Ply **Presspapers**: Processes of Manufacture.—A. R. Dunton, **p. 599.**

The **Prism Derivator.**—E. von Harbou, **p. 656.**

A **Prismatic Derivator.**—E. von Harbou, **p. 111.**

The Tangent Plate, an Auxiliary to the **Prismatic Derivator.** Graphical Differentiation with Prismatic Derivator and Tangent Plate.—J. Picht: von Harbou, **p. 656.**

The Diffusion Air **Pump** using Oil [with Low Vapour Pressure: a New Design giving Fractional Distillation during the Working of the Pump Itself, by Adjustment of the Three Water Jackets].—W. Gaede, **p. 418.**

Speed, Speed Factor and Power Input of Different Designs of Diffusion **Pumps,** and Remark on Measurements of Speed.—T. L. Ho, **p. 537.**

Time-Pressure Characteristics of Various Diffusion and Molecular [Vacuum] **Pumps.**—P. J. Mills, **p. 537.**

The Use of Organic Substances in High Vacuum Technique, particularly in the Working of High Vacuum **Pumps.**—M. von Brandenstein and H. Klumb, **p. 537.**

Radio-frequency Filament Supply.—Möckel, **p. 177.**

Radio-frequency Plate and Filament Supply for Receivers.—Edelstein, **p. 107.**

A New Type of **Radiometer** [using the Condenser Ultra-Micrometer Principle].—A. L. M. Dingee, **p. 297.**

A **Radiometer** Sensitive to Hertzian Waves [and Useful in Exploring Electromagnetic Fields].—G. A. Beauvais, **p. 474.**

The Calculation of **Reactance Coils** with Open Iron Cores.—H. Buchholz, **p. 477.**

Apparatus for Automatically **Recording** the Rate of Variation of a Slowly Varying Physical Quantity.—G. Aprile, **p. 420.**

Contribution to the Theory of **Rectification.**—Y. Rocard, **p. 296.**

A Note on the Theory of **Rectification.**—A. H. Wilson, **p. 597.**

Photoelectricity and **Rectification,** Papers on.—Brazzoduro: Deaglio, **p. 592.**

Current **Rectification at Metal Contacts.**—S. P. Chakravarti and S. R. Kantebet, **p. 654.**

Rectifier Valve with Indirectly Heated Cathode at Full Mains Voltage ["Ostar"].—H. Olvenstedt, **p. 296.**

The Use of the New High-Voltage **Rectifier** Valves on 220-Volt Mains, **p. 419.**

Rectifier Valves working off Full Mains Voltage (200 v A.C. Mains).—G. Ganz Company, **p. 296.**

The Design of Power **Rectifier** Circuits: Applications of Mercury Vapour or Thermionic Valves.—D. McDonald, **p. 108.**

The Design of Power **Rectifier** Circuits.—M. V. Callendar: McDonald, **p. 296.**

Micrographic Investigation of the "Kuprox" **Rectifier.**—M. Torres, **p. 296.**

Various Dry-Plate **Rectifier** Patents, **p. 597.**

The Jet Wave **Rectifier.**—J. Hartmann, **p. 478.**

A New Arc-in-Air **Rectifier** for Very High Voltages and Powers.—E. Marx, **p. 597.**

Comparison between Crystal, Copper-Oxide, and Electrolytic Aluminium **Rectifiers.**—A. Stefanini, **p. 108.**

Engineering Features of Gas Filled [**Rectifier**] Tubes.—Steiner, Gable and Maser, **p. 597.**

Investigations on the Influence of the Electron Emission at the Anode on the Occurrence of Back Discharges in the Mercury Vapour **Rectifier.**—E. Kobel, **p. 597.**

Researches on the Influence of the Mercury Vapour Density in the Anode Space on the Voltage Drop in Mercury Vapour Arc [**Rectifiers**].—E. Kobel, **p. 654.**

The Use of Hot-Cathode **Rectifiers** in Various Connections.—K. Meyer, **p. 654.**

A Method of Eliminating Pulsations in the Terminal Voltage of Mercury Arc **Rectifiers** [Use of a Special Single-Phase Three-Winding Compensating Transformer].—K. Ohsumi, **p. 419.**

The Advantages and Disadvantages of the Various Methods of Connecting-Up a Number of **Rectifiers**: and a Suggested Nomenclature.—J. G. W. Mulder, **p. 419.**

The Advantages of the Nickel-Band Cathode in **Rectifiers.**—Telefunken Company, **p. 359.**

Papers on Mercury Arc **Rectifiers.**—Hull and Brown: Slepian and Ludwig: De Blieux, **p. 108.**

New Designs in High Power Mercury Vapour **Rectifiers** and their Physical Bases.—M. Wellauer, **p. 296.**

Glass Bulb **Rectifiers**: Their Life, Efficiency and Special Advantages.—A. M. Browne, **p. 238.**

Gas-filled Hot-Cathode **Rectifiers**—Part I.—A. Gehrts, **p. 597.**

New Applications of the High-Power Mercury Vapour **Rectifier** with Grid Control.—E. Kern, **p. 108.**

Characteristics of a [Grid Controlled] Mercury Vapour [**Rectifier**] Tube.—A. C. Seletzky and S. T. Shevki, **p. 598.**

New Applications of High-Power Mercury Vapour **Rectifiers** with Grids to Voltage and Power Regulation.—M. Schenkel and J. von Issendorff, **p. 108.**
The Fundamental Technical Principles and the Applications of **Rectifiers and Inverters** with Grids.—M. Schenkel, **p. 597.**
Capabilities of Mercury Arc **Rectifiers** and Mercury Arc Valves with Controlled Grids.—Brown Boveri Company, **p. 238.**
Grid-Controlled Mercury-Arc **Rectifiers.**—H. D. Brown, **p. 654.**
Current Directors: the Use of Controlled Gas Discharges: **Rectifiers, Inverters,** etc.—H. Laub, **p. 597 :** see also Relays (Lewer).
Pulsation in Valve **Rectifiers** [Investigation of Simple Theoretical Formula].—H. Boekels, **p. 238.**
Rectifiers.—See also Aluminium, Attenuating, Barrier, Copper Oxide, Crystals, Detector, Discharge, Electrolytic, Selenium, Thyratron.
Improving the **Regulation** of a Motor-Generator.—R. A. Fereday, **p. 107.**
Improvements in the Gradual **Regulation** of Alternating Currents, **p. 655.**
Symmetrical **Relaxation Oscillations** [with a Two-Triode Circuit] and their Synchronisation.—Hollmann: Frühauf, **p. 45.**
A [Copper-Oxide] Photoelectric **Relay** for [Mirror] Galvanometer Measurements.—A. V. Hill, **p. 110.**
The Use of the Turner Kallirotron Circuit as a Trip **Relay.**—Hollmann and Schultes, **p. 107.**
A Simple Pulse Generator for [Control by] Single and Periodic Phenomena [Dynatron Trip **Relay** Circuit for Use with C.-R. Oscillograph, etc.].—W. Fucks, **p. 106.**
Relay working off A.C. and supplying D.C.—Ducrot, **p. 110.**
Tuned Selective **Relay** on Ferrari Rotating Disc Principle.—Landis and Gyr, **p. 598.**
A Mechanically Controlled Bolometer and Its Use as a Highly Sensitive Quantitative **Relay** and as a Quantitative D.C. Amplifier.—H. Sell, **p. 535.**
A New Galvanometer-**Relay** [using an Ultra-Micrometer Device].—S. Reisch, **p. 109.**
Some Developments in Telegraph Technique as applied to Radio Circuits [including a Self-Restoring Valve Trigger-Effect **Relay**].—H. Faulkner and G. T. Evans, **p. 656.**
The Gulstad Vibrating **Relay** Circuit as an Application of the "Mitnahme" [Pull-In] Effect.—H. Salinger and A. F. Schönau, **p. 237.**
Non-linear Circuits for **Relay** Applications [particularly Saturable Core Reactor Circuits].—C. G. Suits, **p. 236.**
A Vacuum Tube **Relay and Race Timer.**—W. M. Roberds: Speakman, **p. 109.**
Gasfilled **Relays.** Part I—Theory and Design.—S. K. Lewer and C. R. Dunham, **p. 417.**
The Combined Working of Valve- and Magnetic **Relays.**—H. Strohmeyer, **p. 417.**
Investigations into the Response Times of **Relays.**—J. Rybner, **p. 237.**
An Apparatus [Opposed Condenser Discharge Method] for Measuring the Operating Time of Electromagnetic **Relays.**—V. I. Kovalenkov, M. V. Raskin and M. F. Nečitajlo-Andrejenko, **p. 295.**
Two Billion Ohms **Resistance** [Glass Rod Helix surrounding Straight Carbon Rod and sputtered with Thin Film of Carbon], **p. 359.**
A Grid **Resistance** of 10^{11} Ohms, of Manganese Dioxide and Alundum made into a Cement with Water Glass.—D. R. Morey, **p. 297.**
A Spark Method of Measuring High **Resistance** [of the order of 10^{8} ohm].—J. A. C. Teegan, **p. 110.**
On the Measurement of High **Resistance** by the Bridge Method.—J. A. C. Teegan, **p. 110.**
An Improved High **Resistance Unit** [from a few to several hundred thousand Megohms].—R. C. Rentschler and D. E. Henry, **p. 297.**
Cathode Ray Oscillograph Methods for Measuring **Resistance Changes** during Short Voltage Impulses. Investigation of Solid Semi-Conductors.—W. Fucks, **p. 418.**
[Non-Inductive, Non-Capacitive] "Silko" Wire **Resistances** in Ribbon Form, **p. 110.**
Lamp **Resistances** for D.C. Receivers.—F. E. Henderson, **p. 477.**
Investigations of the Electrical Conductivity of Thin Metallic Layers [Application to the Production of High **Resistances**].—G. Braunsfurth, **p. 110.**
High **Resistances** Made from Metallic Oxides.—E. R. Mann and D. R. Morey, **p. 51.**
The High Ohmic **Resistances** of the Hochohm Company, Berlin, **p. 655.**
The Design of Liquid **Resistances,** taking into account the Wehnelt Effect.—G. Becker, **p. 420.**
Composition Type **Resistors** for Radio Receivers [Faults, Requirements and Tests].—L. Podolsky, **p. 298.**
The Evolution of **Resistors** used in Radio [Compression-type and Wire-wound].—H. G. Cisin: Clarostat Company, **p. 298.**
Electrolytic **Resistors** of High Resistance.—H. L. White and E. A. Van Atta, **p. 476.**
A Note on a Mercury **Rheostat.**—W. B. Mann, **p. 177.**
Frequency Multiplication by the Use of a **Rochelle Salt Condenser.**—V. Wologdin, **p. 294.**
Dielectric Losses in **Rocksalt.**—P. L. Bayley, **p. 476.**
Dielectric Loss and Relaxation Time in **Rosin.**—J. B. Whitehead, **p. 298.**
Electrical Properties of Stretched **Rubber.**—A. Gemant, **p. 298.**
A Method for the Purification of **Rubber** and Properties of the Purified Rubber.—A. T. McPherson, **p. 599.**
Rubber Substitute unaffected by Solvents [Thiokol], **p. 655.**
The Shielding Action of Metallic **Screens** against Alternating Magnetic Fields.—H. Kaden, **p. 654 :** see also Shielding.
The **Selenium** Rectifier [A Survey].—E. Presser, **p. 419.**
Progress in the Construction of **Selenium** Rectifiers.—S. German Apparatus Works, **p. 359.**
Contact Rectifiers [Experimental Comparison of Copper-Oxide and **Selenium** Rectifiers: and the Advantages of the Latter].—G. S. Altmann, **p. 654.**
Selenium.—See also under "Phototelegraphy and Television."
Conductivity Measurements on [**Semi-Conducting**] **Powders.**—Guillery, **p. 236.**
Electrical and Optical Behaviour of **Semi-Conductors.** IV. On Surface Charges on Semi-Conductors *in Vacuo.*—W. Leo, **p. 108.**
The Theory of Electronic **Semi-Conductors.**—A. H. Wilson, **p. 108.**
Papers on the Electrical and Optical Behaviour of **Semi-Conductors.**—A. Völkl: P. Guillery, **p. 597.**
Shielding of an Electrode from a High Potential Gradient by means of a Charged Dielectric.—C. M. Slack, **p. 476.**
Shielding for Electric Circuits.—J. G. Ferguson, **p. 110 :** see also Screens.
The Electro-Optical **Shutter**—Its Theory and Technique.—F. G. Dunnington, **p. 111.**
Operating Characteristics of the Electro-Optical **Shutter.**—H. W. Washburn, **p. 295.**
Aspects of Standard-**Signal Generator** Design.—J. D. Crawford, **p. 359.**
A Machine for the Graphical Study of the Composition of **Simple Harmonic Motions.**—T. Soller, **p. 598.**
Skin Effect Curves.—G. B. Robinson, **p. 298 :** see also Stroboscopic.
An "Exponential" **Slide Rule.**—L. B. Sklar, **p. 656.**
The Suppression of Ripple in Direct Currents [Design Calculations of **Smoothing Circuits** for D.C. from Dynamos].—F. Weichart, **p. 107** .
A **Solder for Aluminium** (Alumaweld), **p. 359.**
Cathode **Sputtering**—a Commercial Application [to Covering Microphone Diagrams with Gold Electrode Surfaces].—H. F. Fruth, **p. 478.**
Factors of Reflection and Transmission of Certain Metals deposited by Cathode **Sputtering.**—A. de Gramont, **p. 297.**
A New Charging Rod for **Static Electricity** [**Mercury** in Evacuated Glass Tube].—J. I. Hopfield, **p. 177.**
Steel-Copper Alloys for Dynamos and Transformers.—Kussmann, Scharnow and Messkin, **p. 359.**
The **Stroboglow** [Grid-Glow Tube Stroboscope].—L. R. Quarles, **p. 295.**
The "**Stroboglow,**" a Portable Stroboscope.—W. E. Bahls and D. D. Knowles, **p. 598.**
Stroboscopic Device for Use with the Oscillograph and its Application to the Investigation of the Skin Effect.—A. Moskwitin, **p. 107.**
A Method of High-Frequency **Stroboscopy** for Observance of Density Changes within a Vibrating Quartz Crystal.—J. A. Strong, **p. 239.**
Phosphorescent **Sulphides:** the Intervention of Collisions of the Second Type.—M. Curie, **p. 476.**
The Dielectric Constant of Liquid **Sulphur.**—H. J. Curtis, **p. 655.**
Surges and the Cathode-Ray Oscillograph.—S. Teszner, **p. 238.**
A New **Sweep-Circuit** Device for the Cathode-Ray Oscillograph [giving Saw-Tooth Waves up to 50 kc/s and probably over].—G. S. Field, **p. 653.**
Over-Voltages at "Break" in Small Vacuum **Switches.**—E. O. Seitz, **p. 110.**
Vacuum **Switches** [Breaking in Vacua of 10^{-4} to 10^{-6} mm Hg].—K. A. Wiedamann, **p. 237.**
The Eddy Current Delay of Magnetic **Switching Processes** [*e.g.,* in Relays].—W. Wolman and H. Kaden, **p. 656.**
The **Synchronisation** of D.C. Motors by means of Contact Discs.—W. Bussmann: Steage, **p. 538.**
Small **Synchronous Motors:** Improvement due to Grooves in Auxiliary Pole-Pieces.—Siemens and Halske Company, **p. 655.**
An Apparatus for the Automatic Recording of Very Small **Temperature Changes** over a Wide Range [suitable for H.F. **Calorimetry**: Temperature Changes down to 1/10 000°C].—H. Rieche, **p. 599.**
Automatic **Temperature Control** [to within 0.001°C] by Resistance Thermometer, Mirror Galvanometer and Optical Relay.—H. Moser, **p. 656.**
An Improved Constant **Temperature Device.**—L. M. Pidgeon and A. C. Egerton, **p. 108.**
Temperature Regulator maintaining a Furnace at 1 000° C. with a Constancy of 0.2%.—H. Rechenberg, **p. 108.**
Automatic **Temperature Regulator** [using Thermo-Junction and Galvanometer with Periodic Contacting], **p. 656.**
Temperature Regulator for Electrical Resistance Furnaces.—R. F. Proctor and R. W. Douglas, **p. 656.**
Tellurium-Bismuth Vacuum **Thermocouple.**—C. H. Cartwright, **p. 297.**
Thermocouples of Longitudinally and Transversely Magnetised Wires.—C. W. Heaps, **p. 110.**

Thermocouples Whose Elements are Longitudinally and Transversely Magnetised Ferromagnetic Substances.—S. Seass, **p. 110.**

Some Properties of Vacuum **Thermocouples** [Contact and Non-Contact Types].—J. Jaffray, **pp. 110** and **297.**

A Quantitative **Thermoelectric Magnifier** for Optical Pointers.—J. H. Jeffree, **p. 656.**

Construction of **Thermo-elements** by Electro-deposition.—H. Kersten and R. Schaffert, **p. 598.**

Tellurium **Thermo-elements.**—B. Lange and W. Heller: M. A. Lewitsky and M. A. Lukomsky, **p. 239.**

The Production of Sensitive Vacuum **Thermo-elements** and Vacuum **Thermo-relays** by Cathode Sputtering.—Z. Klemensiewicz and Z. Wasowicz, **p. 109.**

A Precision **Thermo-junction** Needle.—R. W. Brown, **p. 598.**

Notes on Radiation **Thermopiles.**—J. Strong, **p. 297.**

Construction of **Thermo-relay** Amplifiers [for Increasing the Scale Distance of a Mirror Instrument without Loss of Resolving Power].—C. H. Cartwright, **p. 598.**

Thermostat Heating Current Stabilised against Mains Fluctuations.—H. Abraham, **p. 239.**

A Sensitive Flexible **Thermostat** [using Photoelectric Cell as Link between Galvanometer and Heating Current].—J. R. Roebuck, **p. 295.**

S.F.R. Precision **Thermostat** for Piezoelectric Oscillators.—Soc. S.F.R., **p. 108.**

A Precision **Thermostat** for Temperatures from 25°C. to 500°C.—J. A. Beattie, **p. 51.**

A Resistance **Thermostat** with Light-sensitive Cell [Radiovisor Selenium Bridge] Operation.—E. J. C. Dixon, **p. 359.**

A Sensitive Bimetallic Strip Temperature Regulator for **Thermostats.**—L. Dubar, **p. 51.**

Diffraction of Electrons by **Thin Films** of Nickel and Copper Oxides.—Darbyshire, **p. 421.**

On the Crystalline Structure of **Thin Layers** of Metals.—Debinska, **p. 293.**

Notes on the Evaporation of Ag, Be, Cr, and Si [Deposition of **Thin Metallic Films**].—C. H. Cartwright, **p. 598.**

Magnetic Properties of **Thin Metallic Films** [Iron and Nickel].—W. Elenbaas, **p. 654.**

Investigations on the Specific Resistance of **Thin Metallic Layers,** especially of Silver and Tungsten.—L. Hamburger and W. Reinders, **p. 297.**

D.C. [**Thyratron**] Inverter for Radio Receivers.—W. R. G. Baker and J. I. Cornell, **p. 108.**

A **Thyratron** "Scale of Two" Automatic Counter.—C. E. Wynn-Williams, **p. 535.**

A Self-Stopping D.C. **Thyratron** Circuit [using a Glow-Discharge Tube].—H. J. Reich, **p. 176.**

Hot Cathode **Thyratrons** [including the Use of Indirectly Heated, Heat-Shielded Cathodes].—L. J. Davies, **p. 359.**

Thyratrons.—See also Rectifiers, Relays, Voltage, and under "Valves and Thermionics."

A Method of Obtaining a Linear **Time Axis** for a Cathode Ray Oscillograph.—A. L. Samuel, **p. 107.**

Thyratron Linear **Time Axis** for Cathode-Ray Oscillograph.—H. Neustadt: Nottingham. **p. 475.**

Cathode-Ray Oscillograph **Time Axis** [Neon Tube, Indirectly-Heated Tetrode and Transformer Circuit].—F. T. Brewer, **p. 176.**

A New Type of **Time Base** for the Cathode-Ray Oscillograph [for Frequencies up to 10^7 Cycles/Sec. and Over].—G. Ulbricht, **p. 417.**

Dissymmetrical Two-Valve Multibrator **Circuits** [for Linear **Time** Base, etc.].—Vecchiacchi, **p. 358.**

A **Time Base** for the Cathode-Ray Oscillography of Irregularly Recurring Phenomena.—G. I. Finch, R. W. Sutton and A. E. Tooke, **p. 50.**

A Circular **Time Base** giving Radial Deflections, for use with the Cathode Ray Oscillograph.—Staff of Radio Research Station, Slough, **p. 535.**

A Method of Radial Deflection in the Cathode-Ray Oscillograph [Circular **Time Base** with Radial Deflection].—G. Goubau, **p. 596.**

Investigation of **Time Base** Release in the Cathode Ray Oscillograph by Involuntary Transient Phenomena.—K. Girod, **p. 176.**

A Linear **Time-Base Oscillator** for Cathode-Ray Oscillography.—Appleton and Builder, **p. 176.**

The [Thun] **Time Extender** with Mechanical Light Regulation as an Auxiliary in Technical-Physical Research [High-Speed Cinematography].—W. von Ohnesorge: Thun, **p. 598.**

An Electric **Time Marker** for Self-Recording Instruments.—L. H. G. Dines, **p. 51.**

The **Self-Regulating** Static **Transformer** giving a Constant Value of Current.—F. Correggiari, **p. 477.**

A Mechanically Resonant [Audio-frequency] **Transformer.**—Ross Gunn, **p. 357.**

The **Transformer** with Evolute Core.—R. Edler: Vidmar: Zopp, **p. 598.**

The Theory of the **Transformer.**—H. Barkhausen, **p. 110.**

A Direct Method of Measuring the Leakage Field of a **Transformer** [Neutralisation of Main Field].—Brückmann and Engelenburg, **p. 177.**

The Tesla **Transformer** as a High Frequency Test Generator and Its Investigation with the Cathode-Ray Oscillograph.—P. Hochhäusler, **p. 654.**

Transformer Equipment for Large Experimental Radiotelephone Transmitter [Long-Wave Transoceanic].—W. R. Lyon, **p. 654.**

The Calculation of Leakage in **Auto-Transformers.**—R. Gürtler, **p. 236.**

Determination of the Constants of Low-Damping **Transformers** [Graphical Method].—P. Oehlen, **p. 296.**

Production Testing of Small Power **Transformers.**—R. M. Hukle, **p. 597.**

Intermediate Frequency **Transformers**—Cost *versus* Quality.—C. C. Henry and R. E. Stemm, **p. 420.**

Charts for [Telephone or Radio] **Transmission Line** Problems.—H. E. Hertig, **p. 296.**

A **Trip Circuit** for Nerve Excitation [for C.-R. Oscillographic Recording.—H. König, **p. 536.**

A **Trip Relay** with Very Short Response Time, for C.-R. Oscillographs.—M. Knoll and M. Freundlich, **p. 596.**

Electric Coil **Turn-Counter.**—B. M. Smith, **p. 420**; see also Number.

A Greaseless and Chemically Inert Valve for High **Vacua** [Silver Bellows and Seating of Fused Silver Chloride].—H. C. Ramsperger, **p. 107.**

A Pressure Reducing Valve for **Vacuum** Apparatus.—W. Klose, **p. 107.**

A Device for Controlling the Flow of Gas into a **Vacuum** System [Introducing a Piece of Wire into Rubber Tubing before applying Pinch Clamp].—H. P. Knauss, **p. 107.**

High **Vacuum** Pressure Control Apparatus [Galvanometer Contact controlling Mercury Valve through Valve Amplifier].—T. L. Ho, **p. 50.**

A New High **Vacuum** System.—J. A. Becker and E. K. Jaycox, **p. 238.**

Sources of Error in **Vacuum** Measurements with a Mercury Vapour Condensing Trap.—M. Rusch and O. Bunge, **p. 295.**

An Improved Cut-Off for High **Vacuum** Work.—R. W. Ditchburn, **p. 107.**

Vapour-Pressure Tests on Greases for High **Vacuum** Work, by a Thermionic Method.—W. Espe and I. Kroczek, **p. 653.**

The Use of Glycol-Phthalic Anhydride Resin as a **High-Vacuum Cement.**—T. P. Sager and R. G. Kennedy, Jr., **p. 295.**

A **Valve** for the Introduction of Small Quantities of Gas [**Capillary** Tube closed by Rubber Pad on Bimetallic Strip, Electrically Heated].—K. Becker and M. Pirani, **p. 418.**

A New **Vibration-free Mounting** for Measuring Instruments.—R. Müller, **p. 51.**

Note on Julius [Anti-Vibration] **Suspensions.**—M. J. Brevoort, **p. 51.**

Automatic **Voltage Control** by means of a Photoelectric Cell.—H. T. Clark and W. Kohlhagen, **p. 295.**

The Use of a Thermionic Tetrode for **Voltage Control.**—J. C. Street and T. H. Johnson, **p. 653.**

A New **Voltage Quadrupler.**—W. W. Garstang, **p. 358.**

Voltage-Regulating Auto-Transformer.—F. Bedell and J. Kuhn, **p. 295.**

Improving the **Voltage Regulation** of Rectifier-Filter Systems: Two Novel Schemes [Voltage-Regulating Input Choke and Voltage Regulating Transformer] for Reducing Plate Voltage Variation with Change in Load.—E. Glaser, **p. 107.**

Automatic **Voltage Regulation** [Voltage Regulator Transformer].—K. Howe: Ward Leonard Company, **p. 478.**

The "Isovolt" **Voltage Regulator.**—H. André, **p. 420.**

A Thyratron **Voltage Regulator.**—C. E. Weinland, **pp. 295** and **420.**

A Corona Tube **Voltage Regulator** [regulating the Output of a Full-Wave Rectifier and thus controlling the Excitation of a Generator].—H. W. Dodge and C. H. Willis, **p. 359.**

The Philips Triode **Voltage Regulator** [for D.C. and A.C. Generators].—N. A. J. Voorhoeve and F. H. de Jong, **p. 538.**

A **Voltage Regulator** for Furnace Control [Mercury Thermometer Relays giving Constant R.M.S. Voltage in Heating Circuit].—V. H. Stott, **p. 108.**

Battery **Voltage Regulator** [Periodic Connection through Condenser to a Second, Constant Voltage Battery], **p. 655.**

STATIONS, DESIGN AND OPERATION.

The Cape **Air** Route: Experiments with Short Wave Wireless, **p. 478.**

Radio Communication on the International [Pan American] **Air Lines.**—H. C. Leuteritz, **p. 299.**

Wavelengths for **Aircraft** Communication.—C. B. Carr, **p. 299.**

Long-Wave Communication for **Aircraft.**—F. Eisner, **p. 656.**

The Position of Broadcasting Technique in **America and Germany** [A Comparison].—W. Reichardt, **p. 538.**

The **Austrian** Broadcasting Network.—G. Schwaiger and others, **p. 111.**

The **Beelitz** Overseas Receiving Station.—H. Mögel, **p. 539.**

The Broadcast Installations in the New "House of Radio," **Berlin.**—G. Lubszynski and K. Hoffmann, **p. 111.**

The New High Power Broadcast Station at **Beromunster,** Canton Lucerne.—H. A. Ewen, **p. 421.**

Radio Broadcast from **Fast Bobsled** [3rd Olympic Winter Games], **p. 299.**

Lining Up **Broadcasting** Circuits [and a Criticism of the C.C.I. Decisions].—E. K. Sandeman, **p. 299.**

Broadcasting House, London, p. 478.
Broadcasting over Lines.—See Land Line, Light, Lighting and Power, Telephone, Wired.
Broadcast Channels for **Canada, p. 599.**
Probable Future Increase in Available Radio **Channels** [from 2 240 to 3 922 in 5 Years' Time].—S. R. Winters: Bureau of Standards, **p. 299.**
The Menace to Broadcasting: "Clear **Channels**" [for Rural Listeners: worked by only One High-Power Station] being Destroyed under Pressure of Political Expediency, **p. 599.**
Coastal Wireless: Radio Telephone Apparatus to be Installed at Eight More Stations.—Marconi Company, **p. 600.**
The **Coltano** Radio Station, **p. 478.**
Commercial Wireless.—Chetwode Crawley, **p. 178.**
Some Developments in **Common-Frequency** Broadcasting.—G. D. Gillett, **p. 111.**
Contribution to the Theory of Interference Zones in **Common-Wave** Transmission.—Hübner, **p. 517.**
Common-Wave or -Frequency Broadcasting.—See also Parallel, Shared, Synchronisation.
Modulation Meters and Indicators for Broadcasting **Control Rooms.**—G. Lubszynski and H. Weight, **p. 240.**
Piping System for Power Tube **Cooling Water** at Radio Station KDKA.—E. M. Sollie, **p. 299.**
Broadcast Station **Coverage** [and its Estimation].—Westinghouse Company, **p. 52.**
Broadcast Station **Coverage** Surveys.—V. V. Gunsolley, **p. 239.**
On the Use of Field Intensity Measurements for the Determination of Broadcast Station **Coverage.**—C. M. Jansky, Jr., and S. L. Bailey, **p. 240.**
From Croydon to the Cape.—R. F. Durrant, **p. 657.**
A Visit to the New Installations of the **Eiffel Tower** Radio Station.—J. P. Delatour, **p. 599.**
Prevention of **Fading** in Broadcasting by Use of Aerial System of Ordinary Height and Great Horizontal Spread.—Harbich and Hahnemann, **p. 177.**
Measurements in the Near **Field** of a Broadcasting Station [at Basle: and the Effects of Houses, Aerials, etc.].—H. Zickendraht, **p. 239.**
Field Strength Chart of the Buda Pesth High-Power Broadcasting Station.—S. Baczynski, **p. 111.**
Field Strength Chart of the Norrköping Relay Station.—S. Lemoine, **p. 111.**
Field Strengths.—See also Coverage.
The Marconi **System** for Distant Control by Wireless of **Fog Signals** [working between Light Vessels in Thames Estuary], **p. 600.**
Radio Sets in the **Forest Service** [for Fire Fighters], **pp. 360 and 659.**
The **French** Colonial Broadcasting Services.—M. Adam, **p. 111.**
French Broadcasting's Gigantic Constructional Programme, **p. 178.**
The New **French** Broadcasting Network, **p. 538.**
Radio Installations in the **French Colonies.**—H. Staut, **p. 111.**
Present Position of Organisation of the International Control of **Frequencies:** the U.S.A. Control Organisation, **p. 599.**
Frequencies of European Broadcasting Stations measured at the Brussels Laboratory of the U.I.R., **p. 657.**
Type Testing of **Frequency-Checking** Apparatus for Broadcasting Stations.—Bureau of Standards, **p. 360.**
Frequency Control Monitor for Broadcast Stations.—Western Electric Company, **p. 599.**
Frequency Deviation Tolerance at Broadcast Stations [the New 50 Cycle Tolerance]., **p. 599.**
A **Frequency Indicator** for [Broadcasting] Transmitters, **p. 343.**
Government-Owned Radio Broadcasting is Out [Federal Radio Commission's Report to U.S.A. Senate], **p. 599.**
The **Heilsberg** High Power Broadcasting Station, East Prussia.—H. Schumacher, **p. 299.**
Communications in **India**—Future Control of Telegraphs, Telephones and Radio, **p. 539.**
Radio **Interference, p. 52.**
Propagation of the Broadcasting Waves [345–441 Metres] in **Japan.**—Takata and Itow, **p. 156.**
Standard Broadcasting **Land-Line Equipment.**—A. R. A. Rendall and J. S. Lyall, **p. 657.**
Swiss **Land-Line** Radio, **p. 299.**
League of Nations Radio: Some Particulars of the Transmitting and Receiving Stations at Geneva, **p. 360.**
Broadcasting Distribution and the Electric **Light** Network.—Philips Company, **p. 421.**
Feasibility of Broadcasting with Carrier Current applied to **Lighting and Power Lines.**—I. Tanimura, **p. 360.**
New Methods for the Measurement of **Modulation** Ratio [using Critical Voltage of a Neon Tube].—A. L. Minz, **p. 600.**
Recording of **Modulation Level** of a Broadcast System.—H. L. Kirke, **p. 538.**
The **Modulation System** of the Russian 100 kw. Station at Schtschelkowo.—Wigge, **p. 162.**
The Radio [Frequency] **Monitoring** Station at Grand Island, Nebraska, **p. 299.**
Multiplex Transmission and Secret Radio-telephony.—Chireix: Villem, **p. 405.**
Circuit Matching in **Networks** for Radio Distribution [to Loud Speakers].—Jhr. W. Six and R. Vermeulen, **p. 299.**
Simple Telephone Broadcasting **Networks.**—A. D. Apanasenko, **p. 360.**
New **Overseas** Radio-Telephone Extensions.—A. A. Oswald, **p. 178.**
The **Parallel Working** of Radio Broadcast Stations.—S. I. Panfilov, **p. 599.**
The New "Radio-Vitus" Broadcasting Station [near **Paris**], **p. 111.**
The New Broadcasting Station Radio **Paris** [at Saint Rémy l'Honoré]—H. Staut, **p. 299.**
New Broadcasting Station ("**Parisian Station**") of the Compagnie Générale d'Énergie Radioélectrique, **p. 421.**
The New Broadcasting Centre, the "Poste **Parisien,**" of the Compagnie Générale d'Énergie Radioélectrique.—Le Duc and Sallard, **p. 599.**
The New [High Power] Broadcasting Station "Poste **Parisien,**" **p. 538.**
Paris.—See also Saint Rémy.
Wireless Communication in the **Polar Regions** [and the Causes of its Difficulties].—Krüger, **p. 334.**
Papers on **Police** Radio Signalling Systems.—Dunsheath: Kavanagh: Lampkin, **p. 299.**
Radio to the Rescue [**Police Radio,** especially De Forest Radio Police System in Los Angeles].—W. J. Barkley, **p. 111.**
Polish National Broadcasting, **p. 599.**
The **Pontoise** Radiotelegraph Station.—V. Vigneron, **p. 111.**
The **Pontoise** Radiotelegraph Station.—Veaux, **p. 177.**
The New Radioelectric Stations of **Pontoise** and **Noiseau.**—E. Picault, **p. 360.**
Power Equipment at KDKA's New Station.—R. L. Davis, **p. 111.**
Prague Broadcasting Station, **p. 111.**
The **Prague** High-Power Broadcasting Equipment.—D. B. Mirk, **p. 299.**
The **Prague** [Cesky-Brod] High-Power Broadcasting Station.—Strong, Mirk and Gallant, **p. 478.**
Application of **Printing Telegraph** to Long-Wave Radio Circuits.—A. Bailey and T. A. McCann, **pp. 111 and 178.**
European Broadcast **Programme Exchange** [with Some Statistics].—H. Antoine, **p. 478.**
The **Communication** System of the **Radiomarine Corporation** of America.—I. F. Byrnes, **p. 360.**
Radiotelephone Service is Expanding [Survey including Some Details of the New Service California-Hawaii].—J. J. Pilliod, **p. 52.**
Radiotelephone Experiments over Short Distances [Linking Isolated Settlements, etc., in B.C. and Alaska: Wavelengths 50 to 200 Metres].—C. H. McLean, **p. 600.**
Distance **Ranges** of Radio Waves.—Dellinger, **p. 398.**
Relay Broadcast Transmitter, Type BR.1A [for Sweden], **p. 111.**
Medium Wave Receiver for Broadcasting **Relay, p. 657.**
Remote Control of Broadcast Programmes.—G. W. Haug, **p. 599.**
Broadcast Repeaters: A Discussion of the Requirements of Line-Amplifiers used for Programme Transmission over Broadcasting Land Lines.—Vogel, **p. 177.**
Broadcasting **in Russia:** Organisation and the Five-Year Plan.—G. E. Roth, **p. 240.**
The New **Russian** Radio "Five-Year Plan," **p. 178.**
New **Russian** "Five-Year Plan."—Wigge, **p. 178.**
New Broadcasting Station of the Compagnie Française de Radiophonie at **Saint Rémy** [and the Use of the "De-phasing" System of Modulation], **p. 111.**
The New Radio Station at **Saint-Rémy** l'Honoré (the New Radio Paris).—M. Adam, **p. 299.**
Scottish Regional Station [at Westerglen], **p. 478.**
Wireless at **Sea, p. 178.**
Interference Effects with **Shared-Frequency** Broadcasting.—C. B. Aiken, **p. 111.**
Operation of a **Ship-Shore** Radiotelephone System [North Atlantic Service].—C. N. Anderson and I. E. Lattimer, **p. 359.**
Ship to Shore Telephone Installation on the s.s. Empress of Britain.—Marconi Company, **p. 111.**
Radiotelephony Communication with **Ships** [including R.M.S. Olympic Installation].—F. de Fremery, **p. 539.**
Short-Wave Broadcasting Stations of the World [List and Map], **p. 111.**
Short-Wave Beam Broadcasting from Spain to America, **p. 599.**
Simultaneous Telegraphy and Telephony on Short-Wave Circuits.—D. Thierbach, **p. 538.**
Single Wavelength System [of Duplex Radiotelephony, on the "Olympic."].—I. T. and T. Company, **p. 178.**
The **"Spread Side-Band"** System for Short-Wave Telephony Communications [Madrid-Buenos Aires Services].—L. T. Hinton, **p. 657.**
Empirical **Standards** [of Reception, Interference and Service Area] for Broadcast Allocation.—A. D. Ring, **p. 421.**
The New **Swiss** Broadcasting Station [Sottens, near Lausanne]: The Swiss Broadcast Network.—F. C. McLean: A. Muri, **p. 657.**
Broadcasting in **Switzerland, p. 111.**
A New Broadcasting Station in **Switzerland, p. 421.**
Synchronization of Westinghouse Radio Stations WBZ and WBZA.—S. D. Gregory: Westinghouse Company, **p. 111.**
New Possibilities in Broadcast Reception [Distribution over **Telephone Network or Special Lines,** in Switzerland], **p. 240.**

Broadcasting in a **Train**.—A. Dinsdale, **p. 538**.
Ten Years of **Transradio**—A Retrospect.—E. Quäck, **p. 240** (two).
Optimum **Tuning Conditions** for High Frequency Plants [to satisfy Various Requirements].—Osnos, **p. 340**.
Two-Way Radiotelephone Circuits [Connection to Land Lines: the Use of "Vodases"].—S. B. Wright and D. Mitchell, **p. 600**.
Papers on **Ultra-Short-Wave** Broadcasting.—Schröter: Sohnemann, **p. 30**.
Broadcasting with **Ultra-Short Waves**.—G.W.O.H., **p. 218**.
Seven-Metre [**Ultra-Short-Wave**] Broadcasting.—W. F. Floyd, **p. 240**.
Ultra-Short-Wave Broadcasting: Unsatisfactory Results and the Need for Better Receivers.—von Ardenne, **p. 657**.
Broadcasting Tests in Amsterdam on a 7.85-Metre [**Ultra-Short**] **Wave**.—P. J. H. A. Nordlohne: Philips' Company, **p. 657**.
Proposed **Ultra-Short-Wave** Telephone Services between Hawaiian Islands, **p. 51**.
Ultra-Short Wave in Hawaii Telephone Service, **p. 299**.
Duplex Radio Telephony on Few Metre [**Ultra-Short**, 4-Metre] Waves between Ship and Shore.—S. Uda, **p. 298**.
Communication Tests for Radio Telephony by means of **Ultra-Short** [4.6 and 5.8 Metre] Waves between Niigata and Sado.—S. Uda **p. 360**.
Ultra-Short-Wave [42 Centimetre] Signalling.—Westinghouse Company, **p. 360**.
Reflectors and Feeders for **Ultra-Short** Waves [Dover-Calais Service].—Darbord, **p. 346**.
A Portable 56-Mc [**Ultra-Short-Wave**] Transmitter-Receiver.—F. A. Gunther, **p. 600**.
Radiation of Multiple Modulated Carrier Waves due to Common Plate Battery for Transmitter and Receiver, in **Ultra-Short-Wave** Working (Five Metre Waves).—L. Spangenberg, **p. 600**.
Ultra-Short-Waves.—See also Radiotelephone.
Intercontinental Radiotelephone Service from the **United States**.—J. J. Pilliod, **p. 177**.
The **Vatican** Short-Wave Telegraph Station.—G. Gianfranceschi, **p. 111**.
The **Wavelength Problem**.—Noel Ashbridge, **p. 599**.
The **Wavelength Problem** and the U.I.R.—P. Münch, **p. 111**.
Wavelengths.—See also Channels.
Weather Service for All.—T. Herbert, **p. 539**.
Westinghouse Radio Station at Saxonburg, Pa. [for Broadcasting and Experimental Work].—R. L. Davis and V. E. Trouant, **p. 599**.
Wired Broadcasting in Switzerland, **p. 360**.
Cannot Refuse **Wired Music** [Decision against Refusal of New York Telephone Company to furnish Leased Lines], **p. 240**.
The Present Status of **Wired Wireless** Broadcasting on Power Lines.—G. Squier, **p. 177**.

GENERAL PHYSICAL ARTICLES.

The Slowing-Down of **Alpha Rays** in the Air, and Bethe's Theory.—G. Mano, **p. 539**.
The Motion of a **Charged Particle**. Part I.—C. Störmer, **p. 299**.
Relativistic Theory of the Interaction of Two **Charged Particles**.—A. D. Fokker, **p. 601**.
Classical Electrodynamics and the **Conservation of Energy**.—W. F. G. Swann, **p. 52**.
The Nature of Electrical **Contact between Metals**.—T. H. Osgood and E. Hutchisson, **p. 658**.
Contact Potential.—See Dielectric Constant.
On the Nature of Electron Motion in **Crystals** and Its Significance in the Electrical Behaviour of Solids [including Rectifying Action].—L. Nordheim, **p. 601**.
Experimental Investigations of the Current Conduction in **Dielectric** Fluids at High Fields.—A. Nikuradse, **p. 479**.
The Breakdown of the Liquid **Dielectric**.—Nikuradse, **p. 650**.
Conductivity of **Dielectric** Fluids [Summarising Report].—A. Nikuradse, **p. 658**.
On the Conduction of Current in Liquid **Dielectrics**.—W. O. Schumann, **p. 659**.
Dielectric Constant and Contact Potential.—T. Takéuchi, **p. 178**.
Dielectric Constants of Aqueous Solutions.—R. Weber, **p. 112**.
The **Diffusion** of Particles [emitted by a Reflecting Plane] taking into Account the Energy Loss.—W. de Groot, **p. 112**.
On the Townsend **Discharge** in Heavy Mist, when Loaded with Space Charge.—W. Deutsch, **p. 112**.
Is the Initial Electron in an Impulsive **Discharge** Set Free by Photoelectric Action?—K. Buss and K. Mosch, **p. 112**.
The Breakdown Process in the **Discharge** across a Spark Gap.—W. Rogowski, **p. 241**.
The Step-by-Step **Discharge** in Gases.—W. Rogowski: Krug, **p. 361**.
The Step-by-Step **Discharge** [and Krug's Denial].—K. Buss: Rogowski, **p. 421**.
Step-less and Step-by-Step **Discharge** in Air according to New Oscillograms.—W. Krug: Rogowski, **p. 658**.
Experiments on the Glow **Discharge**.—G. Valle, **p. 178**.
Investigation of Surface **Discharge** with Impulse Voltage.—Rosenlöcher, **p. 220**.
The Electrodeless **Discharge** as Measured by the Cathode-Ray Oscillograph [Number of Initiating Electrons, etc.].—K. Buss, **p. 421**.
Papers on the Electrodeless **Discharge**.—Tykociner: Kunz, **p. 421**.
Control of the Glow **Discharge** on a Grid Cathode by means of a Third Electrode behind the Cathode.—Güntherschulze and Keller, **p. 241**.
The High Frequency **Discharge** [Study of the Effect of the Distance between the Electrodes].—Gutton and Beauvais, **pp. 217-218**.
The Extension of Paschen's Law to include the Electrodeless Glow **Discharge**.—O. Stuhlmann, Jr., **421**.
Further Experimental Data on the Electrostatic and Magnetic Components in the Electrodeless **Discharge**.—C. T. Knipp and V. M. Smith, **p. 658**.
The Colour of the Light from High-Frequency **Discharges** in Helium.—J. S. Townsend, **p. 112**.
Electrodeless **Discharges**.—J. S. Townsend, **p. 658**.
Electrical **Discharges** in Gases at Low Pressures.—I. Langmuir, **p. 658**.
Discharges Maintained by Electrical Oscillations in Solenoids.—G. D. Yarnold, **p. 658**.
Electric and Magnetic **Double Refraction**.—J. W. Beams, **p. 479**.
Sir A. S. **Eddington's** Recent Theories.—W. N. Bond, **p. 478**.
The Kinetics of **Electrode Processes**. Part I.—Depolarisation Effects by Hydrogen and Oxygen at Platinum Electrodes.—J. A. V. Butler and G. Armstrong, **p. 659**.
The Dispersion of Conductivity of Some Aqueous and Non-Aqueous Solutions of **Electrolytes**.—H. Gaertner, **p. 241**.
The Theory of **Electrolytic Polarisation**.—H. Fricke, **p. 659**.
On the Dielectric Constants of **Electrolytic Solutions**.—W. Orthmann, **p. 112**.
On the Conductivity and Dielectric Constant of **Electrolytic Solutions** at High Frequency.—M. Wien, **p. 241**.
On the Analogy between the **Electromagnetic Field** and a Fluid containing a Large Number of Vortex Elements.—J. J. Thomson, **p. 112**.
A New **Electron** Inertia Effect and the Determination of m/e for the Free Electrons in Copper.—S. J. Barnett, **p. 52**.
A New Characteristic of the Dirac **Electron**.—Al. Proca, **p. 299**.
The Characteristic Values of the Dirac **Electron**.—Al. Proca, **p. 479**.
The Diamagnetism of the Free **Electron**.—T. Takéuchi, **p. 539**.
On the Canal Breadth of **Electron Avalanches**.—F. Ollendorff, **p. 600**.
Multiple Excitation of Complex Atoms by **Electron Impact**.—L. Goldstein, **p. 539**.
The Structure of **Electron Waves**.—L. Infeld, **p. 600**.
The Theoretical Bases of Electrotechnics: **Electronic Interpretation** of Energy Exchange in Alternating Currents.—M. Boll, **p. 112**.
Diffraction of **Electrons** by Thin Films of Nickel and Copper Oxides.—J. A. Darbyshire, **p. 421**.
Diffraction of **Electrons** by Single Crystals: the Case of Paraffin and the Saturated Fatty Acids.—J. J. Trillat and Th. v. Hirsch, **p. 658**.
The Angular Distribution in the Scattering of Slow **Electrons** by Gas Molecules.—C. Ramsauer and R. Kollath, **p. 241**.
The Effect Produced by a Cloud of **Electrons** on the Structure of the de Broglie Wave.—Szczeniowski and Infeld, **p. 178**.
Electrons and Light Quanta [Negative Experimental Test on Acceleration or Retardation of the Former by the Momentum of the Latter].—Ambrose Fleming, **p. 478**.
Electrons in a Gravitational Field.—T. Takéuchi, **p. 539**.
Electrons, Protons and the So-called Electron Magnetism.—A. Güntherschulze, **p. 601**.
The Molecular Theory of **Electro-Optical** Phenomena.—R. de Mallemann, **p. 52**.
A Search for an **Electrostatic Analog** to the Gravitational Red Shift [Negative Results in Test for Change in Frequency of Light due to Difference in Electrostatic Potential between Source and Measuring Apparatus].—R. I. Kennedy and E. M. Thorndike, **p. 112**.
Energy Fluctuations in a Radiation Field.—W. Heisenberg, **p. 178**.
The Derivation of Maxwell's **Equations** from the Equations of the Quantum Theory.—M. Fahmy, **p. 478**.
On the **Equations of Laplace and Maxwell**.—K. F. Herzfeld, **p. 658**.
An Experiment in Support of the Hypothesis of a Time Lag in the **Faraday Effect**.—F. Allison and J. L. Condon, **p. 600**.
The Changes in Electrical Conductivity of **Ferromagnetic Substances** in Magnetic Fields: Comprehensive Survey.—O. Stierstadt, **p. 658**.
Ferromagnetism and Electrical Properties. 3rd **Communication**. The Connection between Resistance Increase and Magnetisation.—K. Schneiderhan, **p. 241**.
Investigation of the Electric **Field Distribution** in Dielectric Liquids by means of Electrical Double Refraction—Electro-optical Kerr Effect.—J. Dantscher, **p. 112**.
Electromagnetic **Fields** Derived from Non-Commuting Potentials.—B. Cassen, **p. 112**.
Relationships between the Energy of **Gamma Rays**, emitted by an Atom following a **Beta or Alpha** Particle Emission, and the Fundamental Physical Constants.—A. Bramley, **p. 52**.
Unified Theory of **Gravitation and Electricity**.—A. Einstein and W. Mayer, **pp. 478** and **657**.
The Relationship of **Gravitation and Electromagnetism**.—W. A. Tripp, **p. 657**.

Gravity and Electricity are merged in New Mathematics.—C. Lanczos, p. 299.
The **Hall Effect** [in Tellurium] with Audio-frequency Currents.—L. A. Wood, p. 658.
The **Hall Effect** in Single Bismuth Crystals.—H. Verleger, p. 658.
Theoretical Study of **Induced Currents** [with an Application to Instrument Design].—M. Biot, p. 178.
Interconversion Factors for Numbers in Energetic and Related Units.—C. H. D. Clark, p. 600.
Papers on the Motion of a Heavy Sphere in an **Ionised Electric Field**.—Pauthenier and Moreau-Hanot, p. 241.
The Probability Law governing **Ionization** by Electron Impact in Mercury Vapor.—C. E. Haupt, p. 112.
Absolute Values for the Mobilities of Gaseous **Ions** in Pure Gases.—N. E. Bradbury, p. 360.
The Changes which Gaseous **Ions** undergo with Time.—J. Zeleny, p. 361.
A Method for Determining the Mobility of **Ions** of the Rare Gases by means of the Negative Layers.—M. J. Druyvesteyn, p. 361.
The **Kerr Effect** in Rochelle Salt.—H. Müller, p. 241.
The **Magnetic Permeability of Space** and the Theorems of M. Chipart.—J. Cayrel: Chipart, p. 657.
Deduction of the **Maxwell Equations** with the aid of Eddington's Undulatory Tensor.—J. J. Placinteanu, p. 478.
Remarks on our Paper: "Electric and Magnetic Effects on **Metallic Wires** Structurally Influenced by Heat, Magnetisation or Sound."—A. V. Hippel and O. Stierstadt; Supplementary Remarks by O. v. Auwers, p. 112.
The E.M.F. of an Electrode in Motion, and the Electrokinetic Potential of **Metals**.—S. Procopiu, p. 52.
On an Electromotive Force Between Two **Metals in Relative Motion**.—J. B. Seth, B. Gulati and S. Singh, p. 52.
The Force Acting Between **Moving Charges**.—A. D. Fokker and C. J. Gorter, p. 601.
A New Method of Producing **Negative Ions**.—J. S. Thompson, p. 112.
Neutron, the Zero Element.—Swinne, p. 479.
Theory of the Diffusion of **Neutrons**, Coefficient of Absorption and Ionisation.—J. L. Destouches, p. 479.
Orientated Atoms in a Variable Magnetic Field.—E. Majorana, p. 658.
On High Frequency **Permeability**. Some Remarks on the Papers of R. Michels and M. Wien.—W. Arkadiew, p. 240.
Papers on **Photochemical** Processes.—Faraday Society, p. 361.
Photoelectrons and Negative Ions.—Wellish, p. 102.
The **Photon** considered as a Material Point and treated by Quantum Mechanics: The Existence of Photon Spin.—Al. Proca, p. 52.
Plasma Oscillations and Selective Optical Reflection from Metals.—M. Steenbeck, p. 539.
The Intermediate Free Path Case in the Theory of a **Plasma**.—L. Tonks, p. 600.
Effect of Nuclear Spin on **Polarisation of Radiation** excited by Electron Impact.—W. G. Penney, p. 658.
The Form of **Potential Barrier** at the Surfaces of Conductors.—A. T. Waterman, p. 658.
Two Problems in **Potential Theory**.—T. C. Fry, p. 600.
The **Probable Values** of e, h, e/m, and α.—R. T. Birge, p. 478.
A Possible Explanation of the Difference in Mass between the **Proton and the Electron**.—Al. Proca, p. 360.
Electrodynamics and the Theory of Quanta.—J. Solomon, p. 178.
Quantised Singularities in the Electromagnetic Field.—P. A. M. Dirac, p. 113.
Electrodynamic Masses in **Quantistic** Electrodynamics.—E. Fermi, p. 178.
Some Difficulties of the **Quantum** Theory.—J. Solomon, p. 178.
Quantum Theory of Radiation.—E. Fermi, p. 479.
Quantum.—See also Photon.
Radioactive Disintegration.—W. Heisenberg, p. 658.
Electricity as a Natural Property of **Riemannian Geometry**.—C. Lanczos, p. 300.
Electromagnetism as a Natural Property of **Riemannian Geometry** [Theoretical Investigation].—C. Lanczos, p. 300.
On the Appearance of Vector Potential in **Riemannian Geometry**.—C. Lanczos, p. 479.
A New Relation between **Electrical Resistance and Energy of Magnetisation**.—W. Gerlach and E. Englert, p. 52.
Total **Secondary Electron Emission** from Metal Faces.—S. R. Rao, p. 658.
Secondary Electron Emission from a Nickel Surface Produced by Positive Ions of Mercury.—R. M. Chaudhri, p. 658.
Theory of **Secondary Electron Emission** from Metals.—H. Fröhlich, p. 658.
The Emission of **Secondary Electrons from Tungsten**.—A. J. Ahearn, p. 241.
Influence of the Electrical Discharge on the **Secondary Emission** from the Cathode.—W. J. Jackson, p. 658.
On the Complete Differential **Secondary Radiation** in Air for Medium Velocity Electrons.—E. Kipphan, p. 361.
Application of the Principles of **Similarity** to the Flow of Electricity in Gases.—H. Mache, p. 360.
Sparking Potential and Electrode Material.—Loeb, p. 241.
The Solution of **Steady-State Problems** in Dielectric, Magnetically Permeable, and Conducting Media, with Special Reference to Mathematical Analogies between Magnetic Problems and Current-Flow Problems.—W. F. G. Swann, p. 658.
On a Possible Explanation of the Difference in Wavelengths of the Spectral Lines of a Given Element produced on the **Sun and on the Earth**.—F. Sanford, p. 52.
A Theory of **Surface Conductance** at an Electrolyte-Solid Interface.—K. S. Cole, p. 659.
Thermoelectromotive Forces Produced by a Magnetic Field.—S. R. Williams, p. 112.
Remarks on the **Variations in Electrical Behaviour** of Various Substances [including Application to Thermionic Emission].—L. Hamburger, p. 299.
Treatment by **Wave Mechanics** of the Problem of the Free Electron under the Simultaneous Influence of a Homogeneous Magnetic Field and a Plane Electromagnetic Wave (Compton Effect in a Magnetic Field).—F. Lüdi. p. 600.
Liquid Currents and Space Charge round **Wire Electrodes in Water**.—M. Katalinić, p. 659.
Note on "The Effect of Piezoelectric Oscillation on the Intensity of **X-Ray** Reflections from Quartz."—S. Nishikawa, Y. Sakisaka and I. Sumoto, p. 178.
The Dispersion of **X-Rays** by Water.—E. Amaldi, p. 241.

MISCELLANEOUS.

Abbreviation of the Titles of Technical Journals, p. 300.
Shock Measurements [with the Langer-Thomé **Acceleration Meter**].—P. Langer, p. 301.
New **Algebraic Representation** of Alternating Currents and of all other Oscillatory Phenomena.—A. Blondel, p. 479.
Amateur Radio in Great Britain.—J. Clarricoats, p. 601.
Amateurs to Co-operate with H.M. Forces, p. 659.
The Extension of Electrical Engineering **Analysis** through the Reduction of Computational Limitations by Mechanical Methods.—H. L. Hazen, p. 422.
The Use of the Projection Microscope and Photoelectric Cell (Determination of **Areas** of Irregularly Shaped Microscopic Objects).—A. Savage and J. M. Isa, p. 242.
Australian Radio Research Board, Report for Year ending 30th June, 1931, p. 178.
The Concept of **Beauty** as related to Engineering.—A. E. Kennelly, p. 540.
A Comparison between the **Biological Effects** of Short and Ultra-Short Waves.—J. Saidman, p. 113.
Biological Effects of Gamma Rays.—W. G. Whitman and M. A. Tuve, p. 113.
The "Photoelectrograph" Device [for the **Blind**], p. 242.
The "Photoelectrograph" for the **Blind**.—Brachet: Thomas, p. 422.
Reading Machines for the **Blind**: the Visagraph and the Photoelectrograph.—P. Henri: Naumburg: Thomas, p. 540.
Print Reading by the **Blind**.—Thomas, p. 659.
Annual Report of the Director of the **Bureau of Standards,** 1930–31, p. 179.
The Pende **Cardiac and Pulmonary "Teletransmitter."**—G. Santucci, p. 301.
Electro-Cardiographs Using Voltage, not Current, Indication.—H. Gabler, p. 301.
Australian **Carrier** System, p. 361.
Carrier Current.—See also High Frequency, Power T. Lines, and under "Stations, Design and Operation."
The Use of Cable Coatings and Conductors as Capacitative Coupling for **Carrier Current** Working, p. 540.
The Use of Blocking (Rejector) Circuits in **Carrier Current** Telegraphy or Telephony over Power Lines, p. 540.
Carrier Current Telephony on H.T. Lines.—G. Bourelly, p. 300.
Speed of Signal Transmission over **Carrier Telegraph Channels,** p. 300.
Experimental Study of **Cathode Rays** Outside of the Generating Tube.—W. D. Coolidge and C. N. Moore, p. 601.
Cathodic Evaporation in a Magnetic Field.—E. Henriot and O. Goche, p. 422.
Second Meeting of the International Technical Consulting Committee on Radio Communication **(C.C.I.R.)**, Copenhagen, 1931, p. 179.
A Magneto-Optic Method of **Chemical Analysis** [resulting in the Discovery of the Elements "Va" (87) and "Am" (85)].—F. Allison, p. 422.
Magneto-Optical Method of **Chemical Analysis** [Depending on Lag of Faraday Effect].—J. W. Buchta: Allison, p. 601.
Further Research on Element 87 [Magneto-Optical **Chemical Analysis** Method].—Allison, Bishop, Sommer and Christensen, p. 660.
A **Chronological History** of Electrical Communication—Telegraph, Telephone and Radio, p. 300.
A New Method of Preparing **Colloidal Silver and Gold** by means of a Continuous High Frequency Electrical Discharge.—A. N. Fraser and J. Gibbard, p. 660.
Communication Carriers in the Technique of Distant Communication.—F. Lubberger and M. Schleicher, p. 179.

Communication Engineering in the Second Half of 1931.—Kölsch : Watson, **p. 540.**
The Present Status of **Complex Angles** in Their Applications to Electrical Engineering.—A. E. Kennelly, **p. 479.**
Investigations on the Recoil of **Compressed Air Tools** [using Radio Technique].—O. Voigt, **p. 54.**
Fifth Pacific Science **Congress,** June, 1933 ; Preliminary Programme of Papers and Authors, **p. 179.**
On **Contact Conduction and Rectification** [on the Electronic Theory].—G. Hara, **p. 242.**
Oscillations due to **Corona Discharges** on Wires.—R. E. Tarpley, J. T. Tykociner and E. B. Paine, **p. 179.**
Counting Objects without Photocells [by Effect of Approach on a Circuit including a Low-Grid-Current—" Electrometer "—Valve].—W. C. White, **p. 114.**
A Photoelectric Rapid **Counting Equipment** for the Exact Counting of up to 1 200 Objects per minute.—E. Bornitz, **p. 480.**
Rapid **Counting Relays** for Impulses up to 20 per Second.—O. Dworeck, **p. 480.**
Measurements by means of Models of the **Coupling** between Two Lines or Cables through Earth Currents.—A. Mühlinghaus, **p. 114.**
On **Curve-Fitting** by means of Least Squares.—W. R. Cook, **p. 113.**
The **Dielectric Constants** of Colloidal, Biological Sub-strata [Serum, etc. ; Wavelengths 10–30 Metres].—C. Albrecht, **p. 660.**
The **Differential Analyzer.** A New Machine for Solving Differential Equations.—V. Bush, **p. 113.**
A Mechanical Method for the Solution of Second Order Linear **Differential Equations.**—E. C. Bullard and P. B. Moon, **p. 113.**
Simultaneous Integration of Two **Differential Equations** of the First Order.—B. Gambier, **p. 113.**
The Application of Quadratic Forms in an Infinity of Variables to Boundary Problems in Partial **Differential Equations.**—S. W. P. Steen, **p. 300.**
A Simple Method for the Numerical Solution of **Differential Equations.**—W. G. Bickley, **p. 479.**
Precision Measurements of Mechanical **Dimensions** by Electrical Measuring Devices.—A. V. Mershon, **p. 422.**
On **Dissipative Systems** and Related Variational **Principles.**—H. Bateman, **p. 113.**
Dosimeter for High- and Ultra-High Frequency Therapeutic Treatments.—K. Heinrich, **p. 113.**
On the Forces acting on **Drops** in an Electric Field.—G. D. West, **p. 540.**
On Some Properties of the **Electret.**—T. Tiku : Eguchi, **p. 540 and 660.**
Types of Changes in Brain, Spinal Cord and Nerve Cells following an **Electric Shock.**—W. B. Kouwenhoven and O. R. Langworthy, **p. 301.**
Electrical Communication in 1931.—I. T. and T., **p. 300.**
A Survey of the Most Important Work in Electrical **Engineering during 1931.**—German Elektrotechnischer Verein, **p. 540.**
An Improved Form of **Electrocardiograph** [with Special High Input-Impedance Valve Amplifier].—S. H. Caldwell, C. B. Oler and J. C. Peters, **p. 541.**
A New Method of **Electrolysis.**—A. Klemenc, **p. 53.**
Rubber Conveyors are Synchronised by [**Electron**] Tubes [using Variable Reactors and Thyratrons].—B. S. Havens, **p. 301.**
The Reliability of **Electron Tubes** in Elevator Service.—C. C. Clymer, **p. 480.**
Electron Tubes in Traffic-Actuated Control Systems, **p. 54.**
An [**Electronic**] Vacuum Tube Relay and Race Timer.—Roberds, **p. 109.**
An **Electronic** High-Speed Timing Device.—W. M. Roberds, **p. 480.**
Electronic Devices as Aids to Research.—A. W. Hull, **p. 539.**
Electronic Speed and Acceleration Recorder.—H. M. Partridge, **p. 660.**
Electronic Devices in Industry.—See also Counting, Internal Combustion, Light Sensitive, Lifts, Moisture, Photocells, Photoelectric, Piezoelectric, Thyratrons, Ultra-Micrometer.
Industrial Uses of **Electronic Diffraction** [Study of Surfaces, e.g. of Photoelectric or X-Ray Cathodes].—C. J. Phillips, **p. 361.**
The Design and Construction of **Electrostatic Generators.**—H. Chaumat and E. Letrand, **p. 112.**
Electrostatic Machines : the Chaumat Principle applied to the Ramsden Frictional Machine.—H. Chaumat and E. Lefrand, **p. 242.**
New **Electrotherapeutic** Apparatus for the Production of Alternating Long-period Wave Currents and of Pulsating Currents.—Delherm and Laquerrière, **p. 113.**
Selective Heating by Short Radio Waves and Its Application to **Electrotherapy.**—J. C. McLennan and A. C. Burton, **p. 301.**
Emergency **Employment Committee** Report [with Numbers of Applicants with Various Qualifications], **p. 601.**
Making New **Emulsions** at 300 000 Cycles, **p. 361.**
From the Great German Radio and Phono **Exhibition,** Berlin, 1931.—W. Burstyn, **p. 52.**
The Berlin Radio and Phono **Exhibition, p. 113.**
The Great German Radio and Phono **Exhibition.**—A. Harnisch, **p. 179.**
The German P.O. Section at the 8th Berlin Radio **Exhibition.**—G. Kette, **p. 300.**
Forecast of the 1932 Berlin Radio **Exhibition, p. 601.**
The Physical and Optical Societies' **Exhibition, p. 179.**
Physical and Optical Societies' **Exhibition :**—Radio and Allied Instruments and Apparatus : Laboratory Electrical Instruments.—R. L. Smith-Rose : C. V. Drysdale, **p. 422.**
The Physical Society's **Exhibition :** Matters of Wireless and Laboratory Interest, **p. 300.**
The Radio **Exhibition, p. 659 :** see also under " Reception."
Faraday Centenary Celebrations, 1931, **p. 52.**
Some Electrical Instruments at the **Faraday Centenary Exhibition,** 1931.—R. W. Paul, **p. 179.**
New Remarks on **Fermat's Last Theorem.**—L. Pomey, **p. 178.**
Trawling by Electricity : Fundamental Considerations on the Catching of Fish by Galvanotaxis.—W. Holzer, **p. 113.**
The Tracing of Dissymmetry and **Flaws** in Ferromagnetic Machine Parts.—J. Peltier, **p. 54.**
The Addition of a " Memory " [Gas-filled Trigger Relay Tube] to a Photoelectric Cell detecting **Flaws, p. 480.**
Experiments on **Fluids Oscillating** under the Influence of Alternating Electromagnetic Fields.—B. Claus, **p. 660.**
Fourier Analysis of Functions with Discontinuities, Angular Points and Similar Properties.—G. Koehler and A. Walther, **p. 113.**
Report on the Work and Studies of the **French National Laboratory** of Radioelectricity : with List of Publications.—C. Gutton, **pp. 422 and 474.**
Fundamental Considerations on the Use of **Gamma Rays** for Testing Materials.—R. Berthold and N. Riehl, **p. 541.**
On the Magnitude and Depth Effect of the Capacitive Influence on a Line by a Dishomogeneity of the Subsoil [Method of **Geophysical Exploration**].—W. Stern, **p. 114.**
An Apparatus for the Generation and Measurement of Low-frequency Electromagnetic Alternating Fields [for **Geophysical Exploration :** 5–1 000 Cycles/Sec. : Frequency independent of Load].—M. Müller, **p. 480.**
Some Experiments relating to **Geophysical Prospecting** [Equiquadrature Method].—D. C. Gall, **p. 114.**
Geophysical Prospecting by 10–30 Metre Waves.—W. Stern, **p. 179.**
Geophysical Exploration, Prospecting.—See also Prospecting.
The Seventh Meeting of the **German Physicists and Mathematicians** in Bad Elster, November, 1931.—E. Lübcke, **p. 422.**
Graphical Symbols for Communication Engineering (Commission Électrotechnique Internationale), **p. 479.**
Effect of **Ground Permeability** on Ground Return Circuits.—W. H. Wise, **p. 114.**
Ultra-Violet Light and High-Frequency Current **Harden** Steel.—J. J. Egan, **p. 53.**
Properties of **Harmonic Functions** of Two Variables in an Open Area Limited by Particular Lines.—C. de la Vallée Poussin, **p. 601.**
The Kelvin Lecture : Dr. Sumpner on the Work of Oliver **Heaviside.**—W. E. Sumpner, **p. 479.**
Note on the **Heaviside Expansion Formula.**—J. M. Dalla Valle, **p. 178.**
Fun with **Heaviside's Calculus.**—W. C. Johnson, Jr., **p. 300.**
The 1931 Meeting of the **Heinrich Hertz** Association, **p. 300.**
The Present Position of **High-Frequency Telephony** on High-Tension Lines.—W. Pinski, **p. 179.**
The Sensitivity of the **Human Body** to Weak Alternating Currents (50 c.p.s.).—E. Albers-Schönberg, **p. 113.**
The Periodic Fluctuation of the Electric Field of the **Human Body.**—W. E. Boyd, **p. 422.**
On the Normal Resistance of the **Human Body** for High-Frequency Currents.—N. N. Malov and S. N. Rschevkin, **p. 541.**
The Variation with Frequency of the Resistance of the **Human Body** in the Range 365 to 8×10^6 Cycles per second.—N. N. Malov and S. N. Rschevkin, **p. 540.**
Electrical Analogies in **Hydrodynamics.**—J. Pérès and L. Malavard, **p. 540.**
I.E.E. Wireless Section : Chairman's Address.—A. S. Angwin, **p. 112.**
A Cold-Cathode 110-Volt Gaseous **Illuminant.**—Spanner, Germer, Doring, **p. 113.**
Balancing Methods for the Elimination of **Induced Noise** in Telephone Cables.—H. Jordan : Collard, **p. 114.**
Theory of the Co-existence of Power and Communication Lines from the Point of View of Their Mutual **Induction, p. 114.**
Phenomena of Low Frequency **Induction** [Power Lines and Communication Lines].—National Electric Light Association, **p. 659.**
Measurements of the Mutual **Induction** between **Lines** with Ground Return, in Skillingaryd.—H. Klewe, **p. 179.**
The **Inductive** Effects of a Single Line traversed by an Alternating Current.—F. Pollaczek, **p. 114.**
Inductive, Induction.—See also Interference, Wires.
Use of the Photoelectric Relay in the **Infra-red.**—F. Matossi : Bergmann, **p. 54.**
The " Invisible Barrage " and the Prevention of Accidents by means of **Infra-Red Rays.**—Fichet-Céma Company, **p. 361.**
Discussion on **" Interference** between Power and Communication Circuits : Summary of Recent Information (1926–1929)."—D. W. Roper : Radley, **p. 541.**
Measures to Protect Telephone Lines against **Interference** from High Current or High Voltage Power Lines.—C.C.I.T., **p. 114.**

Interference between Power and Communication Circuits: Summary of Recent Information (1926 to 1929).—W. G. Radley, **p. 114.**
Interference.—See also Induced, Induction, Coupling, and below.
The **Disturbing** Influence of High Current or High Voltage Lines on Communication Lines: the **Interfering Potential** and Its Measurement.—Ch. Degoumois, **p. 114.**
Measurement of the Hygrometric State of a Gaseous Mass by a Relaxation Oscillation Method: Application to Tests of **Internal Combustion and Steam Engines.**—P. Le Rolland and T. Te Lou, **p. 300.**
The Method of **Least Squares.**—H. J. Brennen, **p. 300.**
The Calculation of Errors by the Method of **Least Squares.**—R. T. Birge, **p. 479.**
Radio **Legislation** in the U.S.A.: The Legal Basis for Broadcasting in Germany: The Regulation of Television.—Loucks: Hoffmann: Smith, **p. 179.**
The **Leipzig Spring Fair, p. 422.**
Tube Control of High-Speed **Lifts** [Pliotron Oscillations Stopped by Entrance of Metal Plate between Grid and Plate Coils].—**p. 242.**
100% Efficient **Light** Produced in Laboratory.—M. Pirani, **p. 53.**
Light-Sensitive Cells in the Service of Man.—F. H. Constable, **p. 659.**
Light-Sensitive Relays now on the Market, **p. 114.**
Linotype operated direct from Typewritten "Copy": the Semagraph.—B. L. Green, **p. 479.**
German Technical **Literature on Broadcasting** during 1931, **p. 421.**
Automatic **Locomotive Cab Signalling** Using Valve Amplifiers, **p. 54.**
The Relations between the Characteristic Curves for **Losses** and **Efficiency** [of Machines in General].—**L. Binder, p. 480.**
New Methods of Measurement for Workshop **Machines** [Dresden Developments in Mechanical, Mechanical-Optical, Electrical and Optical-Electrical Methods].—E. Sachsenberg and W. Osenberg, **p. 422.**
The Measurement of Rapidly Changing **Mechanical Forces** by Alteration of Cross Section of Liquid Resistances: Discussion.—Wallichs and Opitz: Schmaltz, **p. 480.**
Electricity in Modern **Medicine**:—Artificial Fever: Electrosurgery: Electrocardiograph.—Tenney: Ward: Williams, **p. 301.**
Medicine, Electricity in.—See also Physiological, Surgical.
The Action at a Distance of **Metals** on Bacteria and Yeasts: on Microbes.—G. A. Nadson and C. A. Stern, **p. 541.**
A Grid-Glow **Micrometer** [for Measuring Displacements of Less than One Ten-Thousandth of an Inch].—R. W. Carson, **pp. 361** and **480.**
Increased Resolution in **Microscopy** by Television Technique: the Use of Quartz Crystals for Scanning.—E. H. Synge, **p. 601.**
Action at a Distance on the Development of the Eggs of the Echinus [**Mitogenetic Radiation**].—J. and M. Magrou and P. Reiss, **p. 301.**
Valve Method for the Measurement of the **Modulus of Rigidity** of Materials.—L. N. Tomilina, **p. 361.**
The Rapid Determination of **Moisture** in Seeds and Other Granular Substances [including a Valve-Oscillator Method].—R. M. Davies, **p. 480.**
Lumber **Moisture Content** Determined Electrically [Portable Apparatus using Two Tuned Neon Flashing Circuits].—C. G. Suits and M. E. Dunlap, **p. 54.**
Determination of the **Moisture Content** of Wood by Electrical Means.—C. G. Suits and M. E. Dunlap, **p. 241.**
On the **Moment Distribution** of Moments in the Case of Samples Drawn from a Limited Universe.—L. Isserlis, **p. 113.**
Monochromatic Sources of Red and Yellow Light using the Electrodeless Discharge.—F. Esclangon, **p. 422.**
An Electric **Motor** working on the Kinetic Energy of Gaseous Ions.—H. Chaumat and E. Lefrand, **p. 601.**
A Voice Frequency **Multi-channel Telegraph System.**—J. M. Owen and J. A. S. Martin, **p. 361.**
A Trip Circuit for **Nerve Excitation** [for C.-R. Oscillographic Recording].—König, **p. 536.**
A Comparison of the Efficiencies [in their action on **Nerves**] of Wedge-Shaped Waves of the Second Type and Condenser Discharges, of Equal Initial Intensity.—P. Fabre and P. F. Quesnoy, **p. 541.**
A Short Monograph on **Nomography.**—F. M. Wood, **p. 479.**
Obituary: Dr. D. W. Dye, F.R.S.: General Gustave Ferrié.—G. W. O. Howe, **p. 421.**
Obituary: General Ferrié.—R. Jouaust, P. Brenot, **pp. 361** and **421.**
Olympia, 1931: Impressions of the Radio Show.—A.L.M.S., **p. 52.**
The Trend of Progress [**Olympia Show**], **p. 52.**
Radio Apparatus for 1932 [**Olympia Show**].—P. K. Turner, **p. 52.**
Operational Calculus.—H. V. Lowry, **p. 479.**
Generalised Division and Heaviside **Operators**: Classicism and the Electromagnetic Equations of Lorentz.—A. Press, **p. 659.**
The Electrical Measurement of **Mechanical Oscillations.**—H. Thoma, **p. 301.**
Making High-Frequency Electrical **Oscillations** Visible with the Electrodeless Glow Discharge.—F. Herold, **p. 480.**
Notice to Authors—Some Notes on the Writing of Scientific **Papers** [including the Treatment of Mathematical Expressions], **p. 178.**
On the Preparation of **Papers** for "The Wireless Engineer," **p. 479.**
The Necessity of Compression in **Papers** and **Letters** to Technical and Scientific Journals during the Present Conditions, **p. 242.**
Can Inventive Genius be Organised? [Radio **Patent Pool**].—G. P. Simons, **p. 301.**
A New **Patents Act, p. 659.**
The **Penetration** of Radiation from Different Sources into Water and Body Tissues.—W. E. Forsythe and F. Christison, **p. 113.**
Simplified Method for Calculating **Periodicities.**—S. R. Savur, **p. 601.**
Heat Tempering of [Motor Car] Valves controlled by **Photocells.**—F. L. Prentiss, **p. 601.**
Photocells and Their Applications in Optical Technique [Survey and Bibliography of Recent Work].—H. Singer, **p. 539.**
Photocell Circuits: Photocells and Their Applications.—R. C. Walker, **pp. 54** and **242.**
Photocells and Advertising.—R. C. Walker, **p. 301.**
Photocells for Replacing Hand Picking in the final Cleaning of Coal. **p. 659.**
The Automatic Recording of Light-Distribution Curves by the Use of **Photocells.**—W. Little and H. I. Eckweiler, **p. 660.**
Photocells protect Public from Power-Operated Doors [of Lifts, etc.].—C. E. Ellis, **p. 660.**
The Use of Barrier-Layer **Photocells** for Reflection and Other Measurements in a Glass-Working Laboratory: and a Simple Photoelectric Microphotometer.—B. Lange, **p. 660.**
Photocell Control of Temperature for Filament-Coating [and Other Electric] Ovens.—W. P. Koechel, **p. 480.**
Photocell Controlled Elevator Doors.—C. E. Ellis, **p. 361.**
Automatic Egg-Candling [Freshness Test] Machine uses **Photocell.**—W. C. Ferris, **p. 660.**
Photoelectric Cells: Some of their Applications to Industry [Counting Gift Coupons: Alarm for Breakage of Delivery in Paper Mills, etc.], **p. 601.**
Photoelectric Cells for Adjusting the Illumination of Vehicle Tunnel in Paris to correspond with the Outside Lighting, **p. 480.**
A Precision **Photoelectric** Controller.—C. W. La Pierre, **p. 539.**
The Nature of the **Photoelectric** Cell, and Its Application to (Chemical) Measuring Processes—Automatic Electrophotometer for Light-Absorption Measurements.—G. Gollnow: Geffcken and Richter, **p. 480.**
Photoelectric Control of the Weighing of Batches, **p. 361.**
Photoelectric Cells in Precision Inspection Work [by Automatic Reading of Deflection-type Measuring Instruments].—W. J. Tietz and C. Paulson, **p. 301.**
Commercial Applications of **Photoelectric** Cells.—E. H. Vedder, **p. 242.**
Photoelectric Equipment for Sorting Cards into 100 Compartments, **p. 54.**
Objective Photometry by the use of **Photoelectric** Cells, and the Automatic Testing and Sorting of Incandescent Lamps.—W. W. Loebe and C. Samson, **p. 53.**
A **Photoelectric** Method of Measuring the Smoothness of Metal Plate.—E. Gerold, **p. 54.**
Photoelectric Method of Measuring Evenness of Yarn.—G. R. Stanbury, **p. 242.**
New Uses of **Photoelectric** Cells in Industry, **p. 114.**
Papers on a **Photoelectric** Apparatus for the Quantitative Investigation of Particle Size.—N. N. Andrejew, **p. 422.**
A **Photoelectric** Recorder [for Measuring Smoke, Heat, Light, Pressure, Noise, and Thicknesses of Thin Materials].—C. W. La Pierre, **p. 422.**
Continuous Weighing with Light-Sensitive [**Photoelectric**] "Telepoise."—E. J. White, **p. 361.**
Archaeologists put **Photoelectric** Tube to New Use [Classification of Specimens according to Geological Area, by Ultra-Violet Ray Analysis], **p. 660.**
Photoelectric and Thyratron Devices in Industry.—B. S. Havens, **p. 241.**
Photoelectric Applications.—See also Electron, Electronic, Light Sensitive, Selenium, Solutions, and below, down to Photronic.
The Amplification of Small **Photoelectric Currents** by the Philips Electrometer Valve.—R. P. Lejay, **p. 53.**
Successful Design of a **Photoelectric Polarimeter.**—G. Bruhat and P. Chatelain, **p. 660.**
On a New Photoelectric **Relay** for Amplifying Small Movements.—L. Bergmann, **p. 53.**
Photoelectric Relay for A.C. or D.C. Mains [with Light Source bridging up to 20 Metres].—AEG, **p. 660.**
Photoelectric Relays.—W. R. King, **p. 660.**
Papers on **Photoelectric Telemeters.**—A. J. Johnston and T. A. Busby, **p. 660.**
Photoelectrically Controlled Humidifier governed by Moisture on Window Pane.—B. S. Havens, **p. 361.**
Applications of the Schlieren Method of **Photography** [for Making Gases Visible by Presence of Discontinuities in Density].—D. B. Gawthorp, **p. 179.**
The Mekapion **Photometric Recorder.**—S. Strauss, **p. 480.**
The "Electric Eye" Now Enters Industry [including List of Commercial Applications of **Photo-sensitive** Cells], **p. 54.**
On the **Photo-Telephony** [Successful Use of Incandescent Electric Lamp at Transmitter].—T. Kujirai, **p. 540.**
Phototubes Control Furnace Temperatures.—L. R. Koller, **p. 242.**
Photronic Cell a Direct Aid to Better Lighting.—A. H. Lamb, **p. 601.**
The Use of Valves in **Physico-Chemical** Measurements, Part I.—W. Hiltner, **p. 54.**

The Work of the **Physikalisch-Technischen Reichsanstalt** in 1930, **p. 179.**

Physiological and Biological Effects of High Frequency [Short Bibliography of Recent Papers], **p. 541.**

Piezoelectric Properties of Rochelle Salt Crystals.—R. D. Schulwas-Sorokin, **p. 480.**

Determination of the Tensile Strength of Thin Wires by **Piezoelectric** Methods.—F. Seidl, **p. 601.**

The Measurement of Acceleration of Motors, etc., by a **Piezoelectric** Equipment.—H. Lund : AEG, **p. 539.**

Piezoelectric Device for Measurement of Engine Acceleration.—Physik. Tech. Reichsanstalt, **p. 54.**

Piezoelectric Measurement of Acceleration, etc., in Motors.—H. Lund, **p. 480.**

A **Piezoelectric** Method of Measuring the Pressure Variations in Internal Combustion Engines.—H. G. I. Watson and D. A. Keys, **p. 660.**

Recording the Instantaneous Pressures in Fire-Arms by a **Piezoelectric Instrument.**—C. T. Ervin, **p. 660.**

Ballistic Gas Pressure Measurements with **Piezoelectric** Indicator and Cathode-Ray Oscillograph.—H. Joachim and H. Illgen, **p. 660.**

The **Piezoelectric** Measurement of Mechanical Quantities [Vibration, Acceleration, etc.].—J. Kluge and H. E. Linckh, **p. 54.**

Measurement of Rotational Vibration with **Piezoelectric** Crystals.—H. Lund, **p. 480.**

Investigations, by **Piezoelectrical** Technique, into the Fatigue of Steel Bars.—D. Schenk, **p. 54.**

Some Arrangements for the Electrical Transmission of Signals, etc., along **Power Transmission Lines** [using Beats between Two Musical Frequencies].—J. Bethenod, **p. 540.**

Production Peaks and Valleys.—A. C. Lescarboura, **p. 301.**

Radio—Broadcasting—Television [**Progress**] **in 1932** : Advances in Sound-Recording : Industrial Uses of Tubes, **p. 300.**

Ten Years' **Progress** in Communication Services.—P. Craemer, **p. 540.**

Electrical **Progress in 1931**—Television : Radio Telephony : Vacuum Tubes.—W. G. W. Mitchell : H. Faulkner : L. J. Davies, **p. 300.**

Methods used in Electrical **Prospecting.**—J. I. Heller, **p. 114.**

Some Aspects of Electrical **Prospecting** Applied in Locating Oil Structures : Effects of Heat Treatment on Fine Metallic Suspensions [Eliminating Wandering Zero] : Asymmetry of Sound Velocity in Stratified Formations : and Other Geophysical Papers, **p. 541.**

Application of Electrical Methods of **Prospecting** to the Study of the Foundations of Dams, etc.—M. Lugeon and C. Schlumberger, **p. 660.**

Communication with **Quasi Optical** Waves.—Karplus, **p. 34.**

Radiation Effect (Decreasing the Delay Time of a Spark Discharge) from a Disconnected Mercury Vapour Quartz Glass Lamp.—Heyne, Meyer and Otto, **p. 659.**

A Sensitive **Radiation Meter** using a Bimetallic Strip [Thin Quartz with Bismuth Coating].—M. Weingeroff, **p. 659.**

The Problem of **Radiations** [Solar Spectrum : Radiation from Gases : Mitogenetic Rays : Roentgen and Gamma Rays : Irradiation of Ergosterol, etc., etc.].—H. Konen, **p. 113.**

The Spokesman for the **Radio Engineer.**—S. C. Cooper, **p. 113.**

The **Radio Research Board** Report, **p. 112.**

The Work of the **Radio Research Board, p. 179.**

Annual Convention of the **Radio Society of Great Britain and British Empire Radio Union,** p. 659.

Review of Progress : **Radio Telegraphy and Radio Telephony.**—A. S. Angwin, **p. 179.**

Radiothermy [Survey with 25 Literature References].—W. R. Whitney, **p. 660.**

An Alternative to the **Rejection of Observations.**—H. Jeffreys, **p. 601.**

" **Resistance Cells** " : Absorbable Radiation, Activation of Matter, Production of X-Rays.—G. Reboul : G. Déchène, **pp. 53, 301 (two)** and **541.**

Royal Society Conversazione : Cathode-Ray Oscillograph in Radio Research : in Measuring Telegraph Time Distortion : Thermionic Electrometers : Photo-Conductivity of Diamonds, etc., **p. 601.**

The E.M.F. of **Filtration** produced by the Rise of **Sap** in Plants [Characteristic Curve resembling that of a Detector, and explaining certain H.F. Results].—N. Marinesco, **p. 113.**

The Influence of an Artificial Electrical Atmosphere on the Rising of **Sap.**—N. Marinesco, **p. 660.**

The "Chirotherm" : Improved Apparatus for Bloodless Surgery [H.F. Electric Scalpel].—Messrs. Watson and Sons, **p. 660.**

Thermionic **Seismograph, p. 660.**

The **Selenium Cell as Colorimeter.**—A. Mickwitz, **p. 53.**

Infra-Red **Sextant** used on Mauretania during Days of Cloudy Weather.—MacNeil, **p. 480.**

The Action of **Short-Wave** Apparatus compared with that of Diathermy Apparatus.—Rhenisch, **p. 301.**

A Reliable Method of Obtaining the Derivative **Function** from **Smoothed Data of Observation.**—G. Rutledge, **p. 479.**

The Constitution of **Solutions** deduced from Absorption Measurements : Infra-Red Absorption Spectra of Liquids determined by Thalofide Photoelectric Cell.—P. Vaillant : R. Freymann, **p. 54.**

Ether **Spectrum Chart** showing Recent Radio Reallocation [and Audible and Photoelectric Spectra], **p. 479.**

[**Spectrum**] **Chart** of Some Electromagnetic Relations [Wavelength Scale from 10^7 to 10^{-13} cm].—W. E. Deming and F. G. Cottrell, **p. 541.**

The **Standardisation** of Books and Periodicals in Germany.—A. F. C. Pollard, **p. 421.**

Statistics of Radio and Sound-Pictures, p. 361.

Sterilisation of Milk by High-Pitched Sound Waves.—Gaines and Chambers, **p.172.**

Electricity in Healing. Recent Advances in **Surgical and Medical** Applications.—E. P. Cumberbatch, **p. 541.**

Symbolic Calculus.—B. van der Pol and K. F. Niessen, **p. 300.**

The Transmission of **Telegraphic Signals.**—Bartelink and Bast, **p. 88.**

Telemetering over the Telephone Network, **p. 242.**

Summation Measurement Methods in **Telemetering,** and their Chief Deficiencies.—W. Stablein, **p. 300.**

A Vacuum-Tube Device for Current-Balance **Telemeters.**—B. E. Lenehan and P. MacGahan, **p. 242.**

The Exhibit of **Testing Apparatus and Machines** held in connection with the Annual Meeting of the American Society for Testing Materials.—H. V. Cadwell, **p. 179.**

The Variation in the Conductivity of a **Thin Metallic** [Tungsten] Film as an Effect of an Electric Charge [Increase of Conductivity for Negative Charge, Decrease for Positive : approximately Proportional to the Field].—M. Pierucci, **p. 541.**

Application of **Thyratrons** to the Winding of Copper Wire under a Constant Tension.—Rhea, **p. 54.**

Thyratrons Control 3 500-lb Steam Boilers, p. 660.

Thyratrons.—See Electronic, Photoelectric, and under " Subsidiary Apparatus " and " Valves and Thermionics."

A New Use of the Vacuum Tube in Electrometric **Titrations.** I. Polarisation of Platinum Electrodes in Oxidation and Reduction Reactions.—Kassner, Hunze and Chatfield, **p. 539.**

A New Electrical Pick-Up for Measuring Forces on **Tools,** Cutting Pressures, etc. [based on Variation of Liquid Resistance].—A. Wallichs and H. Opitz, **p. 540.**

Electronic Equipment in **Train Control, p. 242.**

Stationary and Non-Stationary Conditions in Inductive [Resonance Principle] **Train Control.**—A. Kammerer, **p. 242.**

The **Transformation** of $\sqrt{-1}$: A New Equation for the Cycloid.—G. S. Berkeley : C. Turnbull, **p. 113.**

Investigations of Service **Transformers** with the Cathode Ray Oscillograph.—J. Röhrig, **p. 54.**

Transients in Grounded Wires Lying on the **Earth's** Surface.—J. Riordan, **p. 114.**

The **U.I.R.** Assembly at Ouchy-Lausanne.—M. Adam, **p. 113.**

The **U.I.R.** Congress at Rome, **p. 479.**

High Precision Method of Measuring Lengths and Thicknesses [**Ultra-Micrometer** on Pneumatic Principle].—M. Mennesson, **p. 422.**

Ultra-Micrometer Circuits for Studying the Vibrations at the Surface or in the Interior of a Solid, particularly the Framework of a Bridge [Absorbomicrometer].—P. Santo Rini, **p. 361.**

Ultra-Micrometer on the Absorbing Wave-Meter Principle [for Strain Tests in Ferro-Concrete, etc.]—P. Santo Rini, **p. 53.**

A New Electrical **Ultra-Micrometer.**—S. Reisch, **p. 53.**

The Reisch **Ultra-Micrometer** Used as a Galvanometer Relay.—Reisch, **p. 114.**

The Instantaneous [**Ultra-Micrometer**] Pressure Recorder and Its Applications.—M. Horioka, T. Uchiyama and E. Mizuguchi, **p. 242.**

A New Form of Dilatometer [Recording **Ultra-Micrometer** Circuit for Determining the Temperature at which any Abnormal Change in Length occurs].—W. E. Prytherch, **p. 480.**

New Applications of the Condenser Principle for Measuring Purposes [**Ultra-Micrometer : Idometer : Siccometer**].—W. Jaekel : Siemens Company, **p. 242.**

The Rectifier Bridge and Its Use in **Ultra-Micrometer Circuits.**—Walter, **p. 660.**

Electrical Methods of Measuring Pressures and Displacements [Comprehensive Survey of **Ultra-Micrometer, Piezoelectric and Magnetostrictive Methods**].—G. Sacerdote, **p. 480.**

Contribution to the Design and Use of an Apparatus for the Measurement of Small Deformations [Outline of Electromagnetic **Ultra-Micrometer** Devices].—A. Guillet, **p. 242.**

Ultra-Micrometer based on Change of Coupling between Windings of a Transformer : Galvanometer Deflection Method and a Null Method.—A. Guillet, **p. 114.**

Electrodynamic Arrangement for the Measurement of Small Mutual Inductances : Application to the Examination of [**Ultra-**] **Micrometers.**—A. Guillet, **p. 361.**

Electronic Oscillators [**Ultra-Micrometers**] for Industrial Process Control—H. Olken, **p. 53.**

Ultra-Micrometers.—See also Acceleration, Compressed Air, Dimensions, Machines, Mechanical, Micrometer, Oscillations, Piezoelectric, Tools, Very Small, Vibration(s), Vibro-, and below.

Ultra-Micrometric and Other Electrical Methods of Measuring Pressures and Displacements.—G. Sacerdote, p. 601.
A Mechanically Controlled Bolometer applicable to **Ultra-Micrometric** Use.—Sell, p. 540.
A Remote Electrically-Recording Accelerometer [Electromagnetic **Ultra-Micrometric Device**] with Particular Reference to Wheel-Impact Measurements.—F. Aughtie: Dufton, p. 241.
Measuring Instruments and Processes for Interchangeable Parts [**Ultra-Optimeter**, etc.].—G. Berndt, p. 660.
Experiments on the Biological Effects of d'Arsonvalisation on **Ultra-Short** (10-Metre) Waves.—H. Bordier, p. 361.
Special **Ultra-Short Wave** Issue of " Funk-Magazin," p. 541.
Researches on the Effects of **Ultra-Short-Wave Irradiation** on Plant Life and on Silkworms, etc.—Mezzadroli, p. 541.
On the Physics of **Ultra-Short-Wave Therapy** : the Wave Band of Selective Heating.—J. Pätzold, p. 541.
The Latest in High-Intensity X-Rays and " Fever Machines " [**Ultra-Short Wave Treatment**], p. 361.
The Application of Fluorescence to **Ultra-Violet Photometry**.—A. Chevallier and P. Dubouloz, p. 422.
A New Method of Irradiating the Body Cavities with **Ultra-Violet Rays** [using a Tungsten Spark-Gap].—G. Loeck, p. 301.
The Practical Applications of **Ultra-Violet Rays**.—R. Gourjon, p. 541.
Breakdown Message Speech Transmission System of the London **Underground Railways**.—F. Clark and A. A. Chubb, p. 540.
Scheme of **Ursigram** Transmissions by French Radiotelegraph Stations, from 1st January, 1932, p. 179.
Utilisation of the E.M.Fs of Induction for the Registration of Variations in the **Velocity of Conducting Liquids** : a New Haemodromograph without a Blade in the Blood.—P. Fabre, p. 480.
Local Effects on Rats due to **Very High Frequency Fields** [20 Megacycles].—J. Saidman, J. Meyer and R. Cahen, p. 113.
An Apparatus for the Measurement of **Very Small Displacements** [Measuring Microscope aided by Quartz Pointer as Lever, Measuring Displacements of Order of 0.001 mm.].—H. Whitaker, p. 53.
Replacement of a Mechanical Vibrating System by an Equivalent Electrical Circuit [in Study of Diesel Engine **Vibration**].—F. J. Domerque, p. 660.
A New Portable Recording Acceleration and **Vibration Meter** on the Piezoelectric Principle, using Valve Voltmeter and String Galvanometer.—R. Ambronn, p. 480.
The Registration of Rapid **Vibrations** [Ambronn's Piezoelectric Instrument].—R. Ambronn, p. 242.
Recording the Deformations and **Vibrations** of the Wing of an Aeroplane in Flight [using the Variations of Resistance of a Thin Graphite Layer].—A. Guerbilsky, p. 241.
Calculation and Experimental Investigation of the **Vibrations** of Aeroplanes [Recording a " Vibration Spectrum " by the Küssner " Optograph "].—H. G. Küssner, p. 301.
The Experimental Investigation of **Vibrations** in Turbine Wheels and Blades [including Ultra-Micrometric Methods].—B. Pochobradsky, L. B. W. Jolley, and J. S. Thompson, p. 241.
The Mecascope, for Recording **Vibrations** of Machines, etc.—J. Vassillière-Arlhac, p. 54.
Vibrations and Strains Accurately Determined [Electro-Magnetic Ultra-Micrometer Principle].—General Electric Company, p. 601.
Vibrations.—See also Piezoelectric, Ultra-Micrometer, and below.
An Electromagnetic **Vibrograph** applied to the Over-Speed Tests of Turbo-Alternator Rotors.—F. Sieber: Soc. Brown Boveri, p. 54.
Electromagnetic **Vibrograph** [Ultra-Micrometer Device with Balanced Transformer Circuit and Varying Air-Gap] and Its Use in connection with Turbo-Generator Rotors.—F. Sieber, p. 301.
The **Vibrometer**.—Subra, p. 351.
A New **Voice Frequency Telegraph System**.—J. A. H. Lloyd, W. N. Roseway, V. J. Terry and A. W. Montgomery, p. 540.
Voice Frequency Telegraphy : the " Stenode " System—Newspaper Installations—Maintenance and Construction—Method of Operation, p. 659.
Experiments on Hazel Twig **Water Divining** : the Cause of the Action.—Lehmann, p. 601.
[High-Frequency] Oscillator Stabilises A.C. **Welding Arc**.—J. B. Gibbs, p. 601.
The Penetration of Alternating Magnetic Flux in **Wire Ropes** [in connection with Testing for Mechanical Flaws].—T. F. Wall and C. H. Hainsworth, p. 660.
Mutual Impedance of Grounded **Wires** lying on the Surface of the Earth.—R. M. Foster, pp. 114 and 641.

WIRELESS

DIRECTION FINDING

and DIRECTIONAL RECEPTION

By R. KEEN, B.Eng. (Hons.)

SECOND EDITION: (1927)

This volume deals with the principles of the subject and the constructional details of direction finding installations, and includes some information concerning aircraft installation. It describes the principles of Direction and Position Finding in such a way that the subject may be grasped easily by engineers tackling this field of wireless work for the first time. Numerous photographs and diagrams are included.

Price 21/- net **By post 21/9**

From leading booksellers or direct from the publishers:

ILIFFE & SONS LIMITED,
DORSET HOUSE, TUDOR STREET, LONDON, E.C.4

W.E.2.

TANNOY

HIGH GRADE
SOUND REPRODUCERS
P.A. LOUD SPEAKERS
AND
OTHER EQUIPMENT SUITABLE FOR HOTELS, DANCE HALLS, SPORTS MEETINGS,
ETC.

Full Details or Demonstration

1-7, DALTON ST., W. NORWOOD, S.E.27

THE THERMIONIC VALVE AND ITS DEVELOPMENT IN RADIO TELEGRAPHY.

By Sir Ambrose Fleming
M.A., D.Sc., F.R.S., M.I.E.E.
(1924)

A valuable book for all experimenters

Price 15/- net. By post 15/9

ILIFFE & SONS LTD.
Dorset House, Tudor St., London, E.C.4

FOURTH EDITION

HANDBOOK
of
TECHNICAL INSTRUCTION
for
Wireless Telegraphists

By
H. M. DOWSETT, M.I.E.E., F.Inst.P., M.Inst.R.E.
Author of "Wireless Telegraphy and Telephony," etc.

THIS work constitutes a complete textbook for the use of wireless telegraphists. In this new edition the subject matter has been entirely recast and the scope of the book widened to meet present-day requirements.

This volume provides a complete theoretical course for the P.M.G. certificate.

A leaflet giving synopsis of chapters and other particulars will be sent on request.

PRICE
25/- net. By post 25/9

From all leading Booksellers or direct from the Publishers

ILIFFE & SONS LTD.
Dorset House, Tudor St., London, E.C.4

W.E. 14.

RICH & BUNDY

MAINS TRANSFORMER SPECIALISTS

Transformers designed and manufactured to your own specification. Highest grade British workmanship and Materials only. Every transformer and choke an individual job. We supply special models—New Designs—Single items or manufacturers' quantities. Special types for Cinemas, Broadcast Relay or Public Address installations.

Write to-day for New Art Catalogue "W" now ready. Full details of Mains Transformers, Output and Filter Chokes, Auto-Transformers and Output Transformers.

There is a copy waiting for you.

Every "HAYNES RADIO" A.C. Kit includes our products.

We welcome specialist work.

All RICH & BUNDY Mains Transformers for Radio are now fitted with Screened Primary.

Manufactured by

RICH & BUNDY Ltd., Transformer Manufacturers,
New Road, Ponders End, Middx.
'Phone: Enfield 0777.

Sole Distributors I.F.S.: KELLY & SHIEL Ltd.,
47, Fleet Street, Dublin, C.4.

"Calculation and Measurement of Inductance and Capacity,"
by W. H. Nottage, B.Sc. (1924).

The more generally useful formulæ and methods of measurement of inductance and capacity are here brought together in a convenient form. 224 pages. Over 80 illustrations and diagrams. Price 7/6 net, by post (home and abroad) 8/- from

ILIFFE AND SONS LTD.,
Dorset House, Tudor St., London, E.C.4,
and leading booksellers.

W.E.12

EDISWAN VACUUM THERMAL DELAY SWITCHES

Unaffected by external temperature changes

● As is generally known, the inclusion of a thermal delay switch in the H.T. circuit is a positive safeguard to avoid damage to condensers and other components caused by the application of the H.T. before the valve cathodes have reached operating temperature.

Where hot cathode mercury vapour rectifiers are used under full load current, it is essential that a considerable delay should occur between the switching on of the rectifier cathode and the switching of the H.T. to the rectifier.

Ediswan Vacuum Thermal delay switches possess several important features which render them particularly suitable for this work. Operating in a high vacuum they not only remain unaffected by variations in climatic and local conditions (such as the proximity of large power valves), but the contacts keep entirely free from oxidation. Contact resistance is negligible and no arcing can occur. ***Operating time is variable and filament voltages of from 2 to 8 volts may be employed. Two types are at present available.***

RATING	**Type DLS/1**	**Type DLS/10**
Filament Voltage	2-8 volts.	2-8 volts.
Filament current (approx.)	.6 amps.	1.3 amps.
Max. current rating	200 M/a at 2000 volts.	6 amps. at 250 volts.
Time delay (average)	30 secs.	1 minute
	PRICE 7/6	**PRICE 17/6**

THE EDISON SWAN ELECTRIC CO. LTD. 155 CHARING CROSS RD., LONDON, W.C.2

V.176

Printed for the Publishers, Iliffe & Sons Ltd., Dorset House, Tudor Street, London, E.C.4,
by The Cornwall Press Ltd., 1-6, Paris Garden, Stamford Street, London, S.E.1.
Sole Agents for Australasia—Gordon & Gotch (Australasia), Ltd.
Sole Agents for South Africa—Central News Agency, Ltd.