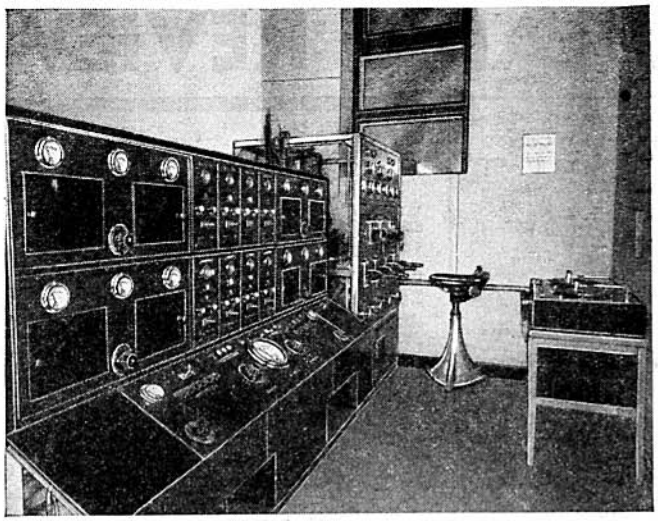


The "technical room" at the 150 kw. Luxembourg station.

THE "LUXEMBOURG EFFECT" IN RADIO

How little we really know about the propagation of radio waves is well illustrated by this curious phenomenon which is baffling some of the foremost men who devote their time and study to radio and physics.

C. W. PALMER

WITHIN the past few months, such eminent authorities as Prof. E. V. Appleton of London University, and Dr. B. van der Pol, Dr. B. D. H. Tellegan and Mr. J. van der Mark of the Philips Labs. in Eindhoven, Holland, have been focusing their attention on a peculiar phenomenon in connection with transmission of radio signals. This odd effect, which cannot be explained by any existing theories of wave propagation has been called the *Luxembourg Effect* for lack of a better name. It was noticed, about a year and a half ago, that when a receiver (located in Southern England) was tuned to Radio-Paris, a faint background of the program sent out by the powerful Luxembourg station was picked up. This in itself is not startling, except for the fact that the wavelengths of the two stations were separated by a wide band which eliminated the possibility of "cross modulation" being the cause.

Prof. Appleton, who has devoted a considerable amount of time to this mysterious phenomenon, made the following comment recently in *World-Radio* (London) magazine.

"The chief features of the phenomenon are easily explained. It is found that when listening to a certain station (in the broadcast band) the modulation of another station entirely different in wavelength (in the long-wave or short-wave range) is heard as a faint background to the desired program. There would be nothing odd in this result if the two stations were in neighboring wavelength channels, for then increased selectivity would permit their separation. But the effect is obtained with stations widely spaced in wavelength. Moreover, when the receiver is distuned from the medium-wave station the intruding program disappears. It must, therefore, be concluded that the long-wave (or short-wave) program has been weakly received by the medium waves—and thus on a wavelength entirely different from that on which it was emitted.

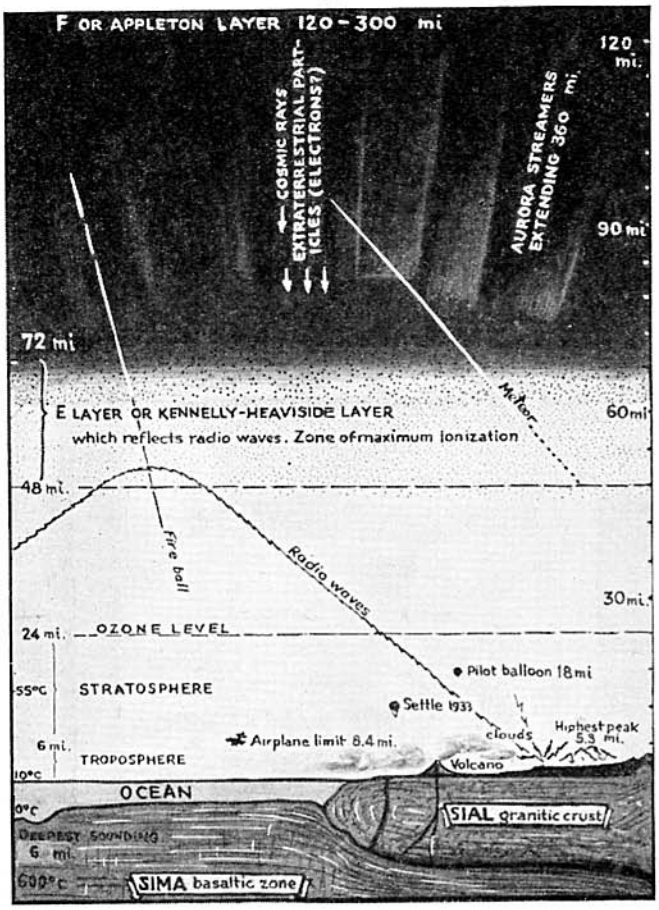
"To the theoretical physicist such a phenomenon is startling indeed. We know from Maxwell's original theory of wave transmission in the ether, that waves of different length can travel through the same free space without any interaction whatever, and, until now, it had been assumed that the same could be said of a medium consisting of electrified particles such as the ionosphere. But this interaction of waves in the process of simultaneous reflection from the ionosphere shows that what we can say about free space does not hold for an ionized medium. A theoretical physicist would summarize the situation by saying that the principle of superposition does not hold in the ionosphere.

"When we attempt to explain the matter in somewhat greater detail our difficulties begin and at present there is no generally accepted theory of this ionospheric cross-modulation, as we may, perhaps, term it. It is true, that due to the pressure of radiation we would expect the electrons in the ionosphere to vibrate a certain amount in the direction of transmission of the waves with an amplitude which is proportional to the square of the wave amplitude, and this would give us the 'square law' we require to get a cross modulation effect. But calculation shows that such an effect should be small and insufficient to account for the phenomena observed."

Later developments of the situation than those outlined by Dr. Appleton, reveal that the Luxembourg Effect takes

(*Continued on page* 499)

An illustration from Dr. H. T. Stetson's book, "Earth, Radio and the Stars" showing the relative positions of the various ionized reflecting layers in which the mysterious "Luxembourg Effect" probably takes place, according to Prof. Appleton.



readings of the four channels are alike. For normal reproduction, the controls are not changed, for any moving sound source will automatically produce more or less output from any one of the microphones, depending upon its proximity.

For trick sound effects, the controls on the power amplifier are thrown into the input circuit which provide for the distribution of sound from any one microphone into any one, two, three or four channels and their corresponding speakers. The spectacular illusions of moving sounds which can be created by this system, are far too numerous to mention.

Now that we have a glimpse of what procedure to follow in order to provide perfect artificially reproduced sound, it remains for the sound technicians to change their technique in order to recreate sound as it naturally occurs in our own fourth dimensional (sound—Ed.) world.

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"LUXEMBOURG" EFFECT IN RADIO

(*Continued from page* 467)

place only at night and that it occurs only (according to Dr. van der Pol) when the great circle joining the desired station and the point of observation passes the undesired or interfering station at a distance not greater than 175 miles. In other words, the two stations and the receiver must be in a straight line (to a greater or less extent).

It has been found that the Luxembourg Effect takes place continually, not only on the broadcast and long waves, but also on short-wave transmissions.

As a means of arriving at some explanation of the effect, the World Radio Research League, a group of radio enthusiasts banded together by *World-Radio* magazine, has solicited the aid of radio listeners and experimenters all over the world. It is requested that whenever the background of an interfering station is heard that is not transmitted on an adjacent channel, a record of the date, time of listening, location of the two stations, number of miles separating the stations and the listening point and any other interesting facts be recorded. RADIO-CRAFT readers may send in their records to this magazine where they will be coordinated and forwarded to the secretary of the above association where they can be used to advantage.

Since these peculiar observations cannot be justified by some of the most eminent authorities according to existing theories of radio transmission, it seems logical to assume that some important facts have been overlooked in arriving at these theories, and it is difficult to predict what far-reaching effects this will have on our present methods of radio communication.

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ORSMA MEMBER'S FORUM

(*Continued from page* 480)

W (AC) = (E x I x Power Factor).
W-Hrs. = (E x I x Hrs.), (W x Hrs.).
KW = (E x I ÷ 1,000), (HP x 0.746), (W ÷ 1,000).
KW-Hrs = (E x I x Hrs ÷ 1,000), W x Hrs ÷ 1,000).
Amp-Hrs = (I x Hrs), (E ÷ R x Hrs),
(W ÷ E x Hrs), (KW x 1,000 x E x Hrs),
($\sqrt{W \div R}$ x Hrs).
Coulomb (Q) = (I x Seconds).
Joule (J) = (E x I x Seconds), (W x Seconds),
(I^2 x R x Seconds).
HP = (W ÷ 746), (KW ÷ 0.746), (E x I ÷ 746),
(KW x 1.341), (W x 0.0013), (746 W).
Effic = (HP x 746 ÷ E x I), (HP x 746 ÷ W),
(Brake HP ÷ Elec HP).
Input = (Output ÷ Effic), (Output x Losses).

Condensers in Series or Resistors in Parallel

$$= C \text{ or } R = \frac{1}{\frac{1}{C^1} \quad \frac{1}{C^2}} = \frac{C^1 \times C^2}{C^1 + C^2}$$

Condensers in Parallel or Resistors in Series

$$= C1 + C2 + C3, \text{ etc. or } R1 + R2 + R3, \text{ etc.}$$

HARRY W. KRUG.

GENERATOR TYPE POWER UNIT

(*Continued from page* 479)

ing the starting torque, it serves to provide better regulation of the genemotor under varying load conditions and acts as an input filter.

The filter circuit in the automobile type genemotor is interesting in that it is possible to install all necessary condensers and inductors within the housing, thus conserving a great amount of space. One of the features of this type of "B" supply that makes the small filter possible is the very low ripple voltage present, before entering the filter. The measure of the initial ripple voltage on a well-designed unit is always considerably less than 1 per cent of the total voltage, and it is at a frequency which requires a small amount of inductance to provide complete smoothing. To obtain this low ripple voltage, it was necessary to take certain precautions in the original design, the most important being to keep the speed reasonably slow as well as to insure perfect commutation.

New Application

The majority of radio technicians have recognized the small rotary generators operating from a storage battery as a dependable "B" supply for auto-radio receivers, but, have failed to consider the many other applications and sales possibilities of this product. It is the purpose of the following few paragraphs to call your attention to the possibilities in this new field.

Recently there has been a growing demand for replacement units as a substitute for vibrator assemblies. A number of such units have been developed to fit in the popular makes of auto radio receivers. The accompanying photo illustrates the conversion of a genemotor in a Ford auto radio. The ease of installation and dependability should create considerable interest with those engaged in the auto-radio service field.

Service Men located in or near rural sections where A.C. power is not available, have found the special "B" eliminators offered for sale to be a valuable adjunct to the regular service enterprise. Models are available operating from 32-volt farm lighting systems or from a 6-volt storage battery. Recently several of the storage battery manufacturers have developed a long life 2-volt cell to operate the 2 V. series tubes over long periods of time. A special genemotor has been developed to work in conjunction with this new 2-volt cell which should, under normal use, provide the user approximately two months "A" and "B" service from a single recharge of the battery.

One of the greatest problems of the customer or installer of mobile P. A. equipment is that of an economical and reliable "B" supply. Most systems require a relatively high consumption from the battery in ratio to the power output of the amplifier, or if the fan belt driven type is used within the motor car, it requires the engine to be continually running to provide the necessary energy. The chief advantage of the rotary type eliminator is that when used with the properly designed amplifier the ratio of power input to power output approaches the highest efficiency that can be obtained in such installations. In a forthcoming article we will describe several efficient amplifier circuits to be used in conjunction with the genemotor, as well as furnishing data for converting existing A.C. amplifiers so that they can be operated from either A.C. power or storage batteries. A canvass of the numerous sound truck users will provide the Service Man with a large number of prospects in this new field.

Numerous special applications will become apparent to the wide-awake dealer and Service Man, once he has investigated the many possibilities in the use of the genemotor. An interesting incident describing one of the many applications was experienced recently upon visiting the projection room of a small theatre. An array of resistance elements were mounted on the wall for the purpose of reducing the 110-volt D.C. (the only current available) to the proper voltage for the exciter lamps and the projection machine. Nearly a kilowatt of energy was consumed to provide the 50 watts necessary for the filaments of the lamps. The operator was astounded to learn that the D.C. could be reduced to the required voltage by the use of a small converter weighing under 15 lbs., which consumed less than 100 watts instead of the original 1000 watts.