If the reflecting layer is half way between the stations, its height is 62 miles under the conditions here assumed. Five minutes is sometimes the interval during which the effect persists. For its disappearance the ionized layer need rise only one-half of one wave length. Almost never have both the waves faded at the same time. This shows that the reflecting stratum is at a great height. I believe that prolonged and tabulated observations will add considerably to our theoretical knowledge of this subject.

It is possible that the so-called "freak work" in wireless is due to this interference effect. It is impossible to say because we have had no simple way of changing the wave length suddenly in the quenched spark sets. But I believe that the extreme long distance work done by small sets must frequently be explained thus. Then too, it would account for the fact that the Marconi Transatlantic stations can operate sometimes with a few kilowatts and sometimes require 125 to 600 kilowatts.

And finally, to return to our commercial work, we now use a wave length of 5000 meters at our South San Francisco station. Thus we avoid interference with neighboring spark stations, altho properly tuned quenched sparks sets with a wave length differing 8 per cent. from our own do not interfere with us. It has been our aim to conduct our business with maximum certainty and minimum of interference, and we have succeeded so well in the first aim that we believe that any failure in the second is rather the fault of the other systems.

EDITORIAL NOTES.

Thru the kindness of the Federal Telegraph Company and Mr. Elwell a number of photographs illustrating the work of the company are here reproduced. Figure 17 is the antenna at San Diego. It is of the earlier double pole and spreader type. Figure 18 is the station at Portland, Oregon. The towers are square in cross section. A newer type of tower construction, namely the triangular cross-section type, is shown in Figure 19, the Central Point, Oregon, station. The Transpacific South San Francisco station is shown in Figure 20. In Figure 21 is shown the interior of the Central Point station. To the left is the 500 volt direct current control board with generator field rheostat. measuring
instruments, and breaker. Next to it can be seen the arc converter with its powerful field magnets, arrangements for artificial cooling, and front button which, when pressed, makes contact and starts the arc. To the left of the operator's table is seen the receiving set with variable inductances and capacities controlled from the front knobs, various switches for altering wave length range, etc., and the telephone jacks. Standing on the top of the receiving set is a specially wound coil which is employed when extra long waves are to be received. Next to the receiving set is the operator's key, and then the board where the wave length of the radio-frequency currents is controlled. The antenna hot wire meter is visible at the top of this board, and below it a rotary switch which enables the operator to rapidly change the wave length, which procedure, from the foregoing article, will be seen to be strictly necessary at times. To the extreme right of the operator's table is the motor-driven ticker for receiving. It is supplied in duplicate. At the top of the room is seen the antenna helix with the various taps leading to it. Near its bottom and to its right is seen the lightning switch.

The details of the transmitting apparatus are shown in Figures 22 and 23. Figure 22 shows the new Poulsen generator with special anode. There is a quick detachable bottom plug for cleaning the arc chamber when necessary. The massive field coils are shown. They are wound with heavy square cross section copper wire. Figure 23 shows the arc and its control board. Under the switch-board panel are shown the water valve lever which controls the flow of water thru the arc chamber jacket, and the receiving contact device. Both of these are operated by the large triple pole switch. This switch controls the flow of water, the flow of gas, the motor for rotating the carbon electrode of the arc, the power current, the radio-frequency circuit, the receiver circuit, and the motor-driven tickers.

The hypothesis suggested tentatively by Dr. de Forest relative to the opacity of the ether for certain wave lengths has, up to the present time, met with no substantiation. We are forced to regard it as highly improbable. The view that the interference effects are the results of the joint action of the direct and reflected waves, as also suggested by Dr. de Forest, is very probably correct, and should lead to valuable and extended researches on the most favorable locations of stations and wave lengths to be employed.

In order to render the action of the ticker somewhat more clear Figure 16 is inserted. It is intended to show the currents in the various circuits. Curve A gives the antenna current. Curve
B gives the current in the secondary tuned circuit. Curve C gives the condenser discharge current thru the telephone receiver. It will be noted how the resonance effects which are obtainable with sustained alternating current in the antenna are utilized fully. This ingenious receiving device is due to Prof. P. O. Pederson of Copenhagen.

The circuit arrangements for which these diagrams apply are somewhat different from those now employed, but embody the same principle.

Dr. de Forest has formally notified the Editor of the results of the tests at the Arlington station. The 30 Kilowatt arc was first tested on December 8th. Two way communication with South San Francisco, and also with Honolulu, was almost immediately established, altho at the time Honolulu was still in daylight! Owing to the greater height (600 feet) of the Arlington antenna, its signals are received with greater intensity than those of the latter station at Arlington. The energy used at Arlington was from 35 to 40 K. W.

ALFRED N. GOLDSMITH, PH.D.

DISCUSSION.

E. J. SIMON: I understand that using 35 kilowatts at the San Francisco station the antenna current is 40 amperes. What is the radiation resistance?

DR. DE FOREST: We have not measured it because it cannot be accomplished in the usual way, namely by the insertion of resistance in the antenna. The arc is directly in that circuit, and any change alters the conditions markedly.

DR. GOLDSMITH: It should be possible to accomplish the desired result thru the following means. Measure the arc voltage which is applied to the antenna (R. M. S. value of the alternating E. M. F.) by means of an electrostatic voltmeter. Then measure the effective inductance and capacity of the antenna at the desired wave length or frequency $\omega$ separately. Then if $R$ is the radiation and ohmic resistance of the antenna, $L$ and $C$ its effective inductance and capacity, $E$ and $I$ the R. M. S. values of the voltage and amperage of the antenna, we have

$$R = \sqrt{\frac{E^2}{I^2} - \left(\frac{L\omega}{C\omega} - \frac{1}{I}\right)^2}.$$