vibrations running in a determined direction were observed on a windless day. Some hours later (up to eight hours) the wind blew in that same direction; evidently it did not keep pace with the sound oscillations it had created in the ice. We call those vibrations 'wind vibrations', but we admit that they may consist in a periodic warping of the ice-plate.

Besides these strictly directed 'wind vibrations' there may be observed 'disturbance vibrations' in the ice, spreading equally from the centre—the spot of the breaking up of the ice in different directions. A systematic investigation of the 'wind vibrations' would evidently greatly assist arctic synoptics. The study of the 'disturbance vibrations' will obviously permit periodicities in the dynamics of the ice-covered sea to be determined.

At present it is proposed to take observations of both types of vibrations by means of special ice seismographs, which will be set up on the shore-ice. There could be created, by means of blastings, artificial vibrations in the ice, and this method could be used also for the determination of the limits of the ice-fields, this too being of considerable practical importance in ice-navigation. The data obtained from seismological investigations of the ice would be of great help in the prognosis of ice conditions.

I take the opportunity to express my gratitude to Prof. O. J. Schmidt for his valuable advice given me in this work.

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April, 1934.

New Type of Telegraph Repeater employing Carrier Currents

CARRIER currents have hitherto been employed, in the field of electrical communication, only for working simultaneously a number of telegraph and telephone channels over the same circuit. My recent investigations have shown the possibility of their application in an entirely new direction, namely, in the problem of 'repeatering' telegraph signals of various speeds, ranging from 25 to 400 words per minute.

The incoming telegraph signals are made to modulate a carrier wave of 5 kc./s. supplied at the repeater station. The modulated wave is then passed through a band pass filter to pass both the side bands, which are amplified by a power amplifier. The amplifier output is demodulated, passed through a low pass filter, amplified again by a single stage power amplifier and passed on to the next line section.

This type of telegraph repeater appears to possess many advantages over a mechanical telegraph repeater, which requires adjustment of polarised and neutral relays, automatic switches, etc. The overall current magnification is about 100 decibels and the wave-form of the amplified signals shows practically no distortion at all speeds of working. Further, the same power amplifier may be utilised for a number of telegraph channels passing through the same repeater station. Further investigations to develop this type of repeater are in progress.

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Induced Radioactivity

WHEN elements are bombarded with neutrons, we suggest that three types of reaction are possible, namely, simple neutron capture, disintegration with proton emission and disintegration with α-particle emission, the particular type of reaction depending upon the energy of the incident neutrons. Experimental evidence is now being published by various workers which seems to confirm these proposed reactions and also our hypothesis[1] that under neutron bombardment stable isotopes transmute to missing, unstable ones which are spontaneously radioactive, disintegrating with the emission of β-rays. For example:

$$_{13}\text{Al}^{28}\text{ (unstable)} \rightarrow {}_{14}\text{Si}^{28}\text{ (stable)} + \beta,$$

the Al^{28} being produced by the following reactions:

$$(a)\quad {}_{13}\text{Al}^{27} + n \rightarrow {}_{13}\text{Al}^{28},$$
$$(b)\quad {}_{14}\text{Si}^{28} + n \rightarrow {}_{13}\text{Al}^{28} + p,$$
$$(c)\quad {}_{15}\text{P}^{31} + n \rightarrow {}_{13}\text{Al}^{28} + \alpha.$$

Of these the second has been observed by Fermi, while Bjerge and Westcott[2] state that phosphorus under neutron bombardment gives rise to two radioactive isotopes, one of which decays with a period of 2·5 minutes. Since the period of radioactive aluminium, due to proton emission from silicon, is also 2·5 minutes, we conclude that both reactions (*b*) and (*c*) have been verified experimentally, the active product of short life from phosphorus being $_{13}\text{Al}^{28}$. Reaction (*a*) has not yet been confirmed.

Bombardment of phosphorus with neutrons of appropriate energy should give the following reactions, according to our theory of induced radioactivity:

$$(a)\quad {}_{15}\text{P}^{31} + n \rightarrow {}_{15}\text{P}^{32}\text{ (unstable)} \rightarrow {}_{16}\text{S}^{32} + \beta,$$
$$(b)\quad \begin{cases} {}_{15}\text{P}^{31} + n \rightarrow {}_{14}\text{Si}^{31}\text{ (unstable)} + p \\ {}_{14}\text{Si}^{31} \rightarrow {}_{15}\text{P}^{31} + \beta, \end{cases}$$
$$(c)\quad {}_{15}\text{P}^{31} + n \rightarrow {}_{13}\text{Al}^{28}\text{ (unstable)} + \alpha.$$

Reaction (*a*) has not yet been observed experimentally, but we suggest that (*b*) and (*c*) explain the two decay periods obtained by Bjerge and Westcott with phosphorus bombarded by neutrons of various energies.

Additional confirmation of our hypothesis is given by the most recent work of these experimenters[3], namely, the formation of $_{11}\text{Na}^{24}$ by neutron capture. Fermi had previously produced sodium from magnesium and aluminium, so that all three reactions, by means of which Na^{24} (unstable and missing) can be formed, have been verified, namely:

$$(a)\quad {}_{11}\text{Na}^{23} + n \rightarrow {}_{11}\text{Na}^{24},$$
$$(b)\quad {}_{12}\text{Mg}^{24} + n \rightarrow {}_{11}\text{Na}^{24} + p,$$
$$(c)\quad {}_{13}\text{Al}^{27} + n \rightarrow {}_{11}\text{Na}^{24} + \alpha.$$

A full account of induced β-radioactivity, arising from these three types of reactions, for all elements will be published later.

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[1] NATURE, **134**, 64, July 14, 1934.
[2] *ibid*, **134**, 177, Aug. 4, 1934.
[3] *ibid*, **134**, 286, Aug. 25, 1934.