increase the difficulties of getting materials resistant to uranium fluoride and the loss of energy caused by radiation of the hot tube. For the length of the tubes we take $2l = 10$ m.; for the outer diameter of the inner tube 4 cm. and for the pressure 1 atmosphere. The natural abundance of ^{235}U is 1/139, and if we demand a tenfold increase of the relative particle density of ^{235}U in the equilibrium state of discontinuous operation, we must put $A_d = 1{\cdot}49 \times 10^{-3}$ cm.$^{-1}$. For uranium fluoride no value has been measured for D, the coefficient of thermal diffusion, and η, the viscosity, but we may assume $D \sim 0{\cdot}05$ cm.^{2}/sec. and $1{\cdot}4\ \eta/\rho = D$ (ρ = density). This assumption gives us for $2w$, the distance between the tubes, $2w = 1{\cdot}34$ mm.

If the top reservoir contains 5 gm. uranium fluoride, the relaxation time would be 80 days. After this time, the concentration of ^{235}U would have increased to 6·7 times of its original value, or to about 4·8 per cent. If we remove the fluoride after this time from the top of the apparatus, we should get about 62·5 mgm./day of uranium fluoride, or 42·5 mgm./day of uranium, 4·8 per cent of the uranium removed being ^{235}U. In continuous operation we should get only 41·7 mgm./day of uranium fluoride or 28·3 mgm./day of uranium, if 4·8 per cent of the uranium removed be ^{235}U.

Thus a considerable quantity of uranium fluoride with the abundance of ^{235}U several times greater than its natural value can be produced by an apparatus which would not be too difficult to construct and to run. I began to construct such an apparatus together with B. Grabe, in August 1939, but the work had to be discontinued because of the political situation.

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Radio Wave Reflections in the Troposphere

IN recent publications, Friend and Colwell[1,2] have reported the reflection of radio waves at vertical incidence from temperature inversions in the troposphere, and have estimated the reflection coefficient to be of the order of 10^{-3} at a frequency of 2398 kc./s. On the assumption that atmospheric reflections are due to discontinuities in water content, Piddington[3] has calculated the reflection coefficient to be not greater than 10^{-4}.

The reception of ultra-short wave signals at distances of the order of 100 km. is known to be correlated with the existence of atmospheric irregularities[4], and these signal strength measurements may be used to calculate the reflection coefficient for longer waves at vertical incidence. Since the air-mass boundary occurring at a temperature inversion must occupy a finite thickness, the effect of this diffuse boundary must be taken into account.

The propagation of electromagnetic waves in a stratified medium has received considerable attention in view of its application to optics and reflections from the ionosphere[5]. In the case of tropospheric reflections, where the variations in dielectric constant are very small, the calculation is much simplified and the method adopted by Darwin[6] and Hartree[7] of integrating the wavelets scattered by each part of the medium may be readily modified to give the required result. If the dielectric constant ε of the atmosphere is taken to be a continuous function of the height z only, and the diffuse boundary extends from z_1 to z_2, the reflection coefficient for radio waves of wavelength λ incident at an angle θ is

$$\rho(\lambda,\theta) = \left| \tfrac{1}{4}(\sec^2\theta - A)\int_{z_1}^{z_2} \frac{d\varepsilon}{dz}\cdot\exp\left(-\frac{i4\pi z\cos\theta}{\lambda}\right).dz \right|,$$

where A is 0 for horizontal polarization and 2 for vertical polarization. At normal incidence this is equivalent to the expression given by Försterling[8]. Whatever variation with height is assigned to ε, there is a simple relation between oblique and normal incidence, namely:

$$\frac{\rho(\lambda,\theta)}{\rho(\lambda\sec\theta, 0)} = \sec^2\theta - A.$$

The measurements of Englund, Crawford and Mumford[4] on the propagation of 4·7 metre waves over a distance of 112 km. may by this relation be used to calculate the corresponding reflection coefficients for a wave-length of approximately 160 metres at vertical incidence. The result lies between 10^{-6} and 3×10^{-5}, the upper limit being in agreement with the experimental values of Appleton and Piddington[9] for random echoes from the troposphere.

It is interesting to compare the values of reflection coefficient for diffuse and sharp boundaries. If reasonable assumptions are made as to the height variation of ε, the reflection coefficient at normal incidence falls to half that for a sharp boundary when the transition layer is about one quarter wave-length thick. For a typical case of ultra-short wave transmission at grazing incidence, where θ differs from $\pi/2$ by about 0·03 radian, the corresponding thickness is about eight wave-lengths.

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April 8.

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Blue Rocksalt

IN a letter in NATURE of February 17 under the above title, Dr. J. Newton Friend and John P. Allchin suggest that the blue colour of rocksalt may be derived from colloidal gold present in the sea-water from which the rocksalt has crystallized out, and give a content of 1 p.p.m. of gold as sufficient to produce a decided tint to a crystal.

From an oceanographer's viewpoint, it may be observed that this proportion of gold to sodium chloride would correspond to a gold content in the original sea-water of about 25 mgm./ton, whereas