within the atoms. Already the dreams of the alchemists are coming true, for nitrogen has been pounded to pieces by electrically charged atomic hammers, yielding simpler forms. When the heavier elements can simularly be broken up the production of gold from lead may be commonplace.

It is interesting to recall that at that while the most minute divisions of matter are being studied by certain physicists, others are measuring the diameters of the stars and Einstein is asking us to rearrange some of our most cherished ideas concerning time and space.

XXVIII. THE CAUSE OF THE OPTIMUM ANGLE IN A RECEIVING CONICAL HORN

Victor A. Hoersch

From the Physics Laboratory of the University of Oklahoma.

Suppose that plane waves of constant amplitude and frequency are incident upon the opening of a conical horn in the direction of the axis of the horn. Let the length of the horn be adjusted for fundamental resonance to the incident waves. Let the amplification of the horn be defined as the ratio of the amplitude of pressure variation at the vertex of the horn to that in the incident plane waves. We shall consider that the horn is used as a receiver, in which case there is an energy loss at the vertex. Neglecting the energy loss due to the non-rigidity of the horn and that due to the viscosity of the medium, the only other energy loss is that due to the spherical waves radiated outwards from the opening of the horn.

Consider first the energy loss at the vertex. For horns of different sized opening all in fundamental resonance with the same incident plane waves, the rate of loss of energy is proportional to the square of the amplification and hence proportional to the square of the energy input per unit area of the opening by the incident waves. For horns of sufficiently small openings the energy radiated from the open end can be neglected in comparison to that abstrated at the vertex. In this case, in the steady state of vibration, when the energy input equals the output, the energy input per unit area, and hence the amplification, must be proportional to the area of the opening of the horn.

Consider next the energy radiated at the open end of the horn. For horns of different sized openings all in fundamental resonance with the same incident plane waves, the rate of loss of energy is proportional to the square of the energy input. For horns

of sufficiently large opening the radiation loss predominates over the loss at the vertex. In this case, in the steady state of vibration, when the energy input equals the output, the energy input has a constant value independent of the size of the opening of the horn. Thus the amplification or the energy input per unit area of the opening is inversely proportional to the area of the opening.

Thus the two energy losses (1) by abstraction at the vertex and (2) by radiation from the opening of the horn tend to respectively increase and decrease the amplification as the opening of the horn is increased. The former loss predominates for horns of small opening and the latter for horns of large opening. Hence when both losses are operative, there must be an optimum angle of greatest amplication. Mathematical analysis shows that at this angle the energy loss at the open end equals that from the vertex.

XXIX. A ELECTROMETER FOR MEASURING THE RADIOACTIVITY OF GASES FROM OIL AND GAS WELLS

F. K. Harris

From the Physics Laboratory of the University of Oklahoma

The ultimate purpose of the problem is to determine whether or not the Helium-bearing earth gases have any radioactivity and to determine the amount of radioactive content of the gases.

It is a well known fact that the gases from many oil and gas fields have an appreciable helium content. This is in itself strong evidence of their radioactivity but cannot at present be accepted as conclusive proof. There has been some work done along this line in the past year or so but is as yet unpublished. This work is being carried out by an oil company operating in Texas. I have, up to the present, been unable to get any information as to the methods they are using and the results obtained. I presume, however, that the gas is collected and its activity measured in some sort of emanation chamber.

The electrometer here described is designed to measure the radioactivity of flowing gas. The order of the effect expected is so small that the instrument used must be of high sensitivity. Portability and compactness are also of prime importance. The instrument therefore selected is an electroscope of low capacity. The electroscope head of the Lind Interchangeable Electroscope is used as a leaf system (this is described fully in Bulletin No. 176 Denver Fire Clay Company). The leaf system is incased in a metal cylinder 10cm. in diameter by 6cm. long. It is suspended