Division for obtaining the expression for the form of the mercury surface. The experiments described above are part of the research programme of the National Physical Laboratory and this communication is published by permission of the Director.

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Use of a Gaseous Discharge as an Identifiable Radar Target

The use of gaseous discharges as generators of radio noise has been widely reported in the literature, and work in this field is in progress at this Laboratory. Due to the high conductivity of gaseous discharges at microwave frequencies, a major problem in the design of a 'noise source' is a suitable means of introducing the discharge plasma into the electromagnetic field of the radio transmission circuit to provide a reflexionless match. It is readily demonstrated that a sudden introduction of a gaseous discharge into the path of an electromagnetic wave will produce a large reflexion of the incident power, and this fact has been used to produce a variable reflector of radio-frequency energy, thus providing in effect a modulated radar target.

It can be shown that a standard fluorescent light tube operating from the 50 c./s. mains supply will reflect 3-cm. radio waves, the reflected signal having a 100-c./s. modulation. By placing such a tube at the focus of a parabolic cylinder, the total reflected signal is considerably increased due to the larger amount of energy being intercepted by the parabola, and depending on the condition of the discharge tube for its reflexion.

The mechanism of the process is interpreted simply as follows. Energy intercepted by the parabola is focused on to the discharge tube. If the plasma is present, then because it has a high conductivity it reflects most of the incident power, and a large signal is returned. If, however, the discharge is extinguished the reflexion of power is from the glass of the tube and is of much less magnitude. At intermediate levels the reflexion depends on the current in the discharge. It has been found that excellent square-wave modulated returned signals are obtained if the discharge tube is suitably driven, that is, if a square wave-form of current is produced through it.

It has been found equally effective to arrange a similar discharge tube along the axis of a paraboloid. In this case the position of the tube is not critical over most of its length, although when the end of the tube is near the focus the additional effect of the electrode acting as a reflector behind the portion of plasma at the focus appears to give an improved total reflexion.

Further experiments have also been carried out with a 'beehive' neon lamp. In this case, the effective portion of the discharge is the cathode glow, and it is thought that the mechanism in this case may be the opposite of the earlier example, with the metal structure in the lamp normally acting as the reflector but screened by the discharge when the lamp is switched on.

No marked polarization sensitivity was observed with the discharge tube placed along the axis of a paraboloidal reflector. In the case of the parabolic cylinder with the discharge tube on the line focus, a considerable increase in performance was obtained at 3 cm. wave-length, with the electric field perpendicular to the axis of the discharge tube.

The device is of use in adjusting continuous wave radar sets where some form of fluctuating target is required, and may possibly have applications in providing a means of identification for the usual corner reflector types of target used in association with pulse radar systems.

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Non-isothermal Plasmas in the Rare Gases

Kenty[1] noticed, many years ago, the finite lapse of time occurring between the termination of current flow in a low-pressure discharge in argon and the occurrence of maximum visible intensity of the afterglow. He suggested that the latter was due largely to radiative electron-ion recombination, and that the time-lapse was necessary for the electron temperature to fall to a value comparable with the gas temperature when the afterglow intensity would have reached a maximum, since recombination would continually reduce the electron and ion density. Bayet[2] and others have noticed a similar phenomenon and attribute it to the same cause. Also, an analogous effect due to pickup, in the afterglow, of electron energy from a microwave beam has been elegantly demonstrated by Goldstein and his collaborators[3].

Bayet[2] suggests that effects due to metastable excited atoms may be ignored at sufficiently high pressures. Moreover, Biondi[4] has shown that increased afterglow ionization due to metastable atom collision processes would tend to increase with increasing pulse-length (up to a limiting pulse-length, set by the time required to establish a full metastable atom population); this is in contrast with our results (Fig. 1), which show a decreasing afterglow light peak at increasing pulse-lengths.

For some years we have observed these effects in the rare gases, and the purpose of the present communication is to present preliminary data which are consistent with the recombination mechanism and which enable a recombination coefficient to be estimated. In view of the current interest in recombination processes, summarized by Massey[5], any method capable of yielding results of potential value may be worth investigation.

We have worked mainly at 1 atmosphere pressure in cylinder neon and helium, with rectangular current-pulses of a few microseconds duration, in contrast with the damped-condenser discharges used by Bayet[2], Olsen and Huxford[6] and others which render afterglow results more difficult to interpret. In high-pressure discharges, for example in helium, where the electron-atom energy transfer may be effected rapidly, the heating of the gas may be so great that there is a finite rate of electron production in the afterglow. This may be demonstrated by the non-