will scarcely be noticed at all when the impressed field is varied from, say, 100 volts to 300 volts as in our own experiments. In other words, for such fields the ionisation currents will give all the usual indications of being saturated, though very strong variations of field rising up to thousands of volts, should bring to light the fact that they are not. *This lack of saturation is then, in our judgment—and we have experimental evidence for it—the real cause of the pressure-ionisation effects discussed otherwise by Hoffmann and Broxon.*

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Aug. 15.

[1] Millikan and Cameron, *Phys. Rev.*, **31**, 922; 1928.
[2] Millikan and Cameron, *Phys. Rev.*, **37**, 237; 1930.
[3] Hoffmann in (5) below comments upon having also observed this relation in his own earlier work.
[4] Broxon, *Phys. Rev.*, **37**, 1320; 1931.
[5] Hoffmann, *Zeit. für Phys.*, **69**, 704; 1931.

Graphical Indication of Humidity in the Upper Air.

SIR NAPIER SHAW'S representation of upper air temperatures by the method of the T-ϕ or tephigram is, from the thermodynamical aspect, the best that has yet been proposed. The depegram (or graph of dew-point temperatures), which ordinarily accompanies it, is a practical means of representing humidity, yet most meteorologists will agree that it is not as wholly satisfying a method for humidity as the tephigram is for temperature. A thermodynamic indication of humidity along with the tephigram is of importance, especially in the tropics, and further consideration of the mode of representing humidity is therefore desirable.

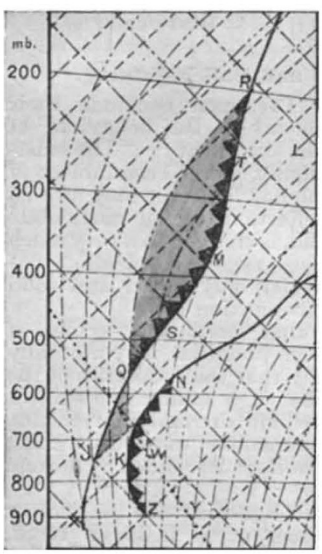

FIG. 1.—Tephigram and estegram: ——, isobars; – – – –, isentropics; —·—, isothermals; ·····, isohygric; —·–·–·—, saturation adiabatics.

In the accompanying diagram (Fig. 1), X the dry bulb and Y the dew-point temperatures at the 900 mb. level, are plotted on tephi-paper. The isentropic XW and the isohygric (or line of constant specific humidity) YW are drawn and intersect at W. Through W is drawn the saturation adiabatic WZ, cutting the 900 isobar at Z. We may call Z the 'saturation' temperature or $S.T.$, and direct attention to the following important properties: The $S.T.$ is so nearly the same as the ventilated wet bulb temperature that in practice they may be substituted for one another.[1] If a sample of the air at the 900 mb. level is raised adiabatically, the dry bulb temperature of that sample moves along the isentropic XW, the dew-point temperature along the isohygric YW, and the saturation temperature along the saturation adiabatic ZW. The air becomes saturated at W, all the three temperatures coincide there, and further upward displacement causes them to follow the saturation adiabatic WST. Beyond T the saturation adiabatic runs parallel to a dry isentropic; that is, it is associated with, and can be identified by, a definite value on the potential temperature scale. That potential value of the $S.T.$ (or wet bulb) is allied to the equivalent potential temperature; it remains an invariant in all adiabatic processes whether the air is saturated or not.

If the saturation temperatures or the wet-bulb temperatures of the upper air be plotted on the appropriate isobars or tephigram paper, the resulting graph of $S.T.$'s, or estegram, proves to be of greater importance thermodynamically than the depegram. We may note the following points:

(1) From any two of the three graphs, tephigram, estegram, and depegram, the third may be readily constructed on tephi-paper without reference to tables.

(2) If we define air of latent instability to be air which, when raised adiabatically, finds at some level above the condensation level an environment in which it is unstable, then all air samples of latent instability are indicated by the points on the estegram that lie to the left of the lowest saturation adiabat tangential to the tephigram. For example, LMN is the lowest saturation adiabat tangential to the tephigram $XQMR$, and to the left of it lies the portion ZN of the estegram; hence the layers of air between the heights represented by Z and N are those which on adiabatic ascent will develop instability in another higher layer.

(3) Superadiabatic gradients being excepted, all layers which form a latent unstable environment for samples of air displaced adiabatically upwards from one or more of the lower layers are indicated by points on the tephigram which lie to the right of the highest saturation adiabat tangential to the estegram. For example, KQR is the highest saturation adiabat that touches the estegram, and to the right of it lies the portion QMR of the tephigram; Q and R therefore represent the limiting heights between which instability may arise on account of the adiabatic ascent of a lower layer.

(4) If the lowest saturation adiabatic tangential to the tephigram lies wholly to the left of the estegram, then no layer possesses latent instability. This is frequently the condition of continental air in India. On the other hand, oceanic equatorial air seems frequently to possess so marked a latent instability that samples of the lower air when raised adiabatically will release more energy during the higher unstable portion of their ascent than is needed to be supplied in the lower stable portion. The point J on the diagram (with $S.T.$ at K) represents such an air sample, because the area QRM represents a much greater release of energy than needs to be supplied to raise the sample from J to Q.

A classification of Indian tephigrams, suggested by the above considerations, is being undertaken by a research student.

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Poona, India, July 20.

[1] Cf. *Ind. Met. Mem.*, **23**, part 1.

Activated Adsorption.

THE transition from van der Waal's adsorption to activated adsorption is shown by a minimum on the adsorption isobar,[1] and a similar minimum occurs on the isobar representing the transition from activated adsorption to chemisorption.[2] There is thus a region of temperature over which the amount of adsorption increases with rise in temperature. The experimental work so far published shows that, at least in the case of the first type of transition, the processes are reversible. The positive temperature coefficient must therefore be associated with an increase in the heat of adsorption.

If ϕ be the activation energy of the surface atoms and Q the heat liberated on adsorption, then at