dust; while if heated by hot air, the air heats the furniture, and in so doing deposits its dust on it. These remarks apply to the fine dust, and not to the larger particles which fall on the furniture, and do not adhere to it like the heat-deposited ones. Electric lighting keeps the ceilings much cleaner than gas. Much of this cleanness is due to the much lower temperature of the air rising from the electric bulb than from gas-lighting, but ceilings over electric lights show blackening, especially in smoking-rooms.

The cause of the streaks on plaster referred to by Mr. Cope may, however, be a little more complicated than stated above, because the plaster is porous, and some amount of diffusion will take place between the gases in the room and those at the back of the plaster, and as the laths will reduce the diffusion their action will, to some extent, aid their heat-conserving effect. The principal cause of the streaks would, however, appear to be the heat effect, as it will be generally found that, if the heating and other conditions are the same, the ceilings of the rooms on the top flat of a house are much more lath and beam marked than those underneath, owing to the upper surface of the plaster in the upper rooms being exposed to the cold air under the slates while the ceilings of the lower rooms are kept warmer by the rooms over them.

It is possible the difference in the plaster in the cold room referred to by Mr. Cope may be due not to any action of the water vapour, but to its condensation on the walls ingraining the dust into them.

The reply to Mr. Cope's last question is, yes. A reversal of the phenomenon is quite simple, and has already been referred to. Any surface hotter than the air keeps free of dust; a surface placed in a smoky chimney, if it is hotter than the gases, gets no soot deposited on it. A paper bearing on the above subject, and entitled "The Formation of Small Clear Spaces in Dusty Air," appeared in the Trans. Roy. Soc., Edin., xxxii., part ii.

In my letter in NATURE of January 21, the date of a letter there referred to is given as March 16, 1913, which should have been March 6, 1913.

JOHN AITKEN.

Ardenlea, Falkirk, January 26.

THE cause of these streaks, which are also often to be seen on ceilings, appears to be due to the fact that bodies which are warmer than the atmosphere are surrounded by a "dust-free space," and that dust is battered upon surfaces which are cooler than the atmosphere.

The dust-free space has been described by Tyndall ("Dust and Disease," Royal Inst., 1870), Frankland ("Dust and Disease," Proc. Roy. Soc., vol. xxv., p. 542), Rayleigh (Roy Soc., December 21, 1882; NATURE, vol. xxviii., p. 139), Aitken (Roy. Soc. Ed., January 21, 1884) and Lodge and Clark (*Phil. Mag.*, March, 1884, p. 214).

Recently I have discussed the question of the discoloration of walls and ceilings (the *Engineer*, July 3, 1914) in an article on the "Theory of the Radiator."

In the above papers your correspondent will find answers to the questions he puts. R. M. DEELEY.

Abbeyfield, Salisbury Avenue, Harpenden, January 22.

Adelard of Bath and the Continuity of Universal Nature.

IN the recently published volume of "Roger Bacon Commemoration Essays" (1) Prof. Pierre Duhem's contribution, "Roger Bacon et l'Horreur du Vide," has for its main thesis that Bacon was the first to formulate a theory of universal continuity; an incorrect hypothesis, it is true, but one which Prof. Duhem believes to have served the useful purpose of supplementing "the peripatetic theory of heavy and light" until the discovery of atmospheric pressure. This theory developed in connection with certain problematical phenomena of which this "experiment" is the chief and typical case. If there is suspended in air a vessel of water having a hole in the top and several narrow apertures in the bottom, no water will fall from it so long as the superior aperture is closed. Yet water is heavier than air, and according to the principle of Aristotle's physics should fall to the ground. Writers before Bacon, according to Duhem, explain this anomaly by saying that the fall of the water would produce a vacuum, and that a vacuum cannot exist in nature. But Bacon argues that a vacuum cannot be the reason why the water does not fall, because a vacuum does not exist; he then explains further that although by their particular natures water tends downwards and air upwards, by their nature as parts of the universe they tend to remain in continuity. Duhem holds that Bacon was the first to substitute this positive law of universal continuity for the mere negation that a vacuum cannot exist in nature (2).

Prof. Duhem supports his case by citation of Greek, Byzantine, and Arabian sources, and by use of writings of fourteenth-century physicists available only in manuscripts. But unfortunately for his main contention he has overlooked that remarkable little treatise, "Questiones naturales," which Adelard of Bath, Bacon's countryman, wrote more than a century before Roger penned his "Questiones naturales" (3). In Adelard's fifty-eighth chapter his nephew says—the work takes the form of a dialogue between Adelard and his nephew—"There is still one point about the natures of waters which is unclear to me." He then asks his uncle to explain a water jar, similar to that just described, which they had once seen at the house of an enchantress. Adelard replies in his clear, easy style, so different from the scholastic discussion in Bacon's corresponding passages :—

"If it was magic, the enchantment was worked by violence of nature rather than of waters. For although four elements (4) compose the body of this world of sense, they are so united by natural affection that, as no one of them desires to exist without another, so no place is or can be void of them. Therefore immediately one of them leaves its position another succeeds it without interval, nor can one leave its place unless some other which is especially attached to it can succeed it." Hence it is futile to give the water a chance to get out unless you give the air a chance to get in. Finally, Adelard not only thus anticipates the theory of universal continuity, he describes what actually occurs in the "experiment" more accurately than Bacon or the other physicists cited by Duhem. "Hence it comes about that, if in a vessel which is absolutely tight above an aperture is made below, the liquid flows out only interruptedly and with bubbling. For as much air gets in as liquid goes out, and this air, since it finds the water porous, by its own properties of tenuity and lightness makes its way to the top of the vessel and occupies what seems to be a vacuum" (5).

LYNN THORNDIKE.

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(1) Edited by A. G. Little, Oxford, 1914.

(2) Bacon Essays, p. 266. "Le doctrine dont nous avons suivi le développement au travers des écrits de Roger Bacon semble bien lui appartenir en propre.