of the ascent of air at once diminished. It is not until the bees have again been able to raise the temperature to its normal state that the power of the motive agent at the start would be again exerted. Again, the friction against the frames, bees, combs, and threads of the mats, all diminish the rate. It would, therefore, obviously be impossible, owing to the variety of changing conditions, to draw up in a tabular form the exact number of times in which the whole interior atmosphere in a hive will be changed in each hour at various rates of temperature outside. However, it is of such grave importance that the hard facts of the case should in some visible way be realized, that the following table, in which 200 per cent. is allowed for retarding purposes, is presented:

Temperature inside the Hive	Temperature outside the Hive.	The approximate number of times the air inside will be changed every hour, with apertures in the mat of the aggregate of			
		(A) 6 sq in	(B) 4 sq in	(C) 2 sq in	(D) 1 sq in
		times	times	times	times
85° Fahr.	80° Fahr.	75	50	25	6
85° "	60° "	154	103	53	13
85° "	40° "	225	150	75	18
85° "	30° "	250	166	83	20

The above table is based on the formula above referred to, and on the assumption that there are about 1000 cubic inches of air inside a hive, and that friction &c., may diminish the theoretical rate by some 200 per cent. With reference to the aggregate size of the interstices in mats, (*a*) 6 square inches would imply that in each square inch of the mat there were about twenty interstices, each $\frac{1}{16}$ in. large, perhaps represented by very coarse scrim; (*b*) four square inches would imply that in each square inch of the mat there were thirty-two interstices, each $\frac{1}{24}$ in. large, represented by finer scrim; (*c*) two square inches would imply that there were in each square inch of the mat, about forty-eight interstices, each about $\frac{1}{40}$ in. large, represented perhaps by coarse washed calico; (*d*) one square inch would similarly imply about sixty interstices, each $\frac{1}{60}$ large, represented by finer calico.

Assuming, then, the above calculations to be sufficiently correct, we can get a tolerably clear idea of what takes place in a hive on a typical summer's day, or a typical winter's day. In summer, with a common scrim mat, as represented by (*b*), in the daytime, the mass of air inside would either be stationary, owing to the sun's heat being 85° or over (the usual state of things under the direct action of the sun's rays, that is, not in the shade), or changed about once a minute, but without much change of temperature. In the evening and night of the same day it would be changed two or three times every minute, and this to a temperature of from 40° to 50° F., quite as much as can be good for the brood. On a typical winter's day, with a mat of the same porosity, the air will be changed about once and a half every minute to a temperature below 85°, of, say 65°, and in the night time about three times every minute, and this to a temperature freezing, or nearly 30°.

It must therefore be taken for granted that there ought to be some check to the ventilation both in evenings of summer days and still more in evenings of winter days, even though in winter additional mats are put on, and so the evil somewhat diminished. It cannot be good for the brood in summer to be from eight to ten hours in our usual night temperature, even though it be mitigated by the presence of a large number of bees on the brood-combs. Still less can it be good for the bees in winter to be in our chilly New Zealand night air. Either by direct manipulation, or by some self-acting simple mechanism, there ought to be some stoppage of the passage of the warm air in the latter cases.

Some further suggestions as to ways of obtaining this end I hope to have an opportunity of making; for the present let it suffice, if the grounds for necessity of some such contrivance shall have commended themselves to the minds of bee-keepers.

NOTE.—One fact in connection with the motive power evolved by the expansion of air when warmed has only been casually noted above, owing to its very limited applicability to the Langstroth hive, and that is, the slightly retarding, but at the same time steadying, effect of a *long column* of warm air, which gives a powerful pull to the whole. A homely instance of this is the better draught obtained by a tall chimney over that obtained by a short one. The contrary effect is shown by the extraordinary power of a long column of water, even in a tiny pipe, as those who try with their fingers to stop the kitchen tap, supplied from a cistern or reservoir, can testify. The Stewarton hive, which, although not known over here, and not much used in England, produces a most astonishing amount of honey, probably owes its success to this principle, and not to its shape. It is hexagonal, but runs up to six, eight, or more storeys. This length of hot air enables the mat to be very fine, as the power evolved forces the air through its pores. Extreme steadiness is thus obtained, and in cold nights and wintry days the ventilation is very slow but regular—just what is wanted.

J. R. M.