

The objection to the ordinary method of administering chloroform is its great irregularity and uncertainty; at one moment the patient may inspire a saturated atmosphere of chloroform, at another "a breath may be taken of almost pure atmospheric air."

In the administration of chloroform two principles must be kept in view, namely, the principle of "tolerance" and that of "definite dilution." When the administration is commenced with a very dilute atmosphere of chloroform, and the strength very gradually increased, it is found that the system will, in a few minutes, bear with safety the anæsthetic of a strength that would be dangerous to administer at the outset. This is called by Dr. Sanson the "principle of tolerance."

Again, it is considered imperative to use due means to secure proper dilution of chloroform vapour. The committee of the Royal Medical and Chirurgical society report on this subject as follows:—

"The several effects produced by the administration of chloroform, as well as other anæsthetics, are tolerably uniform if the same strength of vapour be employed; and there is much reason to suppose that the irregularities attributed to it have been in a great measure due to the uncertain degree of its concentration. Experiments upon the lower animals, however, equally with observations on man, prove that there is but a narrow limit between that strength in which the vapour may be safely inhaled, and that which is likely to produce alarming symptoms if not death."

"But whether the hazard originated in natural or accidental causes, the conclusion must be the same, that it is extremely desirable to adopt a method of administration by which the quantity of the vapour actually being inhaled may be graduated.

"The results of the experiments which have been detailed show that it is as desirable to measure accurately the strength of the vapour as to weigh the dose of a medicinal agent administered by the mouth."

Dr. Snow considered it dangerous for the human subject to breathe more than five per cent. of the vapour of chloroform. Mammifers

can remain in an atmosphere containing four per cent. of chloroform vapour, but will die speedily in an atmosphere of eight per cent. The chloroform committee recommend that "in order that it may be administered (continuously) with comparative safety it is necessary that the proportion of vapour should not exceed three and a half per cent."

The administration of a definite dilution of chloroform vapour can only be attained with exactness by means of mechanical apparatus specially adapted for the purpose. Of such the inhaler of Clover is the most perfect. This apparatus consists of a large bag or reservoir which is filled, or partly filled, with a mixture of atmospheric air, and 4 per cent of chloroform vapour. To this bag is attached a flexible tube and Dr. Sibson's mouth-piece. The mouth-piece is so arranged with valves that at the commencement of the inhalation the patient inspires nearly pure atmospheric air; by degrees, a valve is closed, so that two or three minutes from the commencement of the inhalation the patient inspires the mixture from the bag only. By means of this apparatus we are enabled so to administer the chloroform as to secure *tolerance* and *definite dilution*. The patient can be brought very gradually under the influence of the anæsthetic and we can administer the vapour of known and definite strength. Mr. Clover says of this apparatus,—"I have found my inhaler produce the anæsthesia more uniformly than I have been able to effect by any other means. Patients very rarely cough or make any manifestation of the vapour being too pungent. A large majority of the patients are prepared for the commencement of the operation in less than six minutes, and they certainly recover from the effects of chloroform more readily, and with less sickness and prostration than I have observed when I did not make use of the inhaler." Mr. Sanson says,—"I consider this to be the safest method of all for the administration of chloroform." * * "For myself, speaking theoretically, I believe that this means obviates the most urgent objection to chloroform administration, and is especially useful where patients are assembled together ready to be operated on one after the other."

Unfortunately Mr. Clover's apparatus is too cumbrous and too expensive to be generally