A self-retaining air-tight face-piece for nitrous oxide-oxygen anesthesia / by Walter M. Boothby, A.M., M.D., assistant in anatomy, Harvard Medical School; assistant surgeon, Mount Sinai Hospital, Boston.

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A SELF-RETAINING AIR-TIGHT FACE-PIECE FOR NITROUS OXIDE-OXYGEN ANESTHESIA.

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Last year I took up the task of developing a nitrous oxide-oxygen apparatus that would produce a surgical anesthesia with the patient relaxed in all cases. Early in the study of the problem it became evident that there are five fundamental requirements that must be met.

These requirements are:

1. The apparatus must be capable of delivering constantly the desired amount of nitrous oxide and oxygen by merely setting one valve for each gas; that it must continue to deliver this same amount as long as desired without further attention; and that it be possible, instantly and independently, to change the rate of flow of each gas.

2. In order to be able at a glance to estimate the relative rate of flow of each gas, the mixing chamber must be of glass containing water and the pipes so arranged that each gas bubbles into the chamber separately.

3. It is well recognized that to produce relaxation in all cases ether vapor must be given in addition to the gas-oxygen in a certain number of cases; it is also recognized that different cases may require amounts of ether vapor varying within wide limits, and further that it is necessary to be able gradually and yet rapidly to vary the ether percentage.

Accordingly, the apparatus is designed to meet this requirement.

4. The apparatus must be light and portable.

5. And finally, the face-piece must be air-tight and at least partly self-retaining.

Our experimental apparatus as recently described [1] meets the first three requirements perfectly. By it we are forced to reverse our opinion as to the desirability of warming the gases and to appreciate that any heating appliance is not only unnecessary, but disadvantageous (provided it is efficient). The fourth requirement, that of lightness and portability, has since been worked out, and we will be able shortly to report an apparatus made of aluminum that collapses easily to a size and shape convenient to carry.

The object of this paper is to describe a face-piece or rubber collar that we have designed to meet our fifth requirement; namely, that of preventing air from leaking into the gaseous mixture between the face and the mask, while at the same time retaining the latter in place. It is a modification of the Gatch cuff.[2]

The collar is $2\frac{1}{2}$ inches wide with an upper circumference of 9 inches and a lower circumference of 12 inches. On the nasal part of the collar is vulcanized an extra piece of rubber $3\frac{3}{4}$ inches long to the upper and lower edges. To a point on the side $\frac{1}{2}$ inch distant (away from the nasal part) from the transverse diameter is vulcanized a rubber strap 14 inches long which contains at its distal part a series of nine holes 1 inch apart; to a corresponding point on the other side is vulcanized a tab carrying a hook designed to fit the holes of the strap. The smaller circumference of the collar slips over the celluloid part of the mask, which it tightly and firmly grasps.

Before applying it is explained to the patient

that laughing gas does not produce any feeling of suffocation, but that to be effective as an anesthetic all air must be excluded. Then with the valves on the mask arranged so that the patient is breathing air the collar is carefully adjusted by slipping the lower part under the chin (including the beard if present) and the nasal part is then stretched up over the bridge of the nose. The strap and its opposite tab and hook are found lying on the angles of the jaw; the strap is passed behind the neck and hooked with moderate tension. The collar is now air-tight, except at the angle of the nose; to exclude air at this point one or two pieces of ether gauze are tucked in on either side between the two layers of rubber, thus pressing the inner layer tightly against the skin.

The collar is very quickly removed in case of an emergency (which seldom occurs); it can be readily readjusted. It causes no undesirable pressure on the vessels or nerves of the neck; even the veins are not compressed by the strap, as they are protected in front by the angle of the jaw and behind by the powerful neck muscles.

Occasionally the pressure of the collar across the bridge of the nose interferes with nasal breathing. This may be overcome by introducing soft rubber tubes about six inches long guarded by safety pins through the nares into the oropharynx; or, which is easier, the patient may be allowed to breathe through the mouth, care being taken that the valve-like action of the lips on inspiration be prevented by placing a piece of gauze in the angle of the mouth.

Using this collar in conjunction with my apparatus, I have frequently exceeded twenty minutes in which I neither changed a valve on the apparatus or touched the mask or the face of the patient, the latter being all the while in a state of

ideal surgical anesthesia. Further, I have not seen a case, whether alcoholic or not, that has not run a smoother course than it would have done under any other anesthetic. Using an air-tight face-piece greatly reduces the cost of gas and oxygen; many cases use less than $2 an hour while others more, depending on whether or not the patient stands considerable rebreathing. Excessive rebreathing increases the post-operative discomfort slightly, especially by causing headache. Therefore, unless there is particular reason to economize, I use about $4 worth of gases.

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[2] Gatch: Nitrous Oxide-Oxygen Anesthesia by the Method of Rebreathing. Jour. Am. Med. Asso., 1910, liv, no. 10, 775–780.