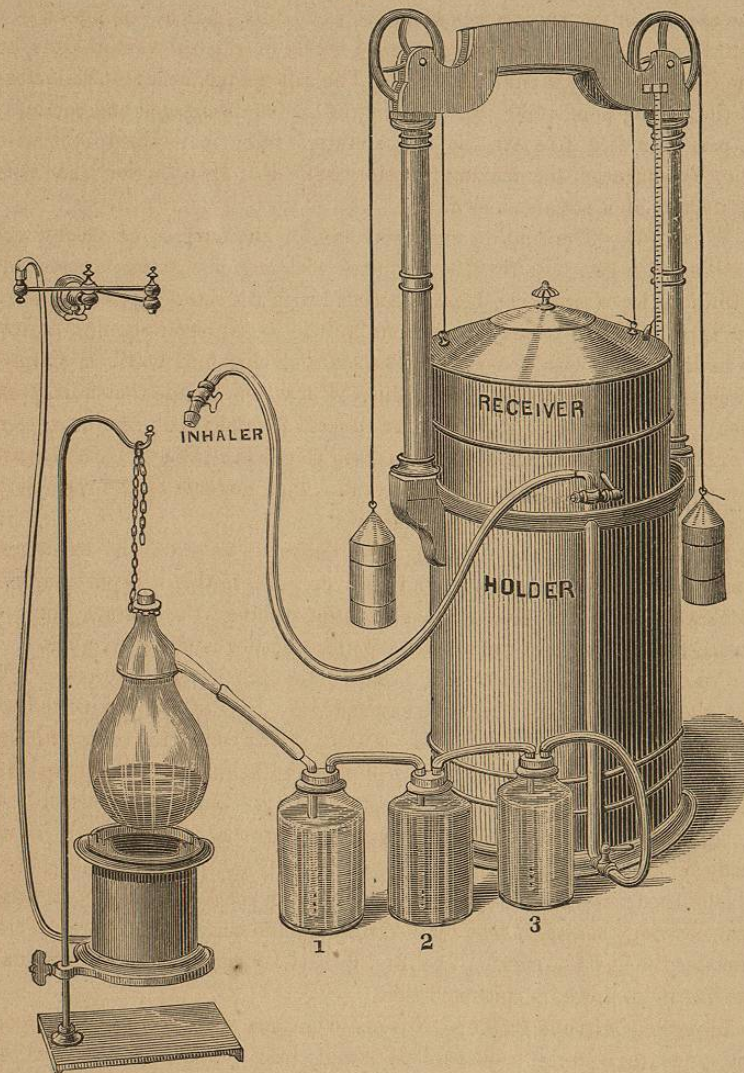


Nitrous oxide gas owes its discovery to Priestley, 1776. Credit for its use as a pain-obtunding agent is due both to Sir Humphry Davy and Dr. Horace Wells; to the latter, particularly. The gas is secured simply by boiling nitrate of ammonia and collecting the vapor evolved in the process.

FIG. 604.



PREPARATION.—Fig. 604 shows a nitrous oxide gas apparatus. It consists, as seen, of a stove and retort, three bottles connected by means of pipes and tubing, and a holder and receiver.

To make the gas an operator provides himself with a quantity of pure nitrate of ammonia (a pound produces thirty gallons of the vapor). This he tests by a procedure as follows: A teaspoonful is placed in half a goblet of distilled water. If admixtures containing chlorine be present the fluid will be rendered milky; if, on the contrary, the salt be pure the water will remain unchanged. Being found unadulterated, the required quantity—measured by the amount of gas needed, one pound to each thirty gallons—is placed in the retort* and heat applied through a sand-holder in which the retort rests, until the fusing point be attained, 250° F. The salt melted, heat is to be increased to the boiling point, 460° F. If now the gas be disengaged and commences to pass over with freeness, the temperature is to be maintained, otherwise it is to be advanced, the maximum being 482° F. Heat higher than this is productive of a poisonous element.

WASHING.—The bottles employed are for the purpose of cleansing, or washing, the gas. Bottle 1 is furnished with a pipe having a hole-riddled terminus, the external end being associated with the retort by medium of rubber tubing; it may or may not contain a little water, never enough, however, to be in contact with the tube. The office of this first bottle is simply to catch the drip. Bottle 2 is partly filled with water: beside that fluid it commonly has put into it three or four ounces of sulphate of iron or copperas. Bottle 3 is to have a stick of caustic potash placed in it, this as a guard against the possibility of chlorine being present. The contents of the wash-bottles are to be renewed after each running.

Before starting the distillation it is desirable to prove the existence of communication between retort and receiver. To do this it is only necessary to blow in the retort end of the connecting tubing: the passage being unobstructed the water in the middle and third bottles is made to bubble.

COLLECTING.—To collect and preserve the gas implies a receiver. The one shown in the cut is highly commended by users of it. Connected with bottle 3 a tube, having a stop-cock, is seen. This conductor relates with the cylinder at a point above the surface of water with which the fixed portion, or holder, is filled. Forced through this pipe the gas enters the receptacle, the weighted and balanced receiver accommodating the collection. It is now ready for use.

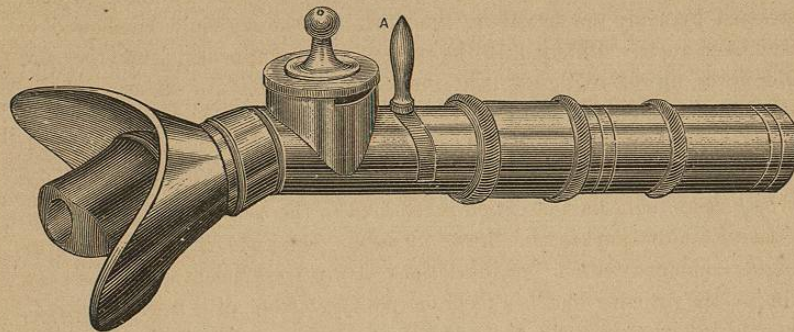
DISPENSING.—This is by means of the outlet marked inhaler. A rubber bag receiving the gas, it may be disconnected and carried anywhere. To administer the agent, a mouth-piece, Fig. 605, is associated with the contents of the bag by means of a spiggoted tube.

Liquefied Nitrous Oxide.—Nitrous oxide gas subjected to extreme cold and pressure is to be condensed in strong iron cylinders in the form of a liquid. Fig. 606 shows such a cylinder in the shape of a not unsightly piece of office furniture. A tube holding one hundred gallons of the gas weighs

* The fused or granulated salt is to be preferred.

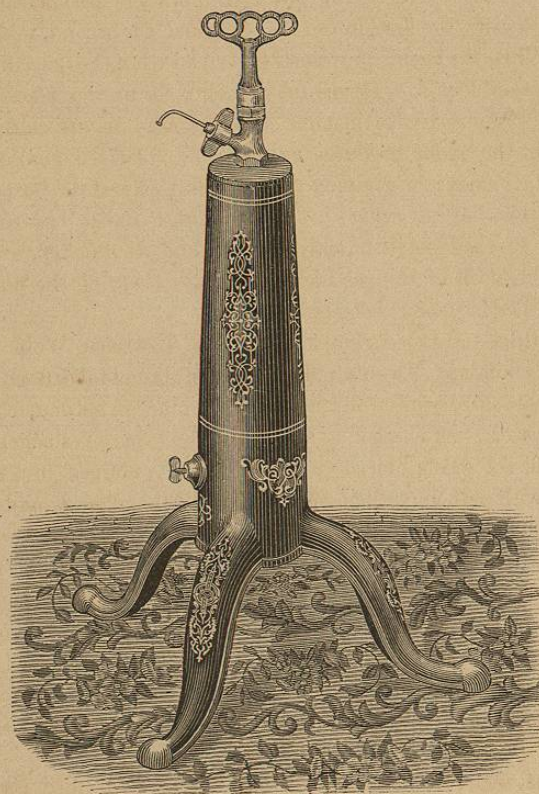
just ten pounds. With paper wrapped about it one would carry the shell

FIG. 605.



in his hand without attracting a passing glance. The surgeon's case, a

FIG. 606.



package containing the liquid, and conveniences for exhibiting it, is a most

handy, economical, and convenient arrangement for the use of general practitioners.

Fresh gas is to be accepted as being better than old. Twenty days is esteemed by many the maximum time that the agent should be allowed to stand over water. Differing, in the respect, as the antipodes, from ether and chloroform, nitrous oxide gas is to be given to the absolute exclusion of air. Bearded men require to this end the application of a hood. No condition or idiosyncrasy absolutely contra-indicative of the use of the agent is admitted.

Spasm of the glottis and syncope are the commonest of the interruptions. In both cases immediate attention is required to the tongue; the organ to be seized with a dry napkin and drawn forward. In spasm the placing of the tongue, combined with a few inhalations of air, is sufficient for relief. In syncope, the patient is put in a reclining position; fresh air is freely admitted; water is dashed against the face; smelling salts or ammonia fortior is applied to the nose; the ear is blown into or the nostril tickled.

Conditions demanding caution are plethora, hypertrophy, fatty degeneration and valvular obstruction of the heart, temporary or permanent systemic depression, as existing, the first, in the over-fatigued, the second, in drunkards.

ACTION.—While the agents previously described relax the muscular system, nitrous oxide gas stiffens it. Hence the necessity for a prop placed between the teeth as a preliminary to inspiration. Respired in association with a modicum of air the agent produces exhilaration; received absolutely pure, such state of excitement is commonly too quickly passed to be noticeable; particularly is this the case where complete *rappor*t exists between patient and operator. Insensibility is quickly induced and as quickly passes away. Judgment of the effect of the gas is derived from observing the mucous surfaces. Danger lies in venous congestion.

Ethyl Bromide.—A process employed by Dr. Lawrence Wolff to secure this agent is as follows: Twenty-four ounces of bromide potassii, coarsely powdered, are conjoined with a mixture of sixty-four of sulphuric acid and thirty-two of water. After cooling, sixteen fluidounces of alcohol (95 per cent.) are added, the whole placed in a large flask contained in a sand-bath and connected with a Liebig's condenser. The temperature is now raised to about 200° F. and maintained thereabout until reaction shall have ceased, and the ethyl, which has been gathering rapidly in a receiver, shall no longer come over. To know of this, about an ounce of water is put in the receiver before commencing the operation. The evolution has stopped when no further sinking to the under surface of the water is observed. The ethyl bromide so obtained will amount to twenty ounces, and is to be shaken with a solution of potassium bicarbonate, subsequently washed with water, and purified by redistillation.

Ethyl bromide, hydrobromic ether as it is as frequently termed, is employed in surgery by many professedly with much satisfaction. The occurrence of several accidents of late, has, however, somewhat modified the estimate of its

safety, and induced a spirit of caution as to its acceptance. Bromide of ethyl is a colorless liquid possessed of an agreeable odor and pungent taste. It mixes perfectly in all proportions with ether but sparingly with water. The action of the agent, from an anæsthetic stand-point, is even more quickly exerted than is that of chloroform. The manner of its use is the same as for ether, a sponge, napkin, or inhaler being employed. Recovery is more rapid than from the two agents just named. According to experiments by Dr. Laurence Turnbull, to whom the profession stands indebted for a knowledge of the anæsthetic quality of the preparation, the shortest time required to place a patient under its influence is thirty seconds; the longest, five minutes; average, ninety seconds. In the experiments, the smallest quantity used was that taken into the lungs by two inhalations from a sprinkled handkerchief; the largest was two ounces. Out of twenty-one cases, sickness of stomach, with vomiting, occurred in three, hysterical excitement in two, prostration in one.

Bonwill's Method of Rapid Breathing.—An anæsthetic effect, as has been shown by Dr. W. G. A. Bonwill, is produced when rapid and full breathing is indulged in for a few minutes. What may prove the result of greater familiarity with the means the writer is not prepared to say. That a condition is produced which allows of puncture being painlessly made he knows from observation. A feature undoubtedly lying in the practice is the diminished quantity of an ordinary anæsthetic required where this process has preceded, and is continued, with the exhibition. A danger connected with the performance seems, to the experiments and experience of the writer, to lie in the direction of venous congestion of the brain; a conclusion to which exception, however, is taken by physiologists whose opinions worthily command wide respect. Greater familiarity, and wider experimentation, with the means, may demonstrate the existence in it of a boon not surpassed by the other great discoveries in Anæsthesia.

Medicines used by Hypodermatic Injection.—“*Gemischte narkose*,” mixed narcosis, is a term introduced by Thiersch of Leipsic to express a relation of means by which insensibility to pain is secured without entire abolition of consciousness. The means consists in the hypodermatic employment of morphia by an anticipation of some five minutes of chloroformization. This manner, while most recommendable, is yet not justly to be credited to the German surgeon; the author has been familiar with it assuredly for the last fifteen years, certainly wrote about it in connection with jaw operations quite that long ago. Advantage residing in the practice is that a semi-consciousness may be maintained which insures against the passage of blood into the larynx at the same time that it serves as a prophylactic to shock.

Sulphate of morphia used in conjunction with sulphate of atropia constitutes an admirable injection. The dose will vary from the eighth to a half grain of the first, from the one-hundredth to the seventieth of a grain of the second. To prepare the combination for use it is to be mixed with from seven

to ten drops of pure water. The spoon containing the solution is to be held over a flame for a single moment that a blood-heat of the fluid be secured. The means is not without danger.

Chloroform, subcutaneously used, is an excellent obtunder. In sciatica, ten drops, injected deep among the gluteal muscles, is efficacious in breaking up an attack. The remedy, and manner of employment, are indicated in obscure neuralgia generally.