XXIX. *Experiments on the Production of Cold by the Evaporation of the Sulphuret of Carbon.* *By* Alexander Marcet, *M. D. F. R. S. one of the Physicians to Guy's Hospital.*

Read July 8, 1813.

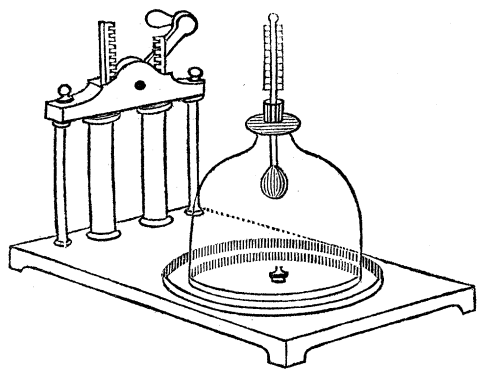
I HAD the honour, at an earlier period of this session, of giving to the Society, conjointly with Professor BERZELIUS, an account of the alcohol of sulphur, or sulphuret of carbon, and of noticing the remarkable volatility of that fluid. I have, since that period, tried a variety of experiments on the subject, and having found this compound more volatile than any other known body, and capable of producing, by its evaporation, a degree of cold of proportional intensity, I have been induced, in order to render the history of the sulphuret of carbon more complete, to present to the Society a brief account of my experiments.*

If the bulb of a small spirit thermometer be closely covered with a bag of fine flannel, or still better, with a piece of fine

* I would recommend to those, who may wish to repeat these experiments, to prepare this substance by means of a large earthen tube of about one inch and a half in diameter, instead of the small porcelain tubes, which are commonly used for this purpose. The process is always a tedious one; but a much more considerable quantity of the sulphureous liquor is procured by the larger tube in an equal space of time. The same tube can scarcely ever be used twice. About half a pint of the liquor may be obtained in one process; but the operation requires almost a whole day. Fresh pieces of sulphur may be successively introduced whilst the distillation is going on, and without renovating the charcoal, as the occasional admission of air does not materially affect the operation. The process would, no doubt, admit of further improvement.

lint, and a few drops of the sulphureous liquor poured upon it, the thermometer rapidly sinks from 60° to about 0; whilst if a similar experiment be made with ether, or alcohol, under the same circumstances, the temperature is reduced by the ether to only about + 20°, and by the alcohol to about 50°.* The hygrometrical state of the atmosphere appears to have some influence on these results.

If the bulb of the thermometer, thus wetted with the sulphureous liquor, be introduced into the receiver of an air-pump, (by means of a brass plate, as expressed in the annexed



sketch, the plate fitting the receiver air tight when laid upon its open neck), the thermometer sinks rapidly, as the ex-

* I have also tried some experiments on the comparative elastic force of the vapour of these fluids, by introducing in succession a few drops of them, through mercury, into a torricellian tube; and I obtained the following results:

	Sp. Grav.	*Temper.*	*Depression of Mercury.*	*Cold produced by Evaporation.*
Pure alcohol	0,806	66°	1,65	from 68° to 52°.
Sulphuret of carbon	1,272	66°	10,75	from 68° to 10°.
Rectified ether	0,724	66°	15,65	from 68° to 24.°

It would appear, therefore, that the degree of volatility of a fluid, or of cold produced by its evaporation, are far from bearing an exact proportion to the elastic force of its

haustion proceeds, and in one or two minutes it descends from + 70° to — 70°, or even 80° of FAHRENHEIT's scale, that is at least 40 degrees below the freezing point of mercury. A cold of — 65 or — 70 is easily obtained by exhausting the receiver till the rarefied air supports only one quarter of an inch of mercury; but with a pump capable of exhausting to one-eighth of an inch, the thermometer sinks to — 81° or 82° in less than two minutes. It is scarcely necessary to observe that, if instead of a spirit thermometer, a tube containing mercury be employed, this metal may be instantly frozen, and the remarkable contraction, which it undergoes at the moment of its congelation, may be seen and estimated with great facility.*

These experiments are but slightly influenced either by the temperature of the atmosphere, or by that of the sulphureous liquor; but if the air be very damp, the moisture which accumulates upon the bulb whilst cooling, slightly impedes the process. This moisture appears in the form of a hoar frost, forming a snowy arborescent deposition all over the covering of the bulb. The oily liquor itself does not freeze when exposed to a temperature of at least — 60°.

I shall not take up the time of the Society by a detail of the various attempts which I have made to increase still farther

vapour. It may be observed also, that the elastic force of the vapour of alcohol of sulphur was stated by Mr. BERZELIUS and myself, in our joint paper, to be only 7,36 inches, instead of 10,75; but this difference is accounted for from the circumstance of the temperature, which in that instance was 53,5°, instead of 66°; a difference which is very nearly that which might have been expected from a comparison with the force of ether at the same temperature as given in Mr. DALTON's tables.

* Mercury may also be frozen by a similar process, by means of ether, as I have stated in NICHOLSON's Journal for February last.

the effects just related. The fact is, that all these attempts have hitherto failed, and the simplest mode of performing the experiment has uniformly yielded the best results. Indeed, I am now inclined to believe, that unless a substance were found which should exert an attraction upon the sulphureous liquor, without being itself evaporable, (as is the case with the sulphuric acid, in Mr. LESLIE's mode of freezing water), I have nearly reached the limit of cold that can be produced in this manner. It may be proper to add, that the presence of sulphuric acid in this experiment would have no immediate effect, as it exerts no attraction upon the volatilized liquor; yet by drying the rarefied atmosphere which surrounds the bulb, it might perhaps assist a little in promoting the process of evaporation. It may also be useful to caution those who may wish to repeat these experiments, against working the pump too rapidly; for in this case, a degree of heat is produced (in consequence, no doubt, of the condensed air rushing violently through the valve), which is sufficient to inflame the volatilized liquor mixed with it. This happens most frequently with pumps of large dimensions, and is immediately perceived by the sulphureous fumes which issue from the barrel; no other consequence ensues, however, except the injury done to the valves, which, at all events, are apt to be acted upon, and more or less deranged, by the repeated contact of the volatilized liquor. On this account the receiver used for these experiments should be of the capacity of two or three pints; for if it be very small, and the vapour very concentrated, the valves appear to be proportionally injured.