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THE CONSTRUCTION OF DEWAR FLASKS

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A method of making Pyrex Dewar flasks of considerable capacity has been developed which may be of interest to some who have a limited or intermittent supply of liquid air. The most convenient size, in view of the limited sizes of Pyrex flasks, is probably three liters. The outer wall is made of a 5-liter flask. If 7- or 8-liter flasks were available, 5-liter Dewars could be constructed. However, with a 12-liter outer flask, silvering becomes rather difficult, and the resulting flask is too bulky to be practical.

A heavy-walled 16-mm. tube, E in the figure, is sealed to the base of the neck of a 5-liter round-bottomed flask. The heavy ring at the top of the neck is then cut off as closely as possible and the flask cut in two parts around a great circle perpendicular to the axis of the neck. The crack is shown at B. It is made by scratching a file mark about an inch long on the flask, wrapping one turn of No. 22 chromel wire about the flask, and heating with a current of 10-12 amp. until the glass is felt to be warm 6-8 mm. from the wire. A few cc. of water is poured on the file mark. The crack obtained is often so smooth that there is difficulty in determining the relative positions previous to cracking. The inner flask is prepared by cutting off the neck of a 3-liter flask as closely as possible to the base of the neck, A, and sealing on a previously flared 40-mm. heavy-walled tube. This is then cut off so that it extends through the neck of the outer flask a distance about equal to that between the walls of the neck.

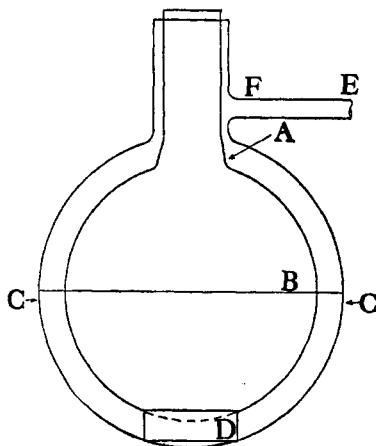


Fig. 1.

The bottom half of the outer flask is placed in an asbestos-covered iron ring. A ring of brass, D, such as a 20-mm. length of a 70-mm. brass tube is then placed in the glass hemisphere, and the inner flask is set on it. The upper half of the outer flask is put in place and clamped down with another asbestos-covered iron ring. The Dewar seal at the top is then made using two hand torches, one with a large air-gas flame, the other with a moderate air-oxygen-gas flame. Obviously this must be done at a rather high temperature, since the inner flask is essentially unstable. Blowing can be done through the evacuating tube, but is usually unnecessary.

Keeping the Dewar seal just below the softening point, the upper iron ring is removed, then the inner flask and top half of the outer lifted and the brass ring removed. The upper half is then replaced, and a large ring burner with holes every 8 mm. is placed around the whole just below the crack, at C. A small gas flame is started first, and the temperature raised slowly. When near the softening point, a small oxyhydrogen torch is used to make the large seal. About four points around the circumference should be sealed initially and then the seal completed rather than attempting to work right around.

As soon as the seal is completed the ring burner is removed and the entire ring stand put in an electric furnace at a temperature of about 600°. The Dewar seal should be at annealing temperature before this transfer is made. The furnace temperature is maintained for about an hour and then the current turned off. After two or three hours the cover is removed and the flask taken out when the furnace is cold.

If new flasks are used it is unnecessary to clean them with cleaning solution, but they should be washed with stannous chloride, rinsed and silvered. Rinsing and silvering should be done with a small quantity of liquid, by shaking and rotating, rather than filling the entire space between the walls. Two or three coats of silver are desirable. The silver is then washed out of the evacuating tube with cotton soaked with very dilute nitric acid, the entire flask rinsed several times with water, and the evacuating tube necked down at F for sealing off. Evacuation is carried out at about 400° in the electric furnace over a period of thirty-six hours, by means of a mercury vapor pump and liquid-air trap. Evacuation for a shorter period of time fails to outgas the silver completely and the flask deteriorates rather rapidly. Sealing off is done as soon after turning off the heat as possible. Our practice is to anneal two of the Dewar flasks at once (this requires the moving of one while hot from one ring stand to another already in the furnace) and later to evacuate them together.

The flask is ordinarily packed in Sil-O-Cel in a 12- or 14-quart pail, and covered over with heavy felt in which a hole is cut for the neck.

One of these Dewars, if filled with liquid air and set aside, will still contain some at the end of thirteen days, whereas the best commercial glass Dewars are empty in four days or less. Also, the soft glass Dewars ordinarily used usually last less than twenty fillings. One of our Pyrex Dewars has been in continuous use for more than three years, and still keeps liquid air as well as it ever did.