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An Inexpensive Photochemical Reactor

The study of photolytic reactions can readily and effectively be carried out using an inexpensive and easily constructed photolysis apparatus which we have recently designed and built.

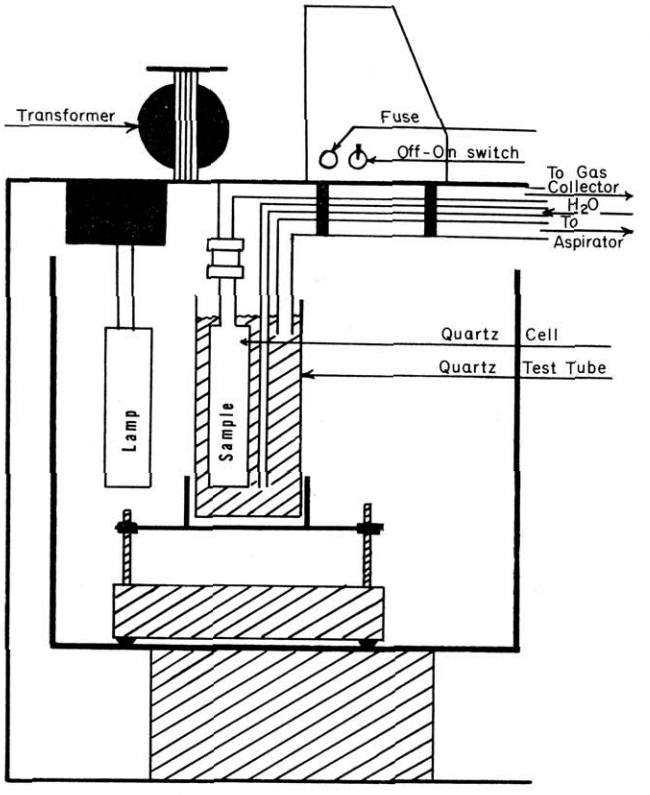

Figure 1. Photochemical reactor.

The apparatus (see Fig. 1) is constructed in a metal box (of the type readily available in any electronics supply house) which is open on one end to permit facile manipulation of samples. The box which we employed is $19^1/_2$ in. high, $11^1/_2$ in. wide, and $15^1/_4$ in. deep. The lamp, which is supported in a socket attached to the top inside of the chassis, is a relatively inexpensive 400 W General Electric H400A33-1 mercury arc lamp, commonly used for street lighting purposes, from which the outer glass envelope has been removed (using a glass saw) to permit the passage of the maximum amount of ultraviolet radiation. The reaction vessel is a quartz cell which is connected by means of a polyethylene sleeve and a brass Swagelock connector to a piece of $^1/_4$-in. copper tubing. This tubing leads to a mercury filled gas buret and vacuum system which is used for flushing the system with nitrogen and for measuring and collecting any evolved gases. The cell is cooled by immersion in a quartz test tube through which water is allowed to flow. The water is introduced into the test tube through a piece of $^1/_8$-in. copper tubing which extends almost to the bottom of the tube, and is removed through a piece of $^1/_4$-in. copper tubing which extends only about $^1/_2$ in. into the test tube and is connected at the other end to the side arm of an aspirator. The three pieces of copper tubing are supported by two metal U-brackets attached to the top of the chassis. The quartz test tube is supported on a stand constructed by attaching a piece of copper pipe to a flat copper disk cut out of a piece of copper sheet. The copper disk is attached by means of six hex nuts to three 2-in. bolts which were forced through three equally spaced holes bored in a laboratory cork ring. The stand sits in the bottom of a battery jar which in turn rests on a removable support which can be either a block of wood or a series of cork rings stacked on top of each other. By removing this support, the battery jar can be lowered for easy access to the lamp and sample cell. A sheet of aluminum foil is glued to the inside wall of the battery jar as a reflector to increase the total amount of radiation from the lamp which reaches the sample. On the top of the chassis is mounted a General Electric Lamp Ballast (Cat. No. 89 G 110 or its equivalent) which supplies the power for the lamp. We have also mounted a small metal panel support on top of the chassis which houses a voltmeter, ammeter, running time meter, fuse and power switch. When the apparatus is in operation, a light shield is placed over the open end of the chassis to protect the eyes of anyone in the vicinity from stray radiation. A wiring diagram is shown in Figure 2.

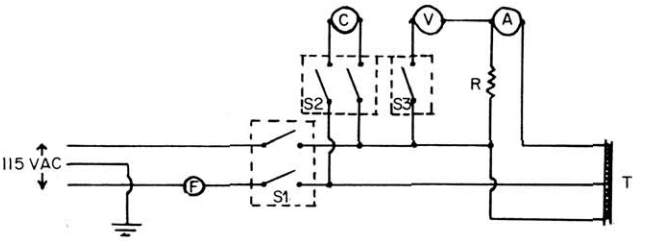

Figure 2. Wiring diagram. S1, main switch; S2, running time meter off-on switch; S3, voltmeter off-on switch; F, fuse (3AG, 10 amp); C, running time meter; V, volt meter (0–150 VAC); A, ammeter (0–3 AAC); R, lamp; T, ballast transformer.

We believe that this apparatus is highly effective yet sufficiently inexpensive and easy to construct that it should enable many chemists to expand into the rapidly developing field of photolysis with minimum cost and effort.