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A method of measuring the delay time of the analyzing flash in flash photolysis apparatus

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A new solution for the time delay system of the analyzing flash with respect to the photolyzing flash used in the flash photolysis apparatus is described.

Introduction

Flash photolysis, originally developed by Norrish and Porter [1-3], has found numer ous applications in photochemistry, photobiology and biochemistry. It is particularly suitable for the study of short-lived excited states of atoms, molecules and free radicals ($\tau \sim \mu s$) — the processes of their appearance and decay can be followed.

The system controlling the delay time of the analyzing flash with respect to photolyzing flash is one of the most vital elements of a flash photolysis apparatus. In this system the photolyzing flash is registered by a photosensitive device, usually a photocell, which in turn, after a suitable delay, triggers off the analyzing flash. The second time delay system, employed only in a small number of instances, is based on the use of an electrical impulse, which initiates both the photolyzing flash and the analyzing flash with the selected time delay separating the two [4-8].

The present paper describes a new solution for the time delay system with spectrographic recording of the absorption spectra.

The new time delay system for the analyzing flash

In our system the delay of the analyzing flash is obtained by using an electrical pulse generated in the delay system employing the delay unit UO-1. This pulse also initiates the photolyzing flash and starts the "sawtooth generator" (within the delay unit UO-1) which is directly responsible for the delay. In the place of the delay unit UO-1 the Camac-1401 unit may be employed — both units are produced by ZZTJ "Polon" (Poland).

In its basic form the delay unit UO-1 could be used to obtain delay times 1-55 μs. However, many fast reactions have to be followed up for longer periods. In our delay system the delay times have been extended up to 550 μs increasing the capacity in the "sawtooth generator" (adding $\sim$ 7000 *pF* capacitor in parallel to capacitor

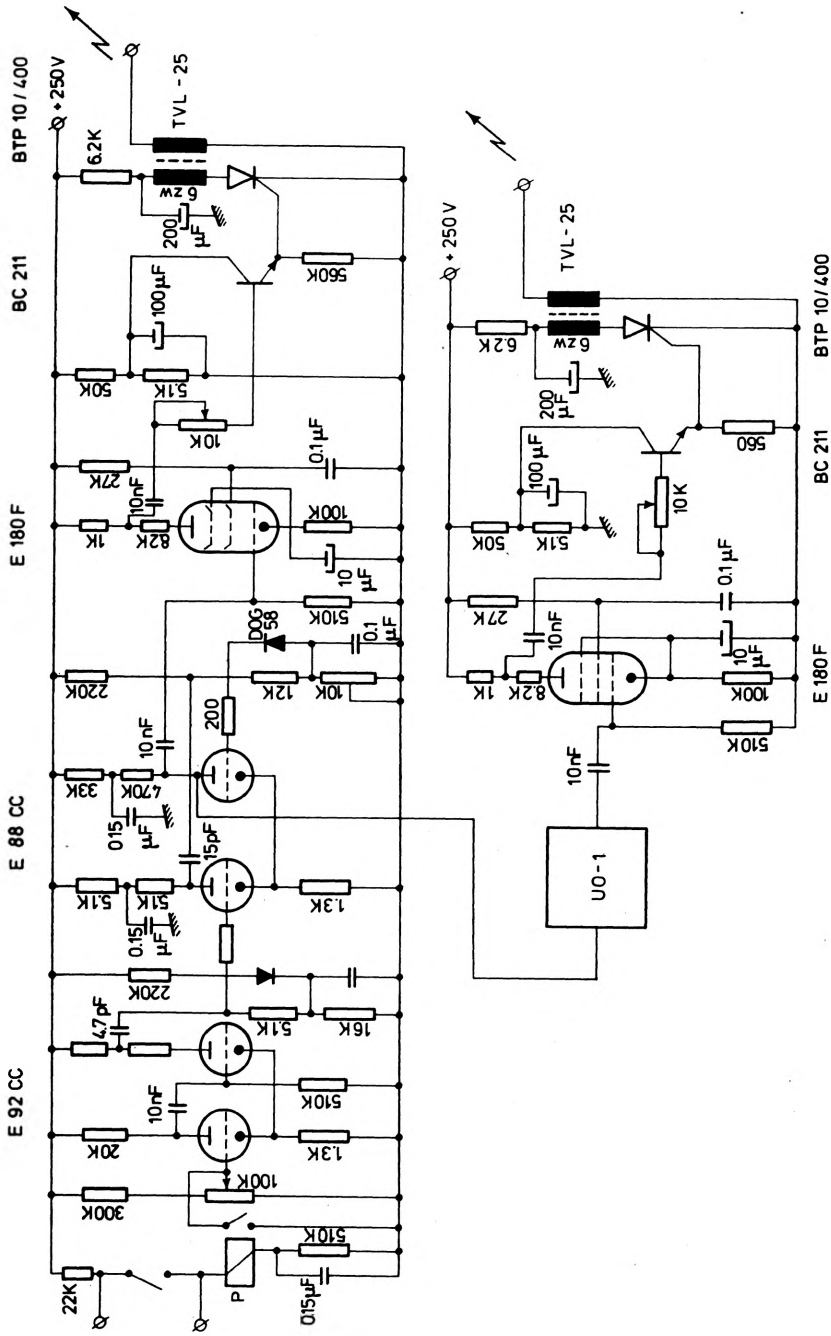

Figure. The new time delay system for the analyzing flash. Notations given in the diagram are typical of electronics

C13) within the delay unit UO-1. With this system the relative error in the difference between the pre-set delay time and the actual delay amounts to about 3%. It is possible to obtain even longer delay time, in the ms range, should it be necessary.

The particular diagram of the delay time system is shown in the figure.

The entire system consists of five basic electronics units. The main purpose of the electric pulse generating unit, constructed with the use of E92CC valve, is to create a single electric signal with a rise time in the shaping unit (valve E88CC) of about 20 ns. This signal generates a high voltage pulse in the triggering unit which consists of E180F valve, BC211 transistor and BTP10/400 thyristor and initiates the photolyzing lamp flash. An electric pulse formed simultaneously in the shaping unit drives the delay unit UO-1. The delay unit, after the selected delay time, generates a high voltage pulse in the triggering unit of the analyzing lamp, which makes it possible to observe the absorption spectra of the transient species formed as a result of the first flash.

In order to improve the performance of our time delay system, through reducing interferences and shortening the rise time of the high voltage pulse (the triggering pulse), thyratrons have been replaced by thyristors.

Our system is both very compact and easy to set in accordance with the requirements of the experiment. Reproducibility of the delay times is also improved compared with the conventional photoelectric delay system.

References

[1] NORRISH R. G. W., PORTER G., Nature **164**, 658 (1949).
[2] PORTER G., Proc. Roy. Soc. (London) **A200**, 284 (1950).
[3] NORRISH R. G. W., PORTER G., THRUSH B. A., Proc. Roy, Soc. (London) **A216**, 165 (1953).
[4] CALLEAR A. B., MCGURK J. C., J. Chem. Soc. Faraday Trans. **68**, 289 (1972).
[5] BASCO N., KENNEY-WALLACE G. A., VIDYARTHI S. K., WALKER D. C., Can. J. Chem. **50**, 2059 (1972).
[6] STASICKA Z., BULSKA H., Roczniki Chem. **47**, 1365 (1973).
[7] JARZYNA T., Patent PRL Nr 95663 (1978).
[8] ALLAMANDOLA L. J., LUCAS D., PIMENTAL G. C., Rev. Sci. Instrum. **49**, 913 (1978).

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Метод измерения времени задержки импульса анализирующей лампы в установке импульсного фотолиза

Представлено решение новой системы задержки анализирующего спектроимпульса по отношению к фотолизирующему импульсу в установке импульсного фотолиза.