INFLUENCE OF VOLTAGE RISE-TIME ON SPARKOVER VOLTAGE OF ROD-PLANE AIR GAPS.

BY

N.M. Farrag*

INTRODUCTION:

In engineering application, major requirement is the evaluation of sparkover and withstand voltages and their statistical variations in electrode systems of different spacing. Since the most dangerous overvoltages are likely to occur as surges, the impulse shape and polarity are important parameters. This paper describes, the effect of voltage rise-time on sparkover voltage of positive-rod/ earthedplane air gaps. Gap lengths up to 500 mm were used.

EXPERIMENTAL PROCEDURES

APPARATUS

A six-stage impulse generator of maximum output 330 KV was used to generate both 1.2/50 uS, and with a total load capacitance of 2250 nF, 60/100 x 2500 uS positive impulses. As shown in Fig.(1), the high-voltage electrode was 13 mm diameter rod with a hemi-spherical tip, and was mounted centrally on the earthed plane electrode. Gap lengths of 150 mm, 300 mm, and 500 mm were used. Sparkover probability measurements were obtained from 50-60 impulses at each test voltage. The test voltages ranging from below the withstand level up to 100% sparkover level.

RESULTS AND DISCUSSION:

For voltage rise-times of about 1 uS, the sparkover voltage is linearly dependent upon the gap spacing as shown in Fig.(2). Similar result was obtained by Allibone, Hawley, and Parry[1]; Gorev, Zalessky, and Riabov[2]; Carrara[3]; Paris, and Cortina[4]; and Bahder, Garcia, Barnes, and Mc Elroy[5]. The 1.2/50 uS standard impulse shape is insufficient duration in the former case to support sparkover in the gaps unless the peak voltage is increased. This is necessary in order to accelerate the breakdown process and to prolong the duration of a minimum field strength. The sparkover voltage increased by up to 40 per cent when the rise-time was increased from 2 uS to 16 uS. Following the maximum at 16 uS rise-time the sparkover voltage decreased rapidly with increasing rise-time. Bazelyan, Brago, and Stekolnikov[6], discovered that for divergent-field geometries a large reduction occurred in mean sparkover field when the rise-time was of the order of hundreds of microseconds. As shown

* Suez Canal University, College of Engineering, Dept. of El-Ectrical Engineering, Port-Said.

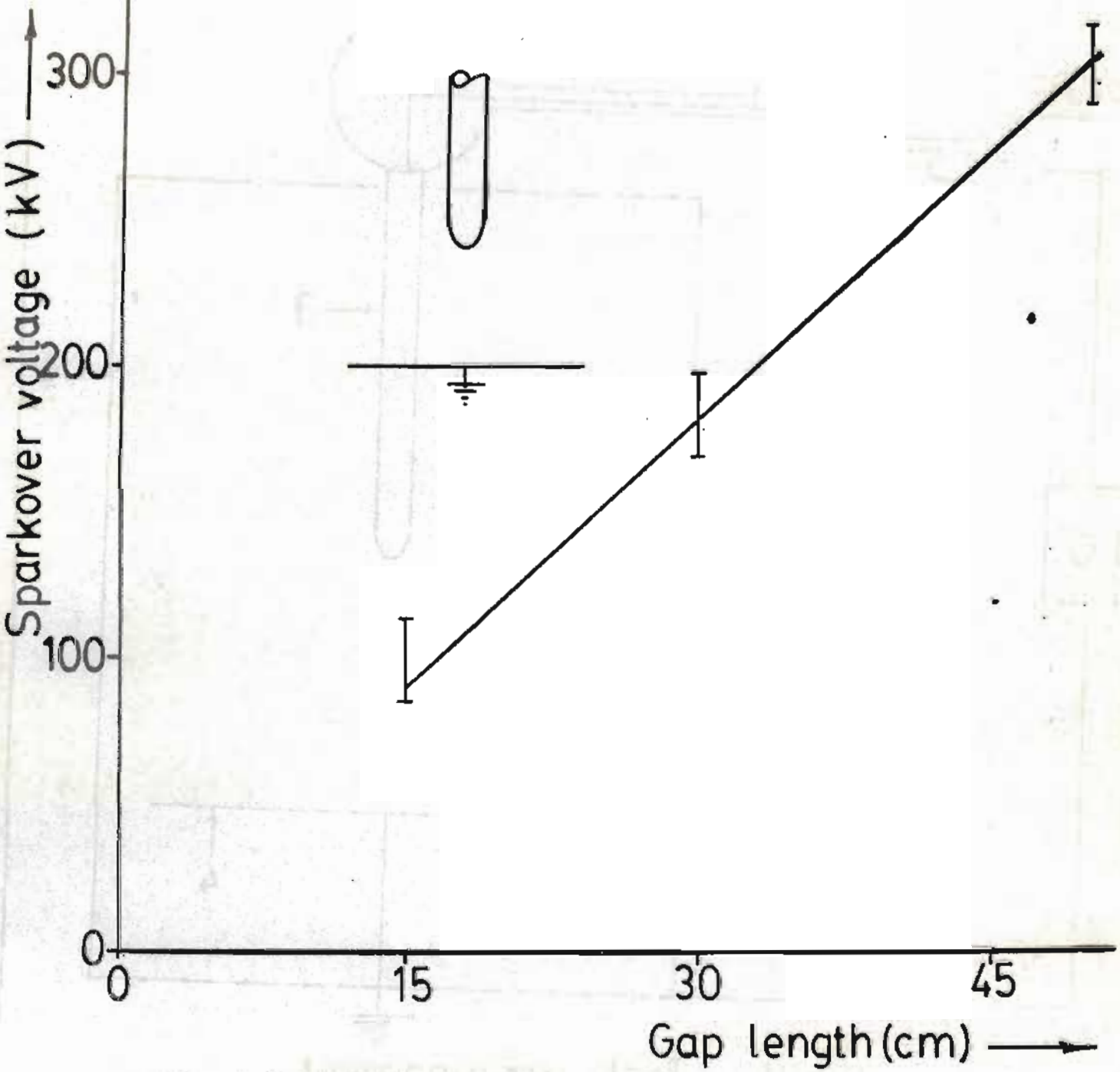
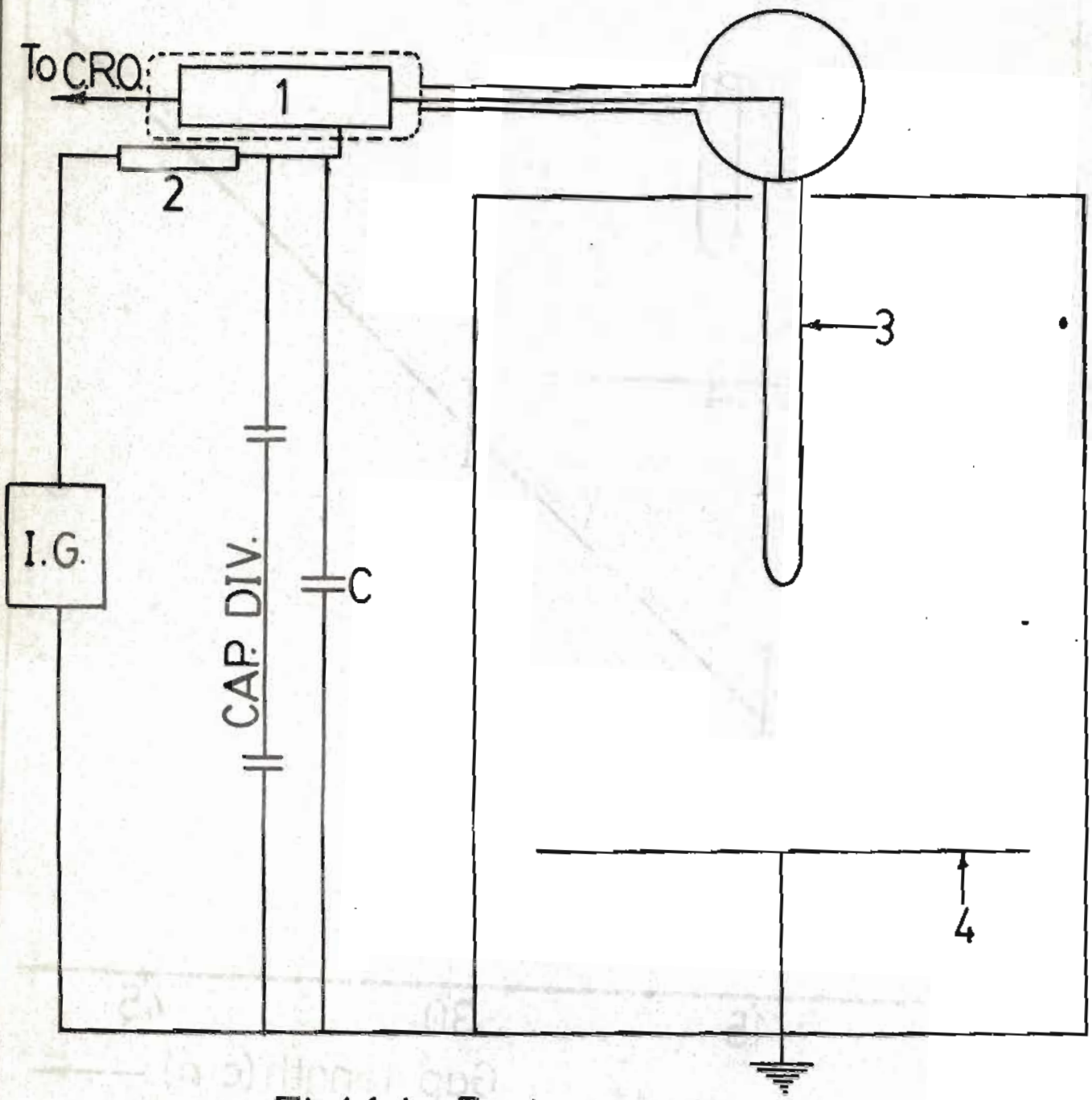


Fig.(2) Variation of sparkover voltage and gap length for positive impulses



Fig(1) Test arrangement

1. Light-link telemetry transmitter unit
2. External wavefront resistor
3. High-voltage electrode
4. Earthed-plane electrode

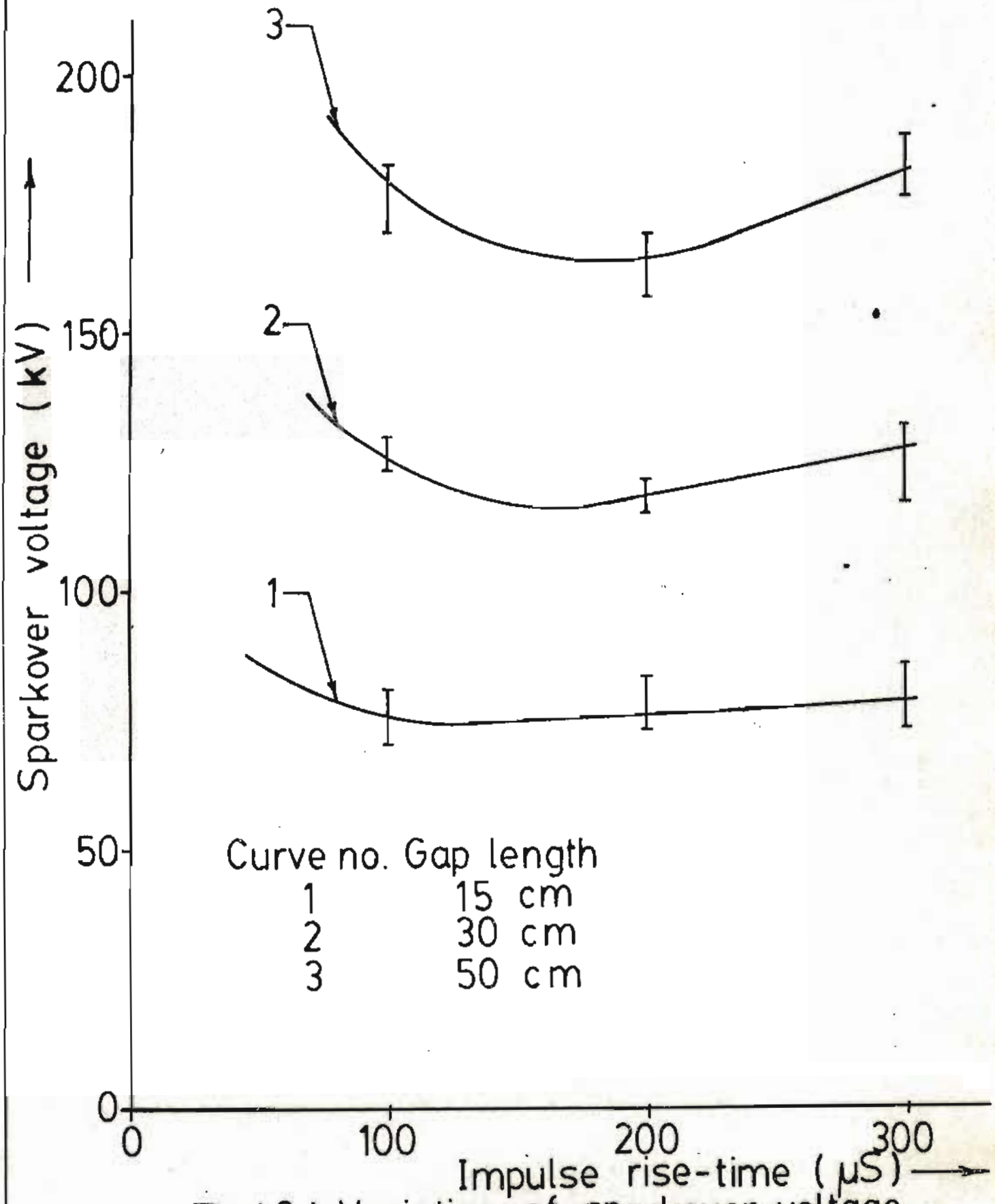


Fig.(3) Variation of sparkover voltage and impulse rise-time