

CHARACTERISTICS OF SINGLE WIRE ANODE STREAMER

COUNTER

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ABSTRACT

Performance of the wire-plane streamer counter in air at normal temperature and pressure have been studied and discussed, Investigations are made on the counting characteristics and corona current in relation to their dependence on various electrode separation and on the anode wire material and diameter.

It is found that the efficiency of detecting the streamer pulses increases with the increase of the anode diameter as well as the decrease of the electrode spacing. The material of the anode has negligible effect on both the counting and corona characteristics.

INTRODUCTION

Tayvendale⁽¹⁾ showed that the conventional corona counter in air at atmospheric pressure can be operated in two modes depending on wire diameter and electrode spacing, i.e. a spark or corona-streamer discharge can be

produced. At low gaps spark action occurs while at larger spacing breakdown terminals at the streamer stage of spark development.

Harrison⁽²⁾ gave the conditions which are suitable for good working plateau in a corona streamer counter.

Recently more work has been done on a new type of corona counter namely "Gridded streamer Corona Counter"⁽³⁾ as well as on "Wire-plane Streamer Counter"⁽⁴⁾ intending to furnish data on the operating characteristic and for better understanding of the related mechanism. Also multi-wire anode streamer counters were constructed and their operating characteristics were studied^(3,4).

The present work was undertaken to investigate more critically the operation of the streamer counter with different anode diameter and variable electrode spacing.

EXPERIMENT

The form of the single-wire anode streamer counter and the block diagram of electronic circuit is shown in fig. I. The pulses from the cathode follower are amplified by an amplifier and fed after a pulse shaper into the input of a fast scaler. High voltage power supply⁽³⁾ is used to supply the detector with stabilized high voltage from 0-to-20 KV. Three other stabilized power units are used as power supply to the cathode follower, amplifier and pulse shaper.

A ^{210}Po alpha-source which was fixed at a constant height from the anode was used for producing streamer pulses.

EXPERIMENTAL RESULTS

Figures (2 and 3) show the results of the counting characteristics for ankon and Molybdenum wires for various values of the distance h between the wire anode and cathode from 5 to 19 mm. corresponding to different values of anode diameter from 0.15 to 0.38 mm.

It is shown from these curves that an increase in the anode-to-cathode spacing is accompanied by considerable decrease in the counting rate.

It can also be observed that for small gaps the counting starts at lower voltage, and at all curves, we notice that the plateaus are perfect flat i.e. have a zero slope.

These families of curves indicate that the counting rate N increases with the decrease of electrode spacing and increase of anode diameter ϕ .

In the absence of any alpha-source near the counter we investigated the variation of the corona current with applied voltage under various wire-to-plate spacing, as

Well as, different values of anode diameter. The results are shown in fig. (4 and 5) for ankor and molybdenum respectively.

These families of curves indicate that I increases with the decrease of either the electrode spacing h or the anode diameter ϕ .

To identify clearly the effect of the anode wire diameter on the counter characteristics the operating characteristics of the streamer detector with ankor ($\phi = 0.25$ and 0.35mm) and Molybdenum ($\phi = 0.25$ and 0.38mm) as anode wire are represented in fig. 6. With the finest wire the counting starts at lower voltage, but with the largest diameter a better efficiency is obtained.

By increasing the anode diameter the corona current decreases and it occurs at higher voltage as the field around the wire becomes smaller. Moreover comparison of the results of the two different materials, shows that the material of anode wire has negligible effect on the counter characteristics.

Fig. 7 shows the family of corona curves for two different wire materials, of which the diameter is (0.27 mm for ankor and 0.26 mm for Md.), (0.32 mm for mol. and 0.33 mm for Ankon), i.e. having nearly the same diameter.

It is clearly seen that the material of the wires have nearly no effect on the threshold voltage or the slope of the corona current curves.

A KNOWLEDGEMENT

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خواص المعداد الفيضي الاحادي المصعد

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ملخص

درست طريقة تشغيل المعداد الفيضي احادي المصعد عند معدل الضغط ودرجة الحرارة وحثت خواص الميزة عند تغير كل من قطر مسلك المعداد ومادته وكذا المسافة بين المعد والمهبط . ووجد ان كفاءة المعداد الفيضي تزداد بزيادة قطر المصعد ولذا يصغر المسافة بين القطبين . ولقد يكون تأثير مادة المصعد عندما على كل من التيارات الهالي ومعدل المعد .

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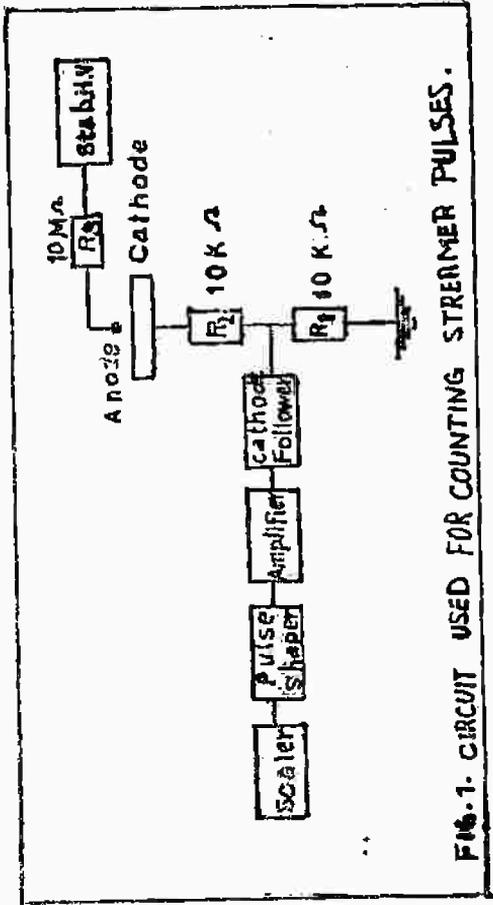


FIG. 1. CIRCUIT USED FOR COUNTING STREAMER PULSES.

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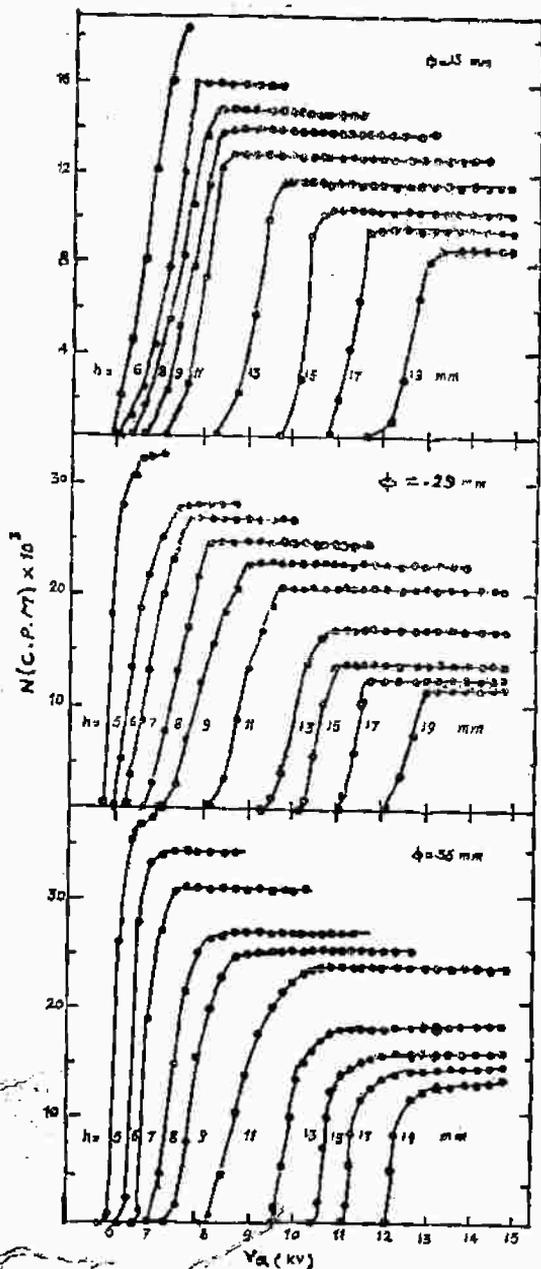


FIG. 2. THE RELATION BETWEEN THE COUNTS PER UNIT TIME AND THE APPLIED VOLTAGE, FOR DIFFERENT ELECTRODE SPACING, (ANKOR).

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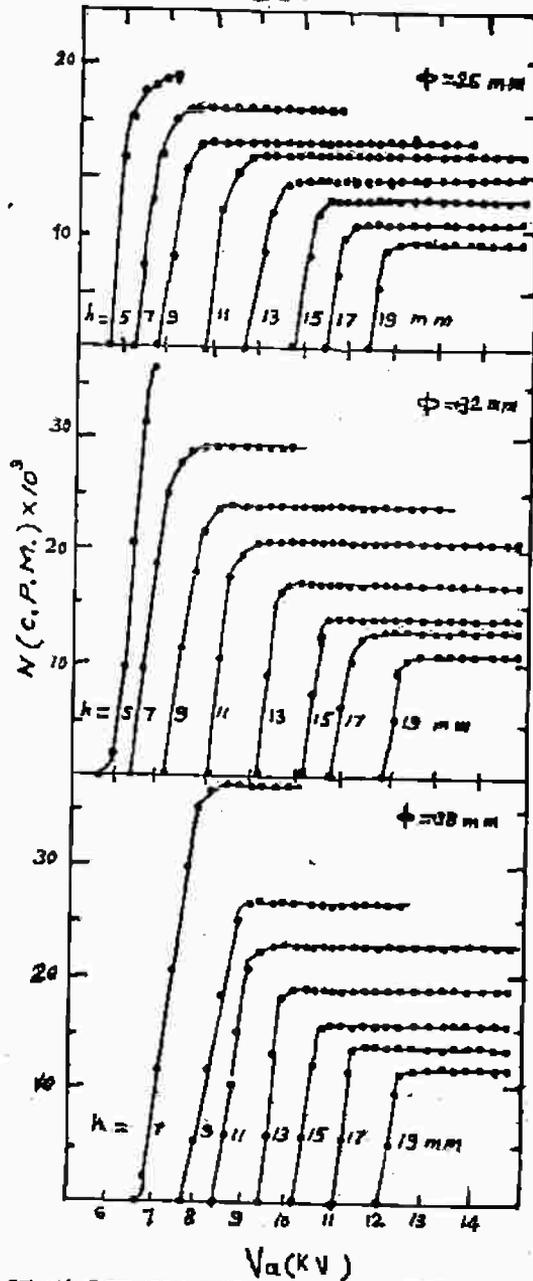


FIG. 5. THE RELATION BETWEEN THE COUNTS PER UNIT TIME AND THE APPLIED VOLTAGE, FOR DIFFERENT ELECTRODE SPACING, (MOLYBDENUM).

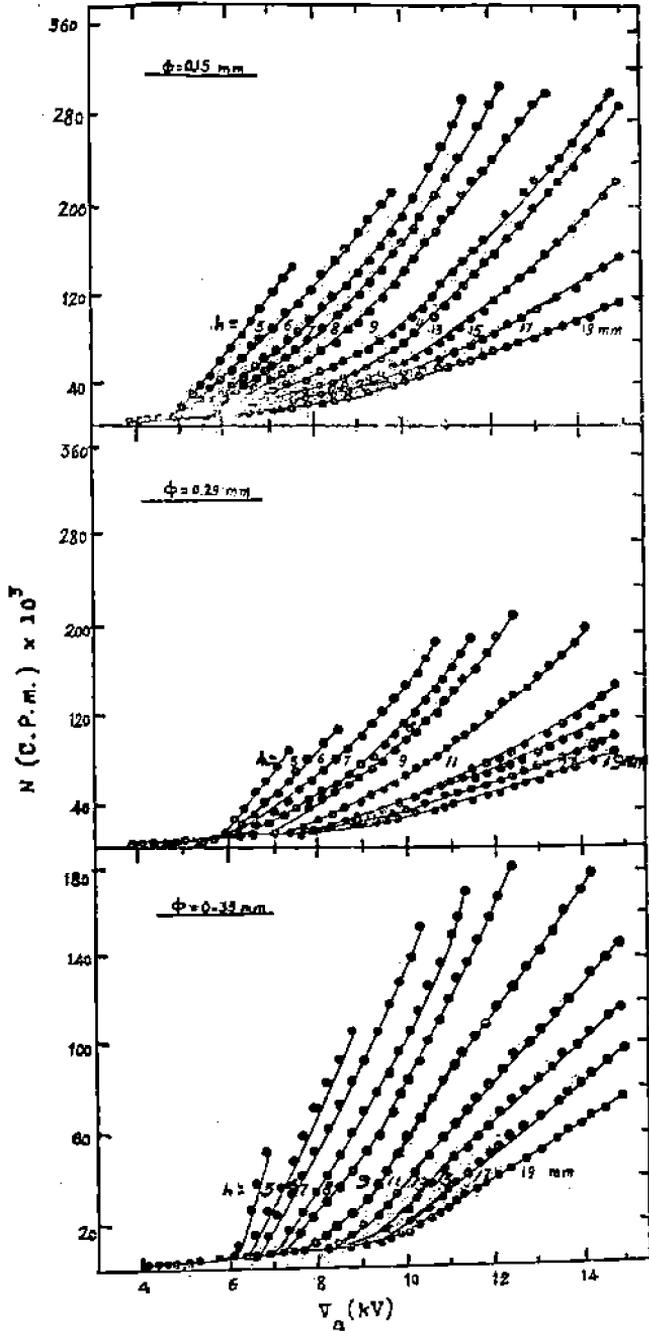


FIG. 4. THE RELATION BETWEEN THE CORONA CURRENT AND THE APPLIED VOLTAGE, FOR DIFFERENT ELECTRODE SPACING (ANKOR).

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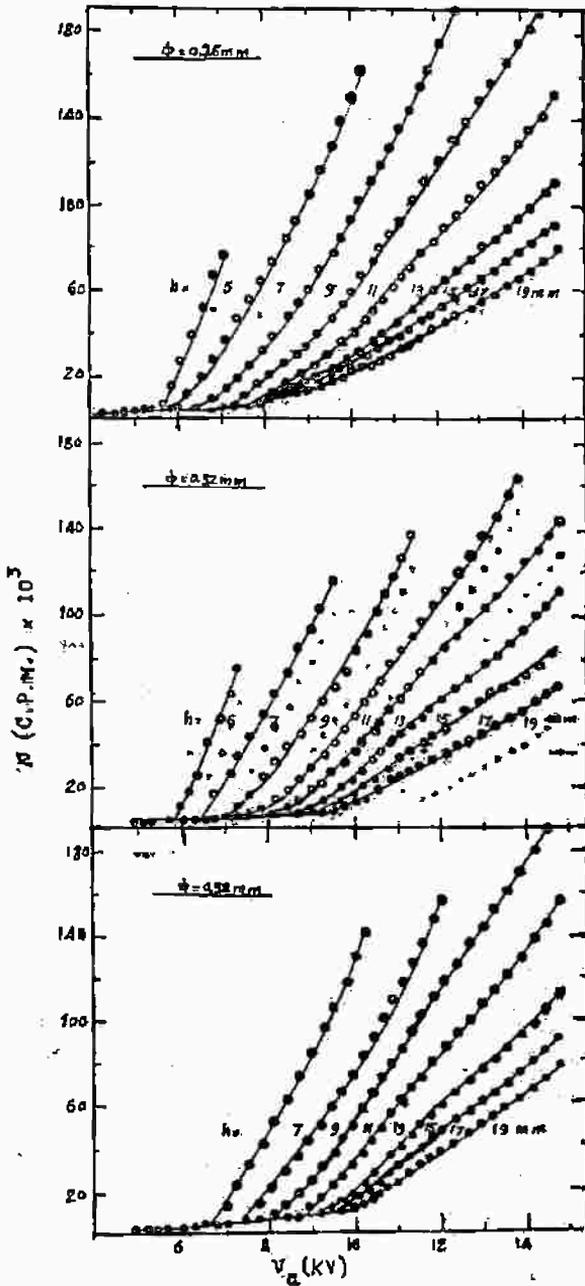


FIG. 5. THE RELATION BETWEEN THE CORONA CURRENT AND THE APPLIED VOLTAGE, FOR DIFFERENT ELECTRODE SPACINGS (104 YB DENIUM).

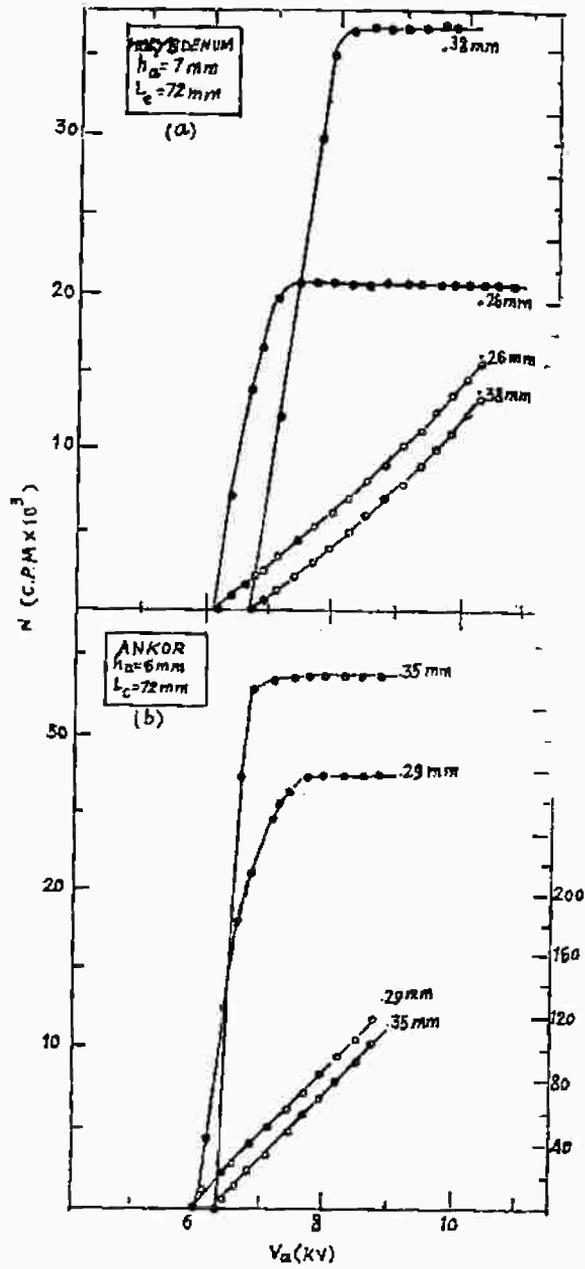


FIG. 6. COUNTING AND CORONA CHARACTERISTICS FOR DIFFERENT DIAMETER ANODE WIRE

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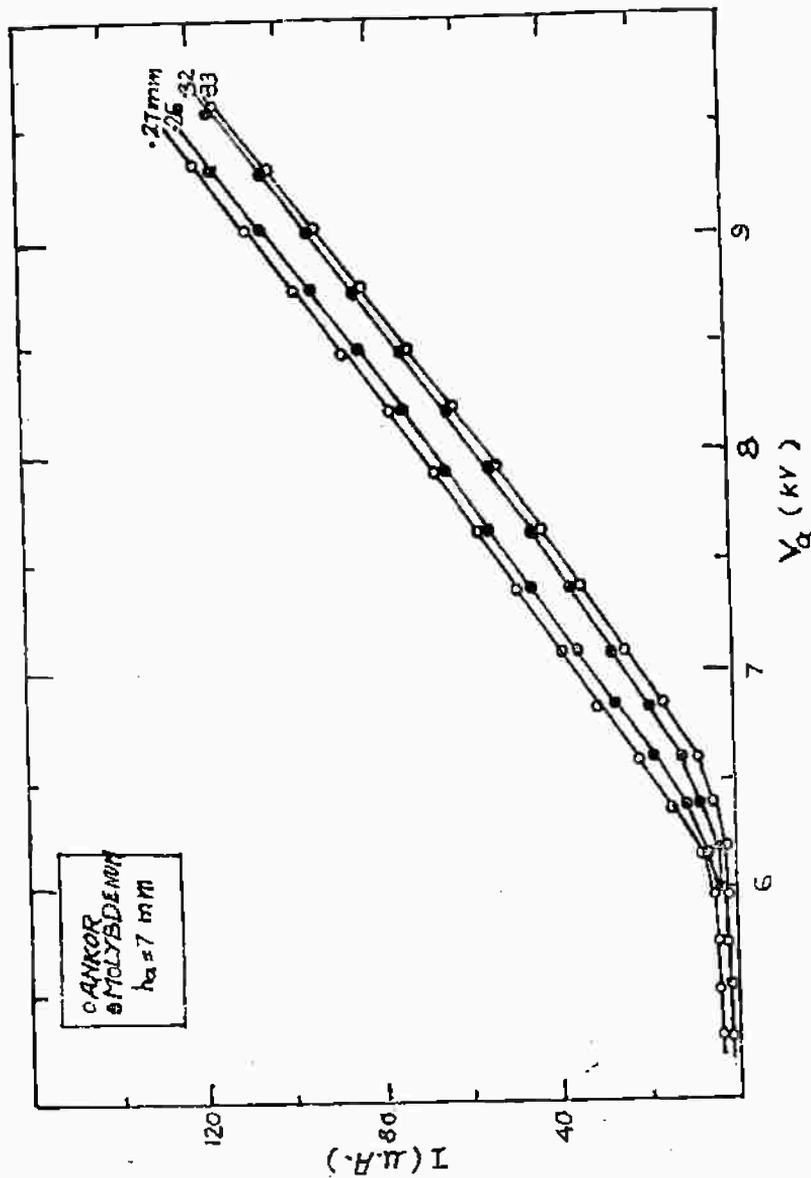


FIG. 7. APPLIED VOLTAGE AND THE CORONA CURRENT FOR TWO MATERIALS OF NEARLY THE SAME DIAMETER.