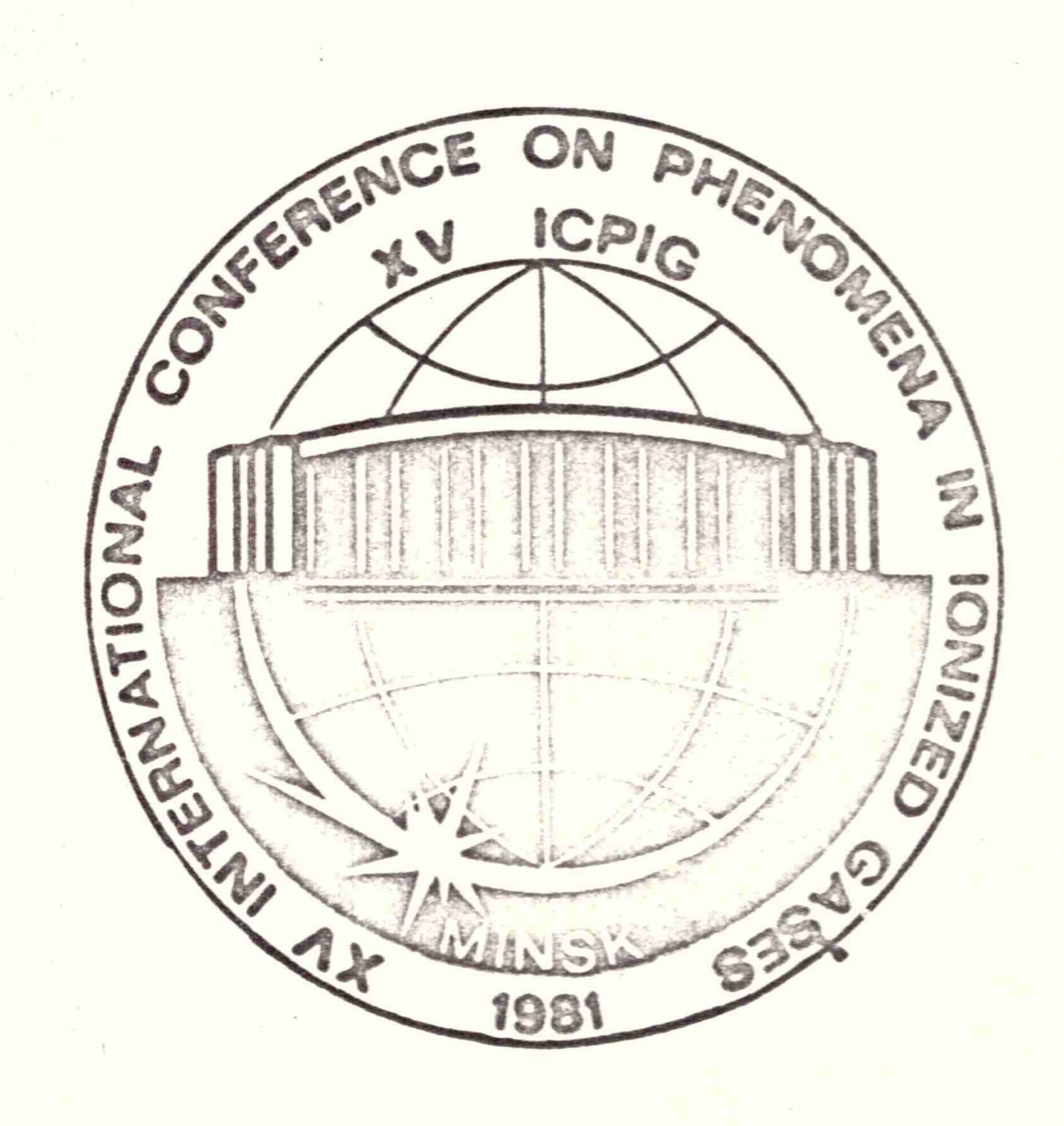
Contributed Papers Part II

PRIENOMENA IN IONIZIO GASIES 1981



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INVESTIGATION OF SHOCK-COMPRESSED ELECTRIC ARC PLASMA

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experimental investigation of the electric arc plasma compression by detonation products. Due to ionization and energy transfer to internal degrees of freedom, under a single electric arc plasma compression a twofold increase in temperature is observed, and the compression is about 10. This in turn results in the arc resis- the parameter distribution. Then the arc on the resistance can increase by several of RDX with an initial density of 1g/cm3. times.

Numerical modeling. The one-dimensional problem of the electric arc developdiant thermal conductivity and energy release due to current are taken into account. The radiant energy flow is divided into two parts: for a red part of spectrum efficient and radiation energy are respec- pressed by explosive detonation products. tively averaged. Radiation and absorption The arc is spatially bounded by long plane shock waves the compression and resistance electrodes and transparent walls transmit- increase of plasma are in agreement with ting all the radiation. The density-temperature distribution of gas within the

This paper presents a theoretical and 1x1x5cm volume is shown in Fig. 1. The data were recorded when the current passing through the arc achieved the maximum value (42.4 µs). The arc initiation is modelled by pre-scribing a high temperature within a narrow layer at the center of the gap under consideration. At this moment of time the value of temperature slightly effects on tance growth. Under a multistep compressi- plasma is compressed by detonation products and the 1x1x3 cm volume. The shock wave generated before the interface between detonation products and plasma propagates ment in neon is considered. It is supposed through the arc and, in addition, heat plasthat a local ionization equilibrium is ob- 'ma inside it. Inspite of the increase in temserved at each point of inviscid gas. A ra- perature and plasma conductivity determined in the Frost approximation. a total arc resistance increases.

Experiment. Plasma was generated by an electric discharge (Fig. 2). When current and an ultraviolet one. The absorption co- achieved its maximum value, plasma was com-The discharge development has been completare considered in a continuous spectrum on- ed by that moment of time. The experimental ly, the magnetic field effect being ignored results show that in the direct and reflected the calculated values and are about 10. Further plasma compression is not recorded

due to a hydrodynamical instability development at the interface between plasma and detonation products. The instabilities cause the energy dissipation from plasma which is 30 times as high as the calculated value. The gap resistance also grows more quickly. During several microseconds a total plasma decay takes place, though the supplied electric power is increased more than by two orders. When the initial plasma density decreases, the characteristic instability dimensions decrease, the plasma existence time being decreased too.

The use of the plasma decay for the current switching in the inductance energy accumulators (Fig.2) allows the current of several dozens of kiloampers to be cumulated during several microseconds. A characteristic dependence of current, voltage on electrodes, resistance and power released in plasma on time is illustrated in Fig.3. The maximum voltage gradient achieved 70 kV/cm, and the commutation power, at the above-mentioned dimensions of the compression vessel, was ranged from 10 to 10

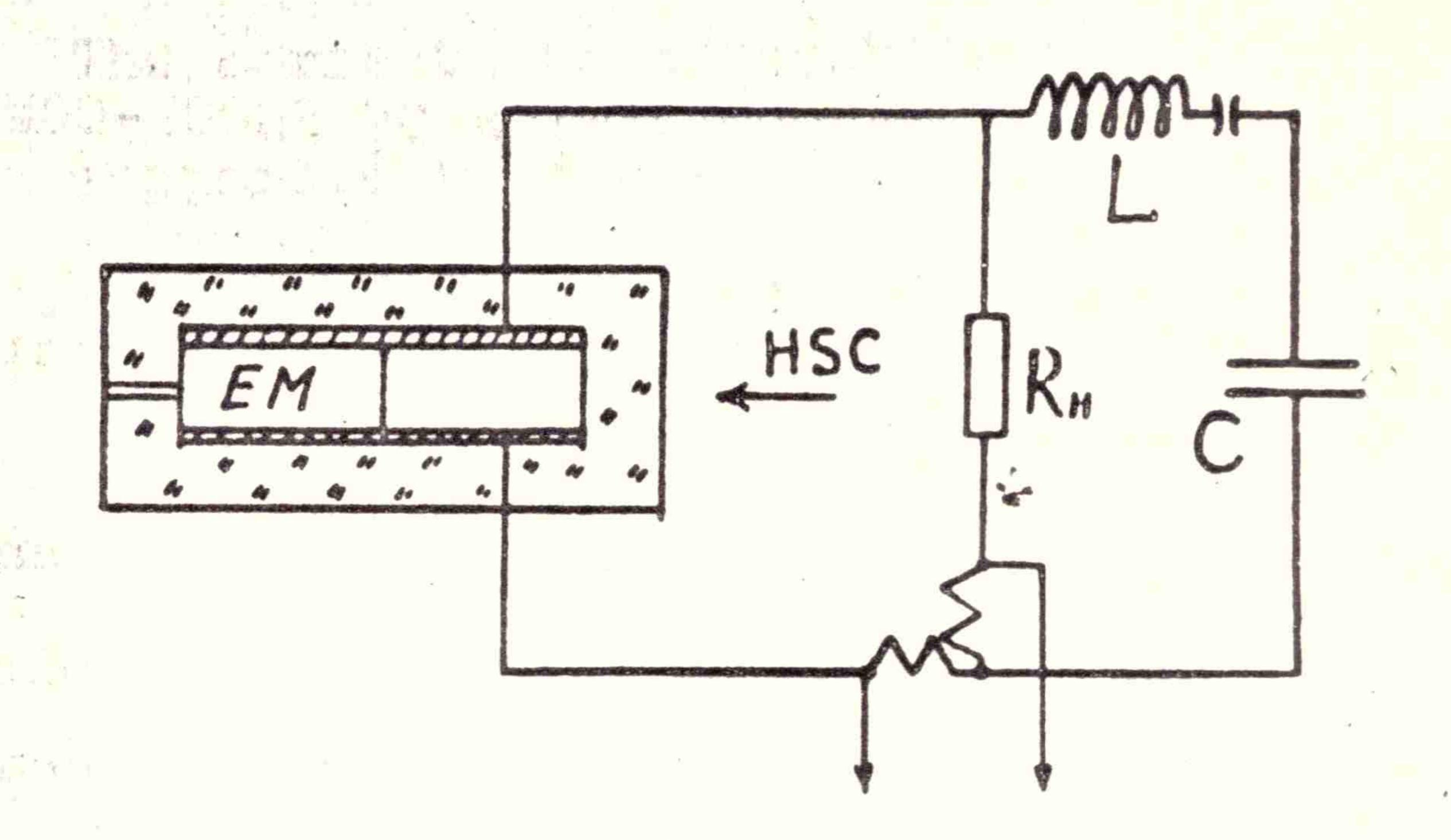
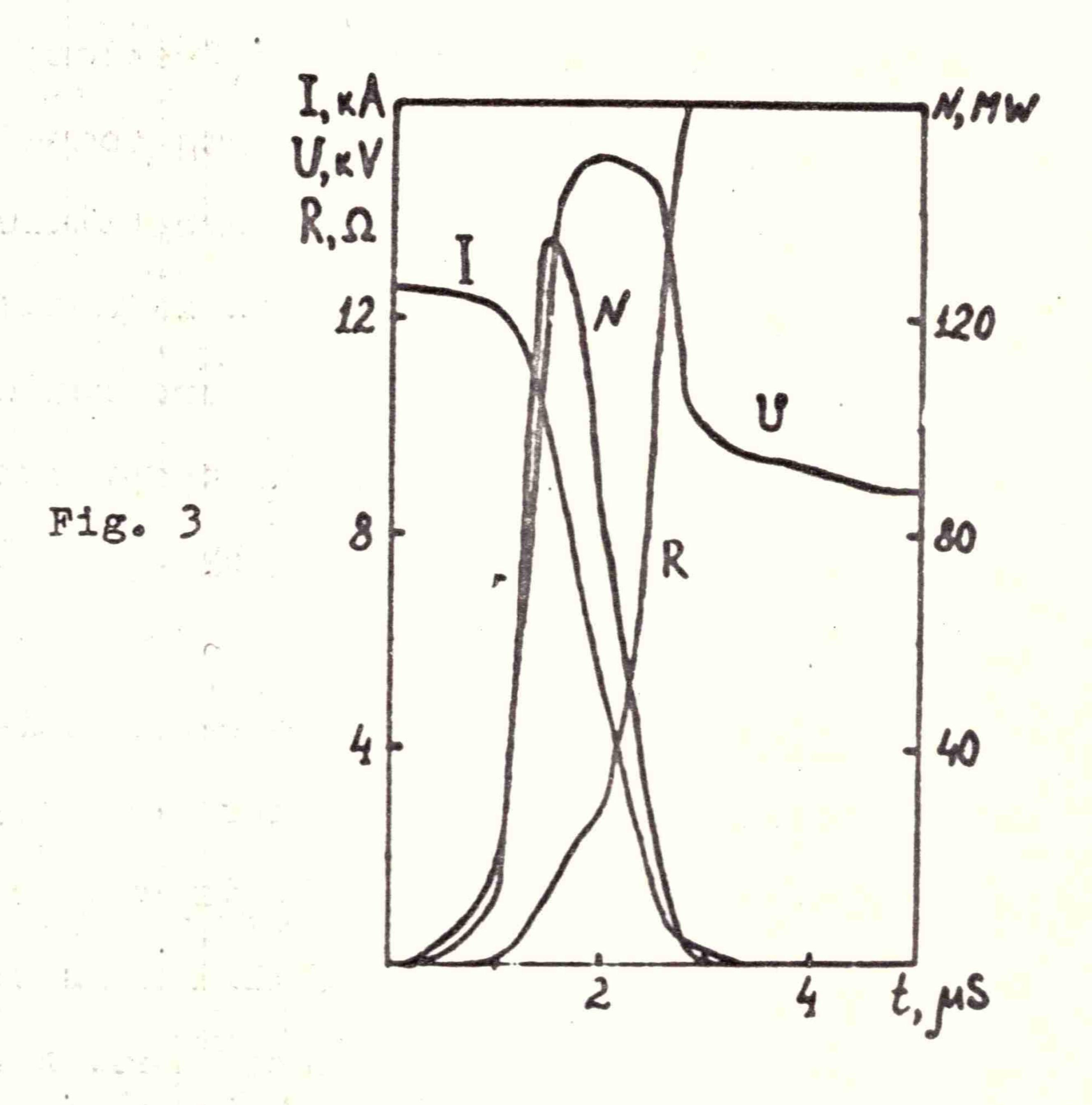


Fig. 2



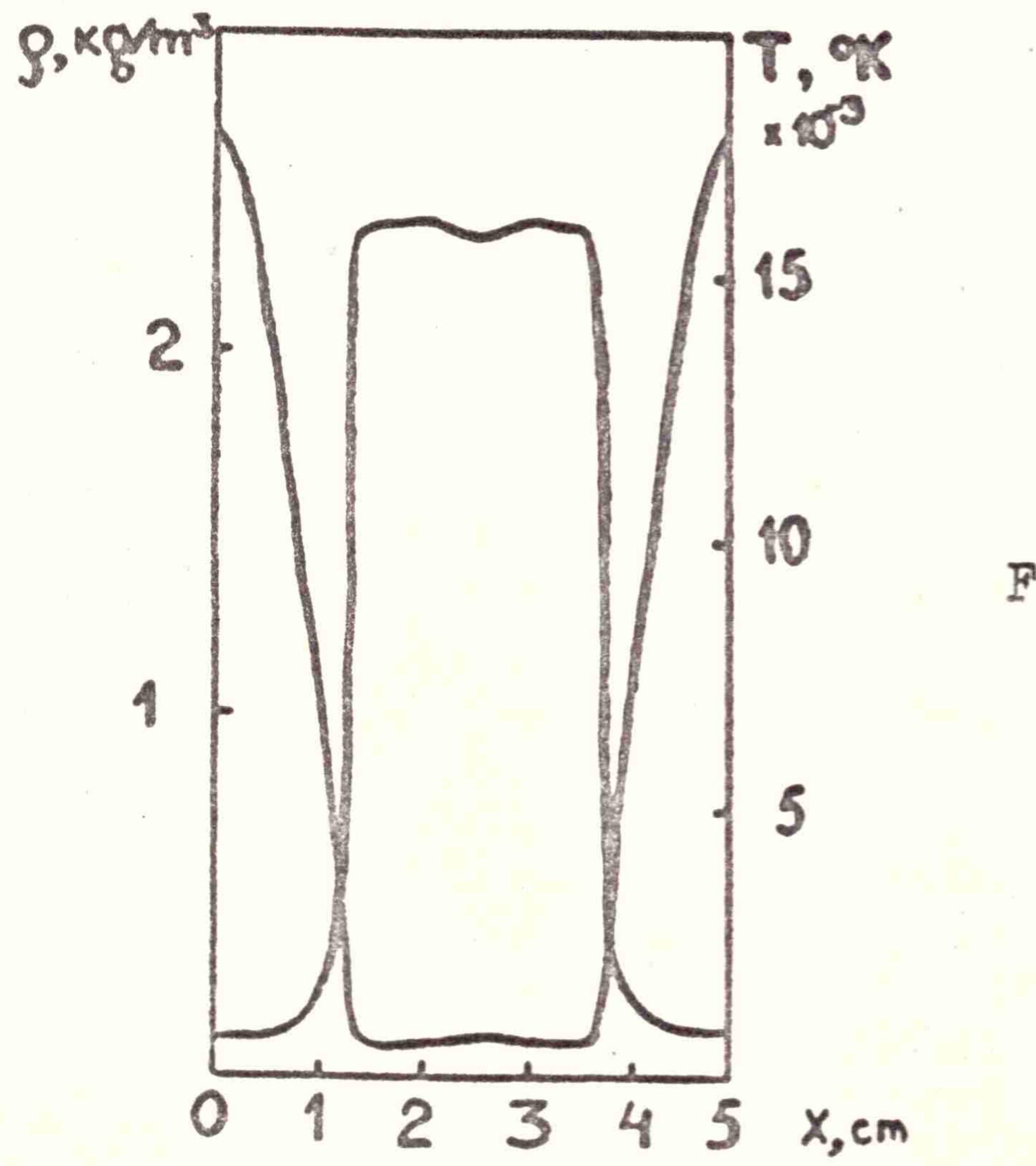


Fig. 1