tion of a superconducting magnetic system (at currents $I > I_p$.

The concepts developed in these investigations described above make possible the formulation of conditions necessary for a safe and reliable operation of a stablized SMS. These concepts have, in particular, led to the establishment of the causes of the breakdown of large SMS, described in the literature in recent years, and the discovery of methods for eliminating the possibility of these breakdowns.

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V. I. Rakhovskiĭ. The Dynamics of the Near-electrode Regions in Electric Discharges.

This paper deals with the systematic study of the dynamics of the development of strong-current-discharge cathode spots on different materials in wide ranges of pressure and current, with the object of establishing the basic laws governing the development of cathode spots as a function of the thermo-physical and atomic constants of the cathode material and the parameters of the external circuit: the formulation, as far as possible, of a simple physical model for the cathode region of the vacuum arc; an approximate theoretical description of the dynamics of the development of cathode spots, taking into as full consideration as possible the interrelated processes that ensure the continuity of transfer of current in this region; and a search for conditions for minimum erosive action of the cathode spots on the electrode.

For the study of the dynamics of the development of cathode region discharges ($I = 5-4000$ A, $P = 760-10^{-5}$ mm Hg), we used an experimental setup which allowed us to make observations on the cathode spots with sufficient time resolution (10^{-8} sec.) by means of an electron-optical converter and at the same time determine the spectra of the cathode plasma by means of a diffraction spectrograph equipped with a special double-ray photoelectric attachment.

Erosion of the electrodes was investigated using optical and mechanical profilographic methods. As cathode materials we used Sn, Pb, Zn, Cd, Sb, Al, Cu, Pb, Au, Ag, Pt, Ni, Mo, and W.

The investigations showed that after a sparkover on the surface of the cathode there appear near the anode spots of high current density (10^6 A/cm^2) moving rapidly (10^2-10^4 cm/sec) in all directions. Each spot exists entirely independently. The characteristic time of stay of such spots (spots of the first kind) in one place varies, depending on the metal and the external conditions, from 5×10^{-7} sec to 10^{-5} sec. The lifetime of one spot did not exceed 10^{-5} sec. The duration of such conditions in the cathode region increases with increasing thermal conductivity and vapor pressure of the electrode material. The warming-up of localized sections of the surface of the electrode and the decrease in the pressure and in the atomic weight of the surrounding gas create conditions under which the necessary level of production of vapor in the near-cathode region becomes possible only when the individual spots coalesce, their velocity of motion decreases, and the so-called group or multiple spots (spots of the second kind) appear.

These spots appear after time lapses of $10^{-4}-10^{-3}$ sec from the instant of appearance of the discharge on the warmest part of the surface of the cathode, which, more often than not, is situated in the immediate vicinity of the anode. Spots of this kind are closely connected together: any individual spot, which leaves the boundary of the area occupied by the group, dies off. The current density in these pots is noticeably low ($2 \times 10^4-10^5$ A/cm^2) and the velocity of motion is negligible (5×10^1 cm/sec) and what is more, these quantities decrease with increasing thermal conductivity and latent heat of vaporization of the cathode material.

The study of the erosion caused by the spots of the first and second kinds showed that while the former do not leave practically any noticeable traces of destruction, the existence of the latter leads to the appearance of considerable localized destruction of the material of the cathode.

On the basis of these experimental investigations, the following model for the development of the processes in the near-cathode region was proposed. Ions create near the surface of the cathode a region of positive space charge whose field acts on the potential barrier at the metal-vacuum boundary, lowering and narrowing the barrier and thereby facilitating the emission of electrons. The incident ions heat the cathode by transfering to it their kinetic and potential energy. The heating of the electrode causes the electrons to occupy energy levels above the Fermi level and, consequently, facilitates electron emission; besides, it causes the evaporation of the electrode material. When the emitted electrons are accelerated into the region of the positive space charge, they ionize the neutral atoms which, now as ions, move towards the cathode, whereby the cycle is completed.

Comparison of the results of theoretical calculations for copper, based on the proposed model, with experimental results gave good agreement and explained a number of peculiar features of the dynamics of the development of cathode spots.

The change from fast-moving to slow-moving spots is quite natural and is connected only with the heating of localized areas of the cathode and with the increase in size of the region of effective emission and evaporation and, consequently, with the decrease in current density, which, as experiment shows, decreases as the discharge develops. In connection with this, as a result of the heating of the cathode, electrons emitted from energy levels above the Fermi level begin to play the major role, i.e., a transition from the cold to the thermionic emission mechanism occurs. The characteristic times of transition from the high-velocity to the low-velocity spots are determined by the characteristic times of heating of localized areas of the surface of the cathode and by the conditions which determine the scattering of the vapor by the surface of the spot.

In view of the fact that the condition for the activity of a spot is determined by the conditions under which ions are produced, the use of additives with large ionization cross sections sharply lowers the loss of cathode material.

Thus the dynamics of the development of emission and erosion processes on the cathode is determined by the dynamics of the appearance and movement of ions in the near cathode region and the dynamics of the heating of the electrode. By changing the parameters that determine these processes, i.e., by using materials with the requisite thermo-physical and atomic constants, we can control the dynamics of the development of cathode processes.

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Ya. A. Ryftin. Prospects for a Radical Increase of the Resolving Power in Television.

The quantity of information obtained through television depends on the resolving power of the television system, which is determined, in the first place, by the resolving power of the transmitting TV tube.

The resolving power of existing tubes does not satisfy the ever-increasing requirements. It is not even high enough for the realization of the potentialities of standard 625-line television, and as a result, the quality of TV broadcasts does not exceed 25% of its possible value[2], while for the solution of many important problems (cosmic, holographic, motion-picture TV, etc), tubes with resolving power at least one order higher are already needed.

All the known methods of raising the resolving power have almost been exhausted. In this paper we describe new ways of solving the problem[1]. They are based on the "pulsation effect - the adaptation of the spots on the charged screen of a cathode-ray tube"[3], established by this author, the main points of which are as follows. The beam storage tube works only when the scanning electron beam contains an alternating passive part, which serves as the reserve buffer that forms the information-carrying component of the video signal. Under these conditions, the tube target is discharged primarily by the front active part of the electron beam, the size and form of which adapt themselves to the displacement (number) of lines and to the mode of scanning, and pulsate together with changes in charge density in the scanned parts. On the basis of this effect, we propose a new principle for tube improvement which leads to an increase in the ratio, unlike the known methods, which always worsen this ratio.

A new method of transmission is also proposed. It comes down to a multi-line scanning of the height-anamorphized image picture on a large spherical target of a wide-angle tube, which the author calls "sphericon." The angular deviation of the scanning beam in a sphericon increases in direct proportion to the number of lines and to that distance between the lines at which the preliminary plotting of the changes, which limits the resolving power, decreases to the optimum value.[4]

Thus, real prospects present themselves for the construction of transmission TV tubes of very high resolving power (up to 10,000 lines and more). Such tubes are indispensible not only for solving the applied-television problems noted above. They will make possible a radical improvement in the quality of television broadcasts. By means of high-frequency oscillation of a small spot of a sphericon, it will be possible to effect a standard 625-line scanning by a "small slit" and to increase the quality of the telecase by a factor of four or more with respect to the present quality. And all that without the necessity for innovating or changing the existing television studios and television sets!

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