Chapter 7
Years of War

On Sunday, June 22, 1941, J.I. woke up early as usual, had breakfast and started working in his study. A preexam consultation had been scheduled for 1 p.m. at the Polytechnic Institute; it was the end of spring examinations, and Frenkel with his family would be going on vacation afterwards. The resort place had been chosen and the train tickets even purchased long before. But then the radio brought terrible news about war: for several hours the fight had already been thundering on the western borders of the USSR. A deep gulf emerged in the life of every Soviet citizen, and everything, even recent happenings, became distant: «this occurred yet before the war».

In the morning of June 23, Frenkel went to the recruiting point of his Vyborgsky district in Leningrad. He appealed to be accepted as a volunteer in the Red Army, but his name was known in Leningrad. The District Military Commandant said to him: «Professor Frenkel, think, where would you be of more use? At the front we would be able to make use of only your hands. Your knowledge is needed much more.»

With the beginning of the war the work of a number of the PTI laboratories was reoriented towards military subjects. Frenkel managed to get connected with the scientists of these laboratories, consulted the researchers from there, and tried to invent something by himself. One of the topics was prompted by the city’s Anti-Aircraft Defense, to which Frenkel had reported with a proposal of service. There were «white nights» in Leningrad, but the fall was not at all far off. And then the problem of the blackout of the city would arise. And in July and August on dark enough evenings and nights, tramcar flashes broke the blackout.

On July evenings J.I. would stand for a long time at the last tram stop across from the Polytechnic Institute observing the dazzling flashes and pondering the frequency of their appearance. He figured out how to eliminate the flashes by conceiving of a way to keep the tram’s brush contact and the wire from disconnecting. Later on this work was published. It is significant that even in such a strictly technical calculation problem Frenkel adhered to his usual way of exposition: the article is written in vivid language and the ideas are illustrated with analogies ...

The other question Frenkel got interested in was the problem of the armour-piercing ability of materials, their interaction with bullets and shells. A group

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1) Recently Professor I.I. Zuckerman, in the article «My teacher», dedicated to the memory of G.A. Grinberg, recalled how he had entered the People’s Emergency Volunteer Corps at the very beginning of the war: «My decision [to enroll — V.F.] was directly influenced by what I had been told in the Dean’s Office [of the Physics and Mechanics Department of the Leningrad Polytechnic, where he had just completed his third year — V.F.]: among the enlisted volunteers were Jacov Il’ich Frenkel and Georgiy Abramovich Grinberg.»

2) JETP, v. 12, 1942, p. 171 (in Russian).
of PTI researchers had suggested some interesting ideas about diminishing of the armour-piercing action (striking force) of projectiles by mounting one or two special grating screens on the front part of a tank hull. The screens would provide the striking projectile with a transverse displacement before it hit the armor; now it would hit at some angle, sometimes even tangentially, and thus the force of the impact would be smaller. The same screens might also cause an early shell-burst, which was desired, since the armor would better resist shell-splinters. It is interesting to note that, according to the Marshall I. Konev’s memoirs, during the storming of Berlin, the tank hulls were «shielded» by sheets of thin tin, with the same objective: they «knocked off» the front strikes of the Faust-cartridges. Such a simple tool proved to be very efficient!

In the beginning of 1942, Frenkel presented his calculations related to these and similar questions in the form of reports entitled «On the resistance of fibrous media to the motion of a bullet», «On the bending of the shell or bullet axis moving in a medium with high resistance», and «Statistical theory of the turn of a projectile (or bullet) penetrating a grating perpendicular to its trajectory».

Before the war Frenkel had been more or less regularly consulting some works on determining aircraft velocity and the formulation of principles for its measurements with the help of the cockpit instruments.

M.S. Sliozberg, a staff member of one of the special Leningrad institutes, recalled that in 1939 Frenkel did a presentation at his institute on the design of a radar system to locate planes. After the war began, J.I. returned to this problem and improved the initial project. Calculations related to these ideas were carried out at the PTI in a tight collaboration with the members of Yu.B. Kobzarev’s laboratory who dealt with the pulse radars.

On 1 October 1941, Frenkel wrote from Moscow to his brother, Vladimir II’ich (V.I. Frenkel was mobilized from the very start of the war and served as a military medical doctor in the 23rd Army of the Leningrad front until the war ended): «... I went to Moscow on the order of S. Kaftanov, a representative of the State Defense Committee. I had written him about my Anti-Aircraft radio invention and asked him to summon me from Kazan’, and the engineer guiding the work at the plant, from Leningrad, to transfer the whole work to Moscow. I don’t know what will come of it. Until now I have had no information about the progress of the work from Leningrad. Possibly, the plant has been evacuated.»

At the conference in Moscow where Frenkel’s results were reported, Professor S.E. Khaikin was present. He later recalled that it was the electrodynamic calculation of the detection system suggested by Frenkel. The latter consisted of a high-frequency continuous transmitter and several optimally positioned receivers. One was able to determine the coordinates and velocity of the target by the Doppler frequency shift of the radio signal reflected from the moving plane.

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