sult of the interaction of the superconducting vortices with the surface of the superconductor.

6. Modern materials capable of carrying large currents are obtained as a result of complicated mechanical working and heat treatment. This produces in them a layered-filamentary microstructure. The separation of the normal-phase particles usually begins on the boundaries of the fibers. Therefore the film considered in Sec. 5 can be regarded as a certain idealization of such a fiber. This uncovers the possibility of combining the "sponge" and "pinning" models. It is possible that the peak effect in the film (see the figure) explains the peak effect observed in many rigid superconductors.

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V. L. Tal'roze. Chemical Lasers.

The present status of research and the results attained in the field of chemical lasers, compared with other existing types of lasers, are quite modest, although the very idea of chemical lasers is almost as old as the lasers in general. Non-equilibrium excitation in the associated chemiluminescence of the products of a large number of chemical reactions have been known for a long time, and have been investigated in sufficient detail. On the other hand, the formation of an inverted population of vibrational levels was apparently first observed by Polyani in 1961 in the HCl molecule produced in the reaction between atomic hydrogen and the chlorine molecule. It was this reaction which led, in final analysis, to the development of the first chemical laser in 1965 by Casper and Pimentel.

What attracts researchers to chemical lasers is apparently the following: (1) The large energy reserve per unit volume and weight of the reacting substance. (2) The practically unlimited volume in which the process of such an energy release can be organized. (3) The possibility of direct transformation of chemical energy into an energetically perfect optical form of energy and the production on this basis of laser power systems, which so far, of course, are still in the fantasy stage.

In the USSR, papers on chemical lasers were published by four groups of scientists: N. G. Basov, A. N. Oraevskiĭ, and co-workers (Physics Institute, USSR Academy of Sciences), Dolgov-Savel'ev and co-workers (Nuclear Physics Institute, Siberian Division of the USSR Academy of Sciences), R. V. Khokhlov and co-workers (Moscow State University), and the author's own group at the Institute of Chemical Physics of the USSR Academy of Sciences. So far, all the actually operating chemical lasers are based on chemical reactions in which they are elementary acts that lead to the formation of vibrationally-excited molecules HCl, DCl, HF, and DF. In 1963, the author presented the principles of the kinetic theory of the chemical laser. One of the conclusions of this theory was the advantage of chain and especially branched-chain chemical reactions as the working process in chemical lasers. There are at least two such advantages: the possibility of transferring the system from a relatively stable state into a state of rapid reaction to small changes of temperature or pressures, namely the transfer of the system to the ignition region, and the spontaneous increase of the reaction rate in this region as a result of branching of the chain to rate values at which the creation of inversion overtakes the relaxation to such an extent that generation with considerable efficiency becomes possible. The first generation with the aid of a branched-chain chemical reaction was realized in 1968 by the author together with G. K. Vasil'ev and O. M. Batovskii. The working mixture was the hitherto unused $H_2 + F_2 + O_2$ mixture. The branched-chain character of the chemical reaction in this mixture was discovered earlier by N. N. Semenov, A. E. Shilov, and co-workers at the Institute of Chemical Physics. The branching itself is here energetic ($HF^* + F_2 \rightarrow HF + 2F$). With the aid of a low-power and short electric discharge it was possible to transfer the mixture to the region of self ignition both through the first and through the second limit, and short generation pulses were obtained, lasting several microseconds, with a peak power on the order of 10 kW and a chemical efficiency up to 2%.

The constants of the rates of all the elementary acts of the reaction were measured independently, and this made it possible to construct a semiquantitative theory of such a laser; the conclusions of such a theory are in satisfactory agreement with experiment.

The published data on chemiluminescence on electronic transitions, on the basis of which no one has yet succeeded in developing a chemical laser, are analyzed in the paper. In particular, strongly luminescing reactions in liquids are considered, particularly reactions of the type that determine the luminescence of biological objects (e.g., oxidation of luciferin, where the light yield reaches 88 photons per 100 reacting molecules). The main problem, for which a solution is still unknown, is that of "rapid" realization of these reactions.

V. V. Fadeev. Ultraviolet Lasers Using Organic Scintillators

1. One of the important problems of quantum electronics is to obtain powerful radiation in the UV band and to ultimately cover the entire band. To solve this problem it is necessary to produce in the UV band sources whose frequency can be continuously varied. One of the promising methods is the method of converting the frequencies of the available sources (e.g.,