VI. THE LINEAR-ACCELERATOR PROGRAM

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Modifications and installation of the accelerator in the concrete radiation shield have been completed. Difficulties with the Van de Graaff generator have continued and although it is believed that all of the problems connected with its operation will be solved eventually, a microwave injector system is being developed for accelerating the electron beam from low energies up to 2 Mev. A new analyzer has been designed for studying and monitoring the output of the accelerator. Work on a high-current electron source for the Van de Graaff generator is nearly finished. Some details of the foregoing are given below.

On the basis of preliminary tests, the modifications made in the accelerator design concurrent with moving it into the concrete shield are successful. Tuning, phasing, and elimination of undesired modes of oscillation appear satisfactory. No tests have yet been made of output energies, but the performance of the microwave system gives strong indication that the acceleration will be considerably increased over the original values obtained. Some breakdown trouble has been experienced in one of the three-foot sections. This has apparently been caused by some exceedingly rough spots and sharp points on the edges of some of the irises in that section, and these irises have now been polished ready for new tests.

A basic difficulty has shown up in the use of the Van de Graaff generator in a horizontal position, as required for obtaining a horizontal electron beam. It has developed that the column is not mechanically satisfactory for horizontal mounting and that it gradually creeps and finally breaks under the stresses set up. This difficulty will require redesign of the column. A new design is now being developed by the manufacturers of the generator.

The possibility of considerable delay until the Van de Graaff generator will be available for injection of high-energy electrons into the accelerator has caused us to investigate the possibilities of using a microwave injector system. Theoretical work on this system is well advanced and preliminary tests on components are under way. In essence, the system can be described as follows: electrons of about 30 kv will be injected into a single cavity acting as a klystron buncher; after passing through an appropriate drift space, the electrons will be accelerated to around 1.5 Mev by means of a cylindrical cavity fed by two magnetrons and then injected

into the accelerator. A coaxial magnetic field will be used to keep the beam down to a small cross-section. This system will have the advantage that the beam can be bunched so as to cut down on the energy spread of the accelerated beam. Power and phasing controls will allow for easy adjustment to optimum operating conditions.

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