PROGRESS IN NUCLEAR ENERGY REACTORS*

THE Geneva Conference on Atomic Energy resulted in the release of such a vast amount of information, that many attempts have been made to present this information in a compact and easily accessible form. The 'Progress in Nuclear Energy' Series does this in eight volumes, and the present volume is the second of the series and deals with reactors.

The first five chapters of the volume deal with research reactors while the remaining six chapters deal with power and production reactors. The research reactors are dealt with on a territorial basis, each of the chapters describing the reactors in Canada, U.S., U.S.S.R., the European Continent (France, Norway and Sweden) and the U.K.

The research reactors recently built or under construction are mostly of three types. Firstly we have the enriched U-ordinary water heterogeneous reactors of the M.T.R. and swimming pool type. These reactors have generally a small volume and a high power and flux density and are very useful in that they provide not only high thermal fluxes but also high fast fluxes, which are essential for radiation damage studies. There is a detailed description in the book of the design and construction of the M.T.R. and of the determinations of its various characteristics, and briefer descriptions of other reactors.

The other popular type of reactor is the heterogeneous heavy water one using mostly natural and sometimes enriched U. The European and Canadian reactors are all of this type and there are detailed descriptions in the book of the NRX in Canada and of the Chatillon and Saclay piles and of the many reactor physics experiments made with these. These types of reactors give high thermal fluxes and having fairly large volumes, are able to provide extensive experimental facilities. They are also very useful for testing out fuel assemblies and lattice designs for power reactors.

The third type of research reactors described are the homogeneous reactors in the U.S. using enriched U and ordinary or heavy water. These have many advantages but seem unable to give high fluxes.

The second half of the book is devoted entirely to a consideration of existing and proposed power and production reactors. The production part is important inasmuch as it appears that nuclear power will not be competitive with power from other sources unless the production of plutonium or U_{233} is taken into account. The power reactors in any country ultimately will not consist of a single type but of several types integrated for optimum power and production.

Britain and Russia seem to be interested in developing as soon as possible a reactor which would be able to produce large quantities of electrical power on a commercial scale. It is interesting that they have both pitched upon the graphite-U type as the one which promised quickest immediate development. There is a detailed description in the book of the Calder Hall reactors which have now come into operation. There is no description however of the Downreay fast reactor, which is the other type the British have decided to develop and only a very brief account of the Russian power reactor.

The rest of the book is devoted to a description of the proposed types of power reactors in the United States. The differences between the types lie mainly in the different ways of extracting and utilising the heat produced in the reactor. In the P.W.R. which is described in great detail, the heat transfer is made with pressurised water which attains a high temperature in the reactor without boiling, while in the boiling water reactor, steam is generated in the reactor itself. The P.W.R. is also interesting in that it employs a type of reactor with highly enriched U seeds in natural U assembly. In homogeneous reactors, the whole solution or slurry is circulated. There is a detailed description of the sodium-cooled graphite reactor There is a discussion of fast reactors without a description of any actual reactor. The possibility of fast power reactors depends largely on high heat transfer performance which is just possible with liquid sodium coolant.

There is a very useful catalogue at the end of all reactors existing, dismantled, building or proposed. There is an interesting foreword by Sir Christopher Hinton.

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