

used increasingly in modern buildings, have been examined. Special studies have been made to improve winter building techniques and there is a section devoted to problems of building in Northern Canada. Building on permafrost in the Far North presents a continuing challenge, and the Division assisted recently in the construction of the Kelsey Rapids hydro-electric plant in northern Manitoba.

Many results of the Division's research are expressed in the National Building Code, an advisory document of building standards increasingly used by the provinces and municipalities. The Division also establishes the building regulations for all houses built with National Housing Act assistance.

**Mechanical Engineering.**—This Division works mainly in the fields of mechanics, hydrodynamics (hydraulic engineering and naval architecture) and thermodynamics. Extensive testing and specification work is undertaken for a variety of industries and for government departments. Much of the work consists of continuing projects related to land, sea and air transportation.

The mechanics activities include mathematical analysis and computation, the development of instruments and servomechanisms, and research on mechanical devices such as gears. One group, working in the field of bio-medical engineering in collaboration with surgeons, has devised a tool for end-to-end joining of blood vessels by a simple stapling operation.

In hydraulics, a number of investigations and models have been made for improving Canadian harbours. As a result of these studies, a new kind of breakwater has been developed which absorbs waves rather than reflects them. Model tests have been successful and means of carrying out full-scale tests are being explored. A promising scheme has also been developed for reducing silt accumulation in harbours by wave energy. The ship laboratory has continued its studies on propeller, rudder and hull design and performance.

Railway work is devoted mainly to locomotives and the riding qualities and mechanical behaviour of freight cars. The improvement of braking systems and the use of cheaper fuels are being investigated. A long-term study is being made of the possible use of gas turbines in locomotives. The application of gas turbines to aircraft taking off and landing vertically is also being explored, together with the thermodynamic, aerodynamic and control problems that this type of aircraft involves. Considerable research is also being done on the behaviour of lubricants at high pressures, and that of gases at extremely high temperatures.

**National Aeronautical Establishment.**—The National Aeronautical Establishment is designed to meet the aeronautical research needs of military and civil aviation, to co-operate with the Canadian aircraft industry, and to carry out its own research program. Its studies therefore centre around problems of aerodynamics, aircraft structures and materials, and flight mechanics.

Aerodynamics research from low speeds up to a Mach number of about 12 is carried out in the Establishment's wind tunnels. Considerable attention is being given at present to low speed problems of vertical and short take-off aircraft. Other studies include work on the aerodynamic characteristics of high-thrust propellers, on wings with submerged fans, and on wings immersed in powerful slip-streams.

The research on structures and materials involves investigation of aircraft accidents, the fatigue and creep of aircraft structures, the determination of flight loads, aircraft design problems, and non-metallic materials. The latter study is part of a research for low density, high strength non-metallic materials resistant to high temperatures that could be used for structural purposes.

The flight mechanics program covers research on flight safety and flying stability and control; the development of a crash position indicator for locating crashed aircraft; atmospheric physics; anti-submarine magnetometry; and the avoidance of aircraft collisions.