

Friction discs for aircraft brakes have been developed for many aircraft programs. Development work is already under way for brakes on the next generation of planes.

In automotive and industrial friction materials, research also continues to contribute product improvement both in frictional characteristics and wear life. A growing number of sintered metal formulations are being developed and tested in order to meet increasingly severe applications.

Railroad brake shoes have been the object of continuous study in the form of cast metal, sintered metal and composition materials. The laboratory has made substantial progress in developing a new type of brake shoe material that shows promise in laboratory and service tests.

During the year, a research project was initiated in collaboration with a roller bearing manufacturer to design and develop a roller bearing for freight cars.

Considerable progress was made at the Hydrodynamics Research Center in the development of new industrial hydraulic equipment. A series of smaller, lighter and more economical pumps has been transferred to production. Work continues on the refinement of electronic devices for the control of hydraulically operated equipment such as presses and machine tools. This research group also developed the control system for our hydraulically powered freight car retarder, which was placed on the market in 1963.

Hydraulic research for aerospace was concentrated primarily on the development of components and systems for specific aircraft or missile programs. A considerable variety of pump-motor packages, auxiliary power units and actuators has been designed, accepted, and placed in successful operation for both military and commercial customers.

AFFILIATED COMPANIES

Lloyds-Brake Shoe Limited in England experienced a good year in 1963, with high production of centrifugally cast tubing, precision cast tire molds and heat-resistant alloys. During the year, the agreement with Lloyds was expanded to cover some manganese steel products which we anticipate will enhance our association with this company in future years.

Sifco do Brasil, S/A is a forging company in which Brake Shoe owns one-third interest. Although the operation of this company is profitable in local currency, the future outlook depends in large measure upon whether or not Brazil is able to attain a greater degree of political and economic stability.