Chapter - 1

INTRODUCTION

Fluid power is probably as old as civilization itself. Ancient historical accounts show that water was used for centuries to produce power by means of water wheels, and air was used to turn windmills and propel ships. However, these early uses of fluid power required the movement of huge quantities of fluid because of relatively low pressures provided by nature.

Fluid power technology actually began in 1950 with the discovery of Pascal's law: Pressure is transmitted undiminished in a confined body of fluid. Pascal found that when he rammed a cork down into a jug completely full of wine, the bottom of the jug broke and fell out. Pascal's law indicated that the pressures were equal at the top and bottom of the jug. However, the jug has small opening area at the top and a large area at the bottom. Thus, the bottom absorbs a greater force due to its larger area.

In1750, Bernoulli developed his law of conservation of energy for a fluid flowing in a pipe line. Pascal's law and Bernoulli's law operate at the very heart of all fluid power applications and are used for analysis purposes. However, it was not until the Industrial Revolution of 1850 in Great Britain that these laws would actually applied to industry. Up to this time, electrical energy has not been developed to power the machines of industry. Instead, it was fluid power that, by 1870, was being used to drive hydraulic equipments such as cranes, presses, winches, extruding machines, hydraulic jacks, shearing machines, and riveting machines. In these systems, steam engines drove hydraulics water pumps, which delivered water at moderate pressures through pipes to industrial plants for powering the various machines. These early hydraulic systems had a number of deficiencies such as sealing problems because the designs had evolved more as art than as science. Then, late in the nineteenth century, electricity emerged as a dominant technology. This resulted in a shift of development effort away from the fluid power. Electrical power was soon found to be superior to hydraulics for transmitting power over great distances. There was a very little development in fluid power technology during the last 10 years of the nineteenth century.

The modern era of fluid power is considered to have begun in 1906 when a hydraulic system was developed to replace electrical systems for elevating and controlling the guns on the battleships USS Virginia. For this application, the hydraulic system developed used oil instead of water. This change in hydraulic fluid and the subsequent solution of scaling

problems were significant milestones in the rebirth of fluid power. In 1926, the United States developed the first utilized, packaged hydraulic system consisting of a pump, controls, and actuator. The military requirements leading up to the World War II kept fluid power applications and developments going at a good pace. The naval industry had used fluid power for cargo handling, winches, propeller pitch control, submarine control systems, operation of shipboard aircraft elevators, and drive systems for radar and sonar. During World War II the aviation and aerospace industry provided the impetus for many advances in fluid power technology. Examples include hydraulic actuated landing gears, cargo doors, gun drives, and flight control devices such as rudders, ailerons, and elevens for aircraft. The expanding economy that followed World War II led to the present situation where there are virtually a limitless number of fluid power applications. Today fluid power is extensively used practically in every branch of industry. Some typical applications are in automobiles, tractors, airplanes, missiles, boats, robots, and machine tools. In the automobile alone, fluid power is used in hydraulic brakes, automotive transmissions, power steering, power brakes, air conditioning, lubrication, water coolant, and gasoline pumping systems. The innovative use of modern technology such as electro hydraulic closed-loop systems, microprocessors, and improved materials for component construction will continue to advance the performance of fluid power systems.