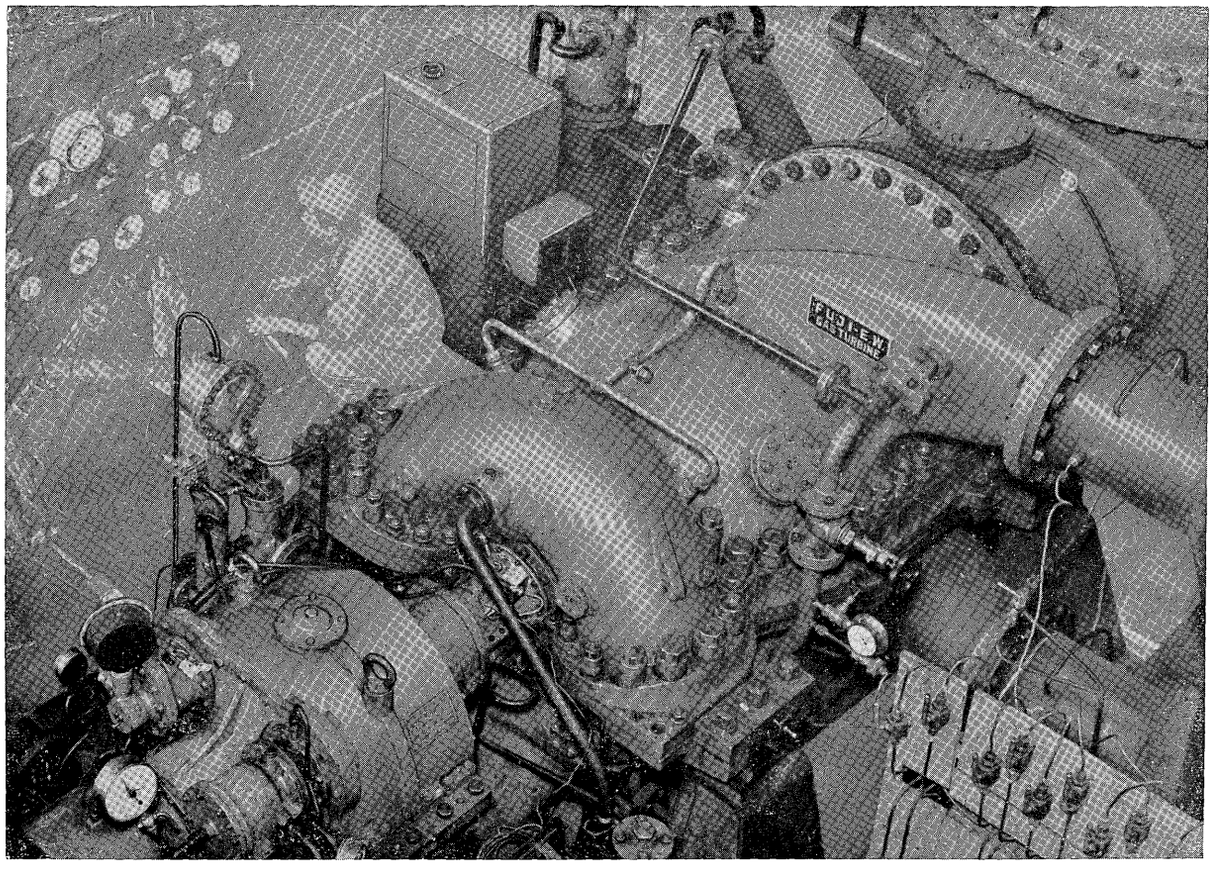

Fig. III·1. 2,000 kW Closed-Cycle Gas Turbine Unit under Trial Operation in Our Works

III. GAS TURBINES

III·1. INTRODUCTION

The closed-cycle gas turbine, based upon its superior principle, has made a continuous and remarkable progress since the completion of the first testing facilities in 1939 by Escher-Wyss Company of Switzerland. Many years of extensive experience in this field gained by engineers in France, England and Germany have contributed greatly to this progress. As for our Company, since 1950, the first gas turbine-generator unit of 2,000 kW output has been designed and manufactured and is, at present, undergoing complete and accurate testing. The picture illustrates the gas turbine unit under trial operation in our works.

In Japan, the difficulties in further development of hydro-power resources have recently become more and more noticeable, resulting in greater importance being placed upon the development of steam power plants. Thus, together with the steam power plant, the gas turbine power plant is accomplishing its share in the development of electric power resources. Due to its comparatively simple construction and high efficiency even for small and medium capacities, the gas turbine is ideal, not only for large capacities in central power stations, but also for installation in small, medium and isolated power plants and offers great possibilities in the future.

III·2. FEATURES

Important features of the closed-cycle gas turbines, already widely acknowledged, are as follows:

a. High efficiency

At present, three sizes of the closed type namely 2,000, 5,000, and 10,000 kW are prepared as standard units. Thermal efficiency of these units is 26 to 32% at the generator terminal or equivalent to 2,700 to 3,300 kCal/kWH in thermal consumption rate. There may be slight variations in the above values depending on the kind of fuel used and the temperature of the cooling water.

b. Constant temperature :

Since temperature at each point in the cycle can be maintained constant without regard to the load, the high efficiency achieved at full load can be attained even at partial loads down to approximately 30% of full load.

Also, at no load, the closed cycle type has low thermal consumption rate.

c. Abundant Fuel

Among the natural fuel resources in Japan, only coal is found relatively abundant and the fact that most prime movers in steam power plants must depend on coal for operation presents a meaning of great importance. In this point, it is in favor of the closed-cycle gas turbine because any source of heat energy, such as gaseous, liquid or solid fuels can be used.

d. Simplicity in mechanism :

As stated above, since the temperature at each point is maintained uniform, control is obtained simply by raising or lowering the level pressure of the cycle. There is no need for the use of a control valve in the high temperature points as is found in the steam turbine and the control is maintained by a simple operation of limiting the highly compressed air flow. Although operating at high temperature, the safety of the gas turbine unit is no less if not better than that of steam power unit.

e. Cleanliness of the cycle :

Since the air used as the working fluid is completely cut-off from the outside, there is no contamination caused by dust in the atmosphere or by the combustion products. Also, since the working fluid has no corrosive properties as are present in fuel gases, there is no need for disassembling and cleaning the inside of the apparatus, and as a result, continuous operation can be maintained without reduction in efficiency.

III·3. 2,000 kW GAS-TURBINE UNIT

The principle and design of the closed-cycle gas turbine, manufactured in our Kawasaki Factory have already been published in detail in Vol. 2, No. 3 of this magazine. This unit which is to be installed at Toyotomi Power Plant of the Hokkaido Electric Power Company, has a turbine inlet temperature of 660°C, level cycle pressure of 8 ata and 2,000 kW output at the generator terminal.

IV. DIESEL ENGINES

The Fuji Diesel Engines are manufactured by the Fuji Diesel Company Ltd. (old name : Tateyama Seisakusho Company Ltd.)

The works was founded as the special factory for manufacture of Diesel engines of the Ikegai Tekokosho (Ikegai Iron Works Ltd., established in 1889) which always occupied a leading position as a maker of Diesel engines and production machines in our country. The factory was constructed in 1942 at Tateyama city at the present site. Since then, the superior Diesel engines both for land use and for ships that have been manufactured there have come to be widely recognized by the industrial circles but in the year 1951 the works became a subsidiary company of the FUJI DENKI SEIZO K.K. and started as its special Diesel engine factory with superior technics and factory equipment. The followings show the recent products.

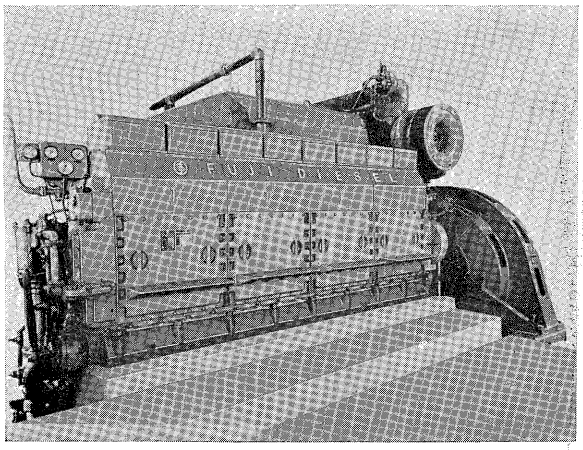

Fig. IV·1. Stationary Diesel Engine, Model 8MD27E 750 HP, 600 r.p.m., Coupled with 625 kVA 380 V 50 c/s A-c Generator, Supplied to the Thai Prasit Company, Thailand

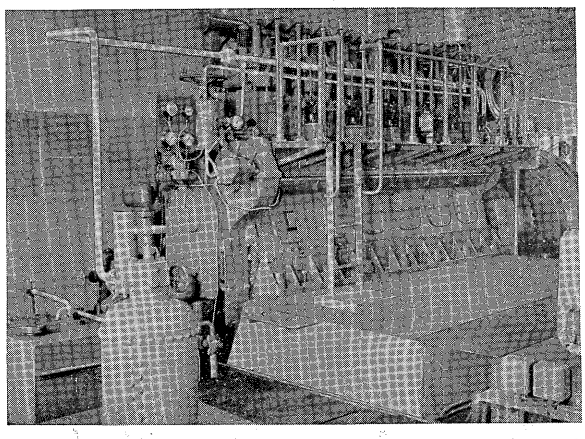

Fig. IV·2. Stationary Diesel Engine, Model 6SD 33E 750 HP 375 r.p.m., Coupled with 625 kVA 3,300 V 50 c/s A-c Generator, Supplied to Toyo Glass K.K.