HIGH SPEED 3 PHASE INDUCTION MOTOR FOR FEED PUMPS OF STEAM BOILERS

These motors have been built for driving feed water pumps of boilers in New Tsurumi Steam Power Plant of the Tokyo Electric Power Company forming a link in the chain of 5 years plan for the development of electric power. They are four in number and are record products in the capacity as feed pump driving motors.

As the feed water quantity of boiler varies in response to the power supply, 2 pumps are provided to each boiler and 2 or 1 unit is operated depending on the power demand with 20% speed control by means of grid resistance inserted to the secondary side of the motor, adjusting the feed water to a wide range.

Fig. 1 Illustrates the pump and its specification is as follows:

Motor	
Construction	Enclosed, drip-proof, wound rotor type.
Ventiration	Self-ventilated
Out put	1,800 HP
Voltage	3,000 V
Number of poles	2
Frequency	50 c/s
Speed	2,970–2,400 R. P. M. (20% speed control)
Rating	Continuous
Pump	
Construction	Multi-stage centrifugal type
Delivery pressure	85 kg/cm^2
Suction pressure	3 kg/cm^2
Feed water temperature	110°C
Feed water quantity	350 Ton/hr
Speed	2,970～2,400 R. P. M.

I. CONSTRUCTION

Stator frame and stator frame covers at both ends are made of welded steel plates. Between the back of core and the core body, there are ventilating ducts. Stator core are made of silicon steel plates, which are pasted with paper on one side for insulation, punched to segment pieces and laminated with tightening bolts around the periphery.

Stator coils are of the double layer, insulated with class A material and are placed in the open slot. The coil ends are strengthened not to get loose and are supported by the stator frame as one body.

To rotor cores are used grade B silicon steel plates in the similar manner to the stator. They are pasted with paper insulation on one side. Rotor coils are formed double layer copper bar windings, insulated with class B material and placed in enclosed slots.

Joints of upper and lower bars at the coil end are of special construction and brazed with silver soldering to form one body. They are made strong not to get loose on account of vibration. Each conductor is provided with cooling plates to facilitate radiation of heat. Binding wires are made of non-magnetic steel and wound seperatly to give better cooling effect.

Shafts are made of forged steel, and because of high speed use cautious attention is paid to every coupling parts. At the part to receive the core, several ventilation holes are cut in the axial direction. Since the machine has a wide speed range (2,970 ～ 2,400 R. P. M.), the first critical speed is set below values, the second critical speed being made above 3,000 R. P. M.

II. VENTILATION SYSTEM

The ventilation is of self ventilation system and axial fans are fitted to the shaft at both sides of the rotor. Air is drawn in from the upper half of stator covers at both the driving side and opposite side, exhausting from the food of both sides of stator frame cover to the room. At the exhaust outlet is provided a muffler of special construction to absorb the noise perfectly without hampering the air flow. The slip rings are cooled by self ventilation that is made by fans mounted at the shaft, drawing air through ventilation openings at both axial sides of slip ring covers and exhausting around the periphery of cover to the interior of the room.

III. BEARINGS

Bearings are of stand type employing high class white metal. Lubricating oil is fed in the circulation system operated by a gear pump in common with the pump bearings, supplying oil via oil coolers. A flow detector is fitted at the outlet of oil deliverly to be able to watch the oil circulation with ease. Further, oil rings are employed to provide for the failure of the gear pump and stop of oil circulation, being capable of taking care of lubri-

cation for a short time to avoid the burning of bearings. A dial type thermometer is used for the watch of bearing temperature with a temperature feeling element embedded inside the lower bearing metal. Dials of both bearings are mounted together at the base to facilitate readings.

IV. SLIP RINGS AND ACCESSORIES

In such large capacity high speed unit as this motor and still equipped with a speed control device, the construction and materials of slip rings, brush holders and brushes are hard to make proper selection. Any mistake in the selection is liable to cause overheating and sparking which may lead to the failure of continuous operation. Hence, the design must be made with careful consideration. We have paid every special attention in the design and conducted varied tests before starting the design. From the results, the most fitting construction and cooling system have been made available to our great satisfaction.

V. OTHER REMARKS

A permanent magnet generator type tachometer is directly coupled to the shaft end of slip ring side and the speed of motor is readable on the switchboard. If necessary, a **Hasler type** tachometer can be attached to the shaft end by removing the

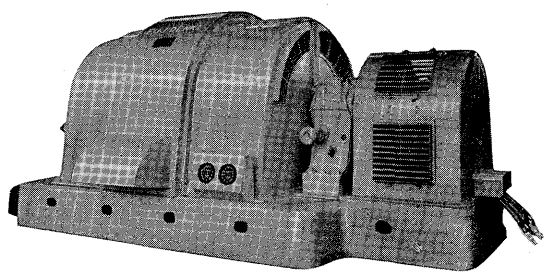

Fig. 1. 1800H.P. 2p Induction motor

generator type tachometer. The base is of cast iron specially built strong to avoid vibration due to high speed.

The coupling to the pump base is made by means of flange. Both bases are tightened together with bolts to avoid the shaft center going wrong on account of sinking foundation.

We have had experience of building many high speed, large capacity units for blowers.

The success in the manufacture of such a unit having a speed control added to high speed and large capacity has given us further confidence in the design and manufacture of this kind of equipment.

FUJI CENTRIFUGAL DEHYDRATING MACHINES

Electric washing machines are now spreading vigorously because of their feature of rationalizing the living. Dehydration of laundries after the washing is indispensable work but to wring them by hand is a hard work to housewives.

Old method of dehydration is wringing by hand and by rollers at best at home. The method making use of Centrifugal force, in spite of ideal method, has not been very popular for the reason that vibration of the machine due to the unbalance of charged clothing is undesirable, stable operation being technically difficult.

Our company, however, has ingeniously solved these difficulties by dint of hard effort on the part of our engineers, and has succeeded in sending to the market newly developed Fuji centrigal dehydrating machines. We hope they will be approved by the public as well as our double turbulent flow type washers.

I. CONSTRUCTION

Fig. 1 illustrate the machine

Fig. 2 illustrates the outline of construction. The centrifugal basket is directly connected to the motor shaft rotating 1,460 r.p.m. for 50 cycles and 1,750 r.p.m. for 60cycles. Its powerful centrifugal force dehydrates the laundries about completely. The basket and motor are supported by 3 springs of small stiffness so that they vibrate only momentarily by very low speed of starting, but soon become stable operation. The body of the machine, however, is supported by buffers of rubber and no vibration is transmitted to the floor. Fig. 3 shows its connection diagram.

II. SPECIFICATION

Fuji Centrifugal dehydrating machine has the following specification.

Type	C-251
Capacity	2.5kg (weight of dry clothing)
Time required for work	3 min.
Motor	Condenser start single phase induction motor (totally enclosed)