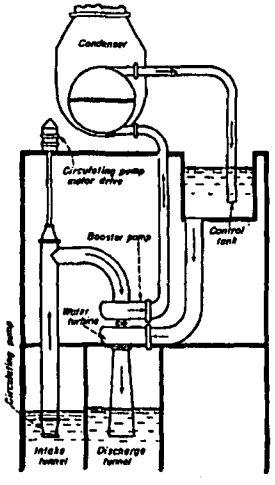
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

HYDRAULICALLY DRIVEN BOOSTER PUMP ALLOWS ELEVATED PLANT LOCATION



HIGH DEMAND for cooling water primarily dictates the placing of steam-electric plants within the area of a system. Because of the steady flow and relatively high-energy consumption for pumping required, special effort is usually directed toward maintaining a low pumping head through which the cooling water is lifted. This further limits locating the plant, along river banks, to sites of low elevation.

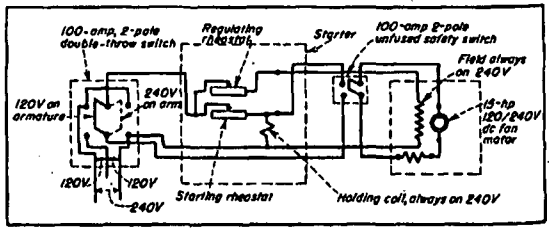
Studies of some sites have shown that placing plants at higher elevations than normal river level would lower substructure costs. This, together with the reduction in construction and operating hazards from flood waters, would justify the extra cooling-water pumping costs. Added to this advantage it proves economical to salvage part of the pumping energy by applying a booster pump driven by a water turbine that uses the energy in the cooling water discharged from the main condenser, as shown in the diagram.

This system was jointly developed by the engineering departments of Electric Advisers, Inc and Worthington Pump & Machinery Corp. One installation in the R E Burger plant of the Ohio Public Service Co pumps 55,000 gpm. The main electrically driven circulating pump, of 600-hp rating, can deliver 60% of maximum flow when working alone against about 60-ft static head plus friction losses. Full flow develops when the water turbine drives the booster pump.

Combined efficiencies of the hydraulic units are such that the turbine-pump unit salvages 70 to 80% of the power needed to develop the extra head. Water flow reaches design flow for lowest river stage and increases to 5% more at higher river stages. Power input to the motor-driven pump remains practically constant under the river conditions experienced. Pump and turbine characteristics are selected so that the control-tank water level remains stable. Pump-system factors are self-compensating and control proves no problem. At normal river stages the water turbo-booster recovers about 425 hp net.

USING AVAILABLE VOLTAGES INCREASES SPEED RANGE

IN THE STANDARD HOOKUP of a 240-v dc motor driving a fan, the available speed range was 1700 to 850 rpm, or 2:1. The *fan supplies cooling air to a dry-type* radiator and this speed range proved ample in warm weather. For winter conditions as well as light-load periods less air is needed than that provided by the lowest speed. To reduce the resulting excess auxiliary demand, motor connections were rearranged as shown in the diagram with the aid of a 2-pole double-throw switch. Thus either 240 or 120 v could be thrown across the motor armature circuit with the field always fed at 240 v.



This gives the motor an additional speed range from 850 to 520 rpm or a total range of approximately 3.25 to 1.

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