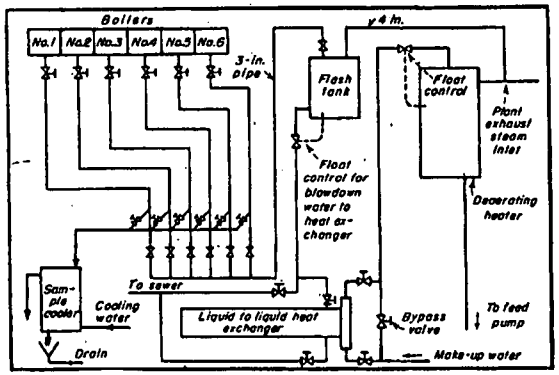

One Flash Tank Is Recommended for System

SINCE BOILER PRESSURE in *CH's* plant is only 135 psig, he is right in saying one flash tank and one heat exchanger is the most economical heat-saver system for his plant. The system proposed for him was undoubtedly designed for a high-pressure plant.

Sketch above shows a system that I believe will suit his needs best. Piping used should be larger than for a high-pressure system, in order to get all flash steam possible from blowdown water. About 50% of heat in blowdown water will be extracted from flashed steam while most of remaining heat will be given up to feedwater makeup through heat exchanger.

Flashed steam may be piped to heater steam inlet, as shown, or it may be used for process or plant heating if present exhaust steam fills demand for heating feedwater. Leave exact piping sizes to the design engineer.

ARTHUR BELTON *Montreal, Canada*

One Tank and Liquid-to-Liquid Heat Exchanger

USE OF one flash tank and a liquid-to-liquid heat exchanger is most economical in *CH's* case. As makeup and blowdown are approximately the same, feedwater will be heated to 202.4 F provided blowdown is cooled to a temperature of 222.4 F.

Less heat-transfer surface will be required to heat feedwater to 202.4 F if blowdown inlet is at 3 psig rather than atmospheric pressure. Incidentally, liquid-to-liquid heat transfer requires less area than steam-to-liquid, and volume handled is far less than if the blowdown is not allowed to flash. Actually, if sufficient heat-exchanger area is provided in either case, fuel saving will be the same.

If flash tank No. 2 is eliminated, care must be taken to prevent blowdown liquid at 3 psig from flashing at entry to heat exchanger. It will not if friction loss through exchanger is over 3 psi. Pressure can be maintained in exchanger by throttling or by installing a short riser in outlet. Outlet pressure can be less than 3 psi as blowdown has been cooled at this point.

Assuming a boiler efficiency of 75% and coal at 14,000 Btu per lb, actual savings are easily worked out. Flashed steam to the deaerator saves 61 tons of coal per year. Cooling blowdown from flash tank No. 1 to 80 F (whether flash tank No. 2 is used or not) saves 49 tons of coal per year. As a matter of interest, latent heat in steam flashed from No. 2 tank amounts to only 3.6 tons of coal per year.

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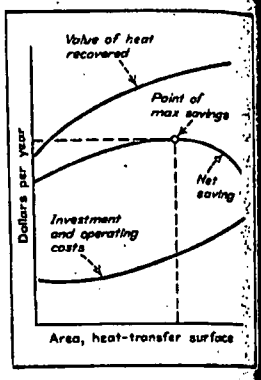

Outlines Economic Study

BEFORE *CH* can state positively that cost of extra flash tank is unwarranted he must analyze the problem thus: Determine enthalpy of water leaving steam-to-liquid heat exchanger using ordinary heat-balance methods and calculate efficiency of both exchangers. Then find enthalpy of water leaving liquid-to-liquid heat exchanger when flash tank No. 2 is omitted. Difference between these two values gives amount of heat that must be added elsewhere in cycle. Multiplying this result by monetary value of one Btu in feedwater and number of operating days a year yields the extra annual cost of the single-flash-tank system.

Extra annual cost is then compared with annual cost of second flash tank, taking into account amount of money, depreciation, maintenance. This comparison quickly shows the most desirable economic system.

Addition of second flash tank and exchanger increases heat-transfer surface and efficiency of blowdown system. *CH* will find extent and efficiency of heat-transfer surface dependent on various factors, some of which are: (1) over-all coefficient of heat transmission (2) cost of a Btu (3) length of time the surface is used during a year. Analyzing the blowdown system completely and plotting the results, he obtains a curve like the above. This shows greater saving as heat-transfer surface increases up to a certain point. Increasing surface beyond this point decreases saving. Above method can determine system closest to maximum saving.

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