

STEAM ECONOMIES AT DARNALL

D. J. L. HULETT

The period 1957 to 1964 is the topic for discussion as it was over these years that large economies were made in the steam consumption at Darnall with very little capital expenditure on additional plant to achieve it. Table I shows the statistics relevant to the steam economy of the factory and a study of this table shows how the amount of fuel used has decreased notwithstanding a large increase in water evaporated in the factory.

In 1957 the boiler plant consisted of four boilers, 3 WIF Type B. & W. boilers of 7,322, 11,080 and 11,000 square feet heating surface respectively, each fitted with air heaters and V & P type bagasse furnaces and one C. E. boiler fitted with a C. E. spreader stoker and of 50,000 lbs. per hour rated capacity. These boilers at that time were continually hard pressed to meet the steam demand of the factory and coal was fed regularly to the C. E. unit. As can be seen from Table I, by the end of 1964 these same boilers were managing a far greater factory load and the only extra fuel burnt was to start and stop the plant as inadequate bagasse storage facilities existed at the mill. In the meantime surplus bagasse was being burned on the hillside.

In 1957, the factory was set up as is shown in Chart 1. The evaporation was accomplished in two Quadruple effect evaporators; juice heating and all pan boiling was done on 10 p.s.i. exhaust steam.

Chart No. 2 shows the first step in the economy sequence when the primary heaters were resited and steamed with Vapour 1 from the spare 4,500 sq. ft. evaporator vessel. This move necessitated the cleaning of the evaporator over the week-end, but since the mill stopped each week-end in any case, this was not a serious drawback. The primary heaters at this stage absorbed about 40,000 lbs. of steam per hour and this resulted in a steam saving of about 10,000 lbs. per hour and, of course, the brix of the syrup improved as the evaporator became more powerful. This saving of 10,000 lbs. per hour of process steam resulted in a direct saving of fuel as at the time the accumulator was passing in the region of 60,000 lbs. per hour to the process main.

During the 1963 season some money became available for the conversion of the factory to the remelt system for the manufacture of J. A. sugar so further alterations to the evaporator and the purchase of

two additional heaters became necessary. Chart No. 3 shows how the heaters were installed and the arrangement of the evaporator. The five vessels of the 22,500 square feet evaporator were connected together in parallel so as to operate as one large pre-evaporator supplying vapour for the pans, secondary juice heaters and the first vessel of the 32,000 sq. ft. quad. The exhaust back pressure was raised to 15 p.s.i. so as to supply 9 p.s.i. Vapour 1 to the pan floor. Primary heating to 150° F. was done by a 2,300 sq. ft. liquid-liquid exchanger on the condensate and a 2,300 sq. ft. heater operating on second effect vapour. The old primary heaters were converted to pre-heaters for the clear juice and were operated on exhaust steam.

This scheme of operation resulted in an exhaust steam saving in the region of 60,000 lbs./hr. over the original scheme and coupled with the increased steam consumption of the prime movers due to the 15 p.s.i. exhaust caused a surplus of exhaust over the process steam requirements. To minimise this surplus more water was applied to the imbibition but the surplus remained even at 60 per cent imbibition on cane and at 210 T.P.H. However, notwithstanding the fact that Darnall mill continuously had a cloud of steam hanging around the exhaust relief valve, the set-up was healthy and the available bagasse storage space could be filled in a day and a bagasse fire was kept going on the nearby hillside.

1965 and the Future

During 1964 it was decided that all the "Hulett" group of mills should be provided with stand-by plant both at the boiler station and the power station and so an additional boiler and turbo generator had to be purchased for Darnall mill. It was considered wise to use this opportunity to balance the process steam demand with exhaust steam supply and so a 450 p.s.i. 750° F boiler was ordered together with a Topping turbine of 2 MW. capacity exhausting at 200 p.s.i. This turbine would relieve 2 MW. of electrical load from the existing 200 p.s.i. generating sets and consequently their steam consumption would fall by a corresponding 50,000 lbs./hr. In addition a de-aerator feed water heater was required for the new boiler and this increased the exhaust steam consumption by approximately 10,000 lbs. per hour. All this would result in a deficit of exhaust production over process demand and it was visualised that should further economies or increased evaporator capacity

be required, use could be made of thermo-compressors using the live steam of 200 p.s.i. to re-compress V_1 back into the exhaust line at a slightly higher exhaust pressure. Chart No. 4 shows this proposed layout.

Once the extra fuel is eliminated and imbibition is

increased to its maximum and still surplus bagasse exists, this bagasse could become a nuisance. However, bagasse is a useful raw material for paper and board and so when a guaranteed large surplus of this substance exists, it is likely that a plant will be installed to process this and turn it into money.

Table I

Year	Tons Cane per hour	Fibre per cent cane	Imbibition per cent cane	Sucrose per cent cane	Brix Syrup	Moisture per cent bagasse	Coal & Wood Rands
1956	183.61	15.57	47.24	13.26	57.26	54.94	*
1957	188.15	15.01	44.78	12.93	55.76	54.46	*
1958	189.24	16.04	41.87	13.01	56.15	54.69	25,000
1959	184.25	16.53	48.02	13.65	58.08	54.04	6,660
1960	191.83	15.09	55.71	13.93	58.82	53.61	3,180
1961	199.03	14.81	55.15	14.03	61.86	52.12	1,675
1962	188.60	16.23	62.00	13.28	61.65	51.38	1,950
1963	200.73	16.12	59.89	13.54	61.94	52.54	2,468
1964	209.40	15.86	59.00	13.99	60.74	52.19	3,578
1965	192.07	15.69	58.88	13.19	60.58	51.96	8,481

*Records not available for these years.

CHART 1
FACTORY STEAM LAYOUT DARNALL 1957

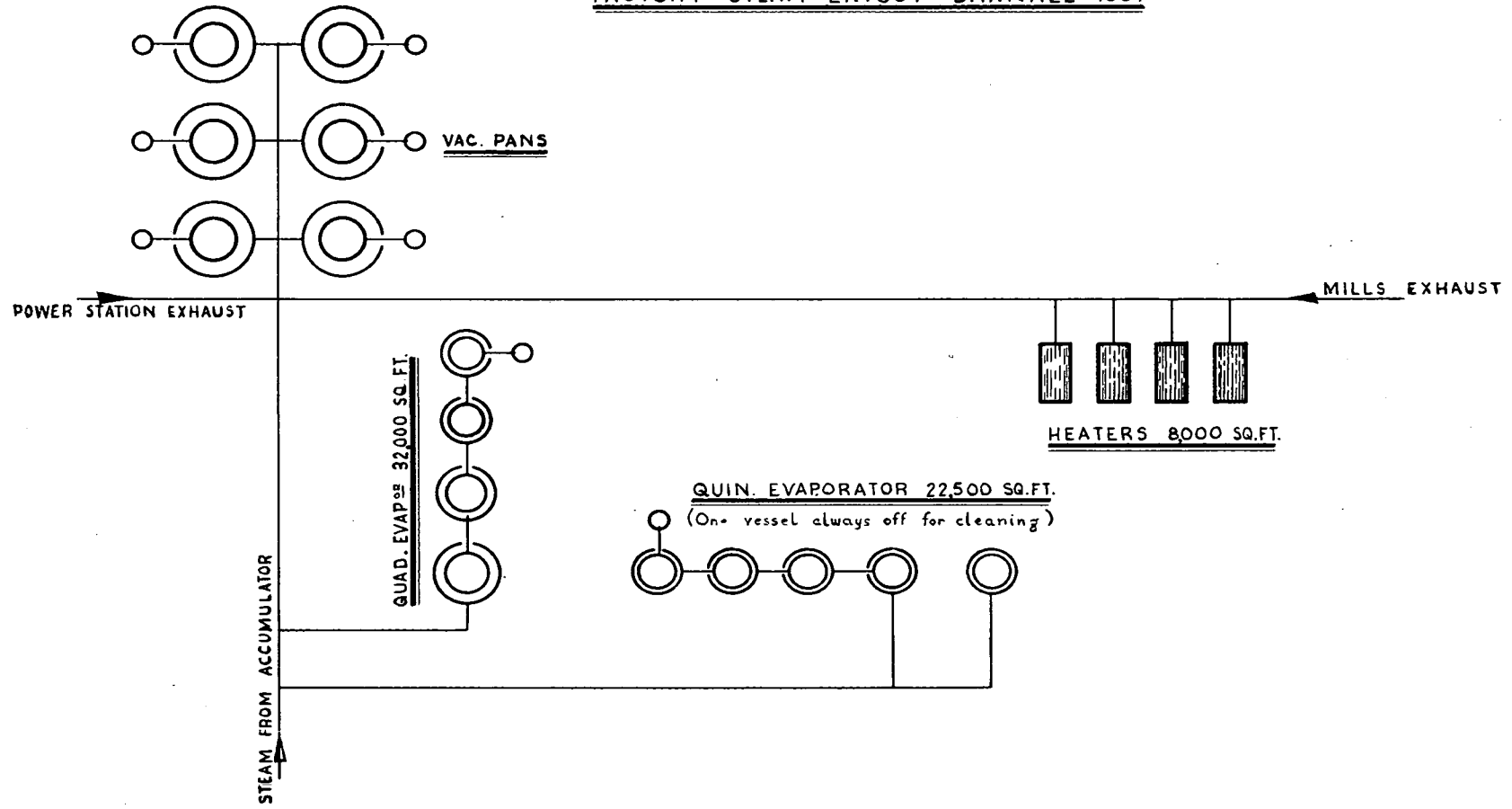


CHART II
FACTORY STEAM LAYOUT ~ DARNALL 1960

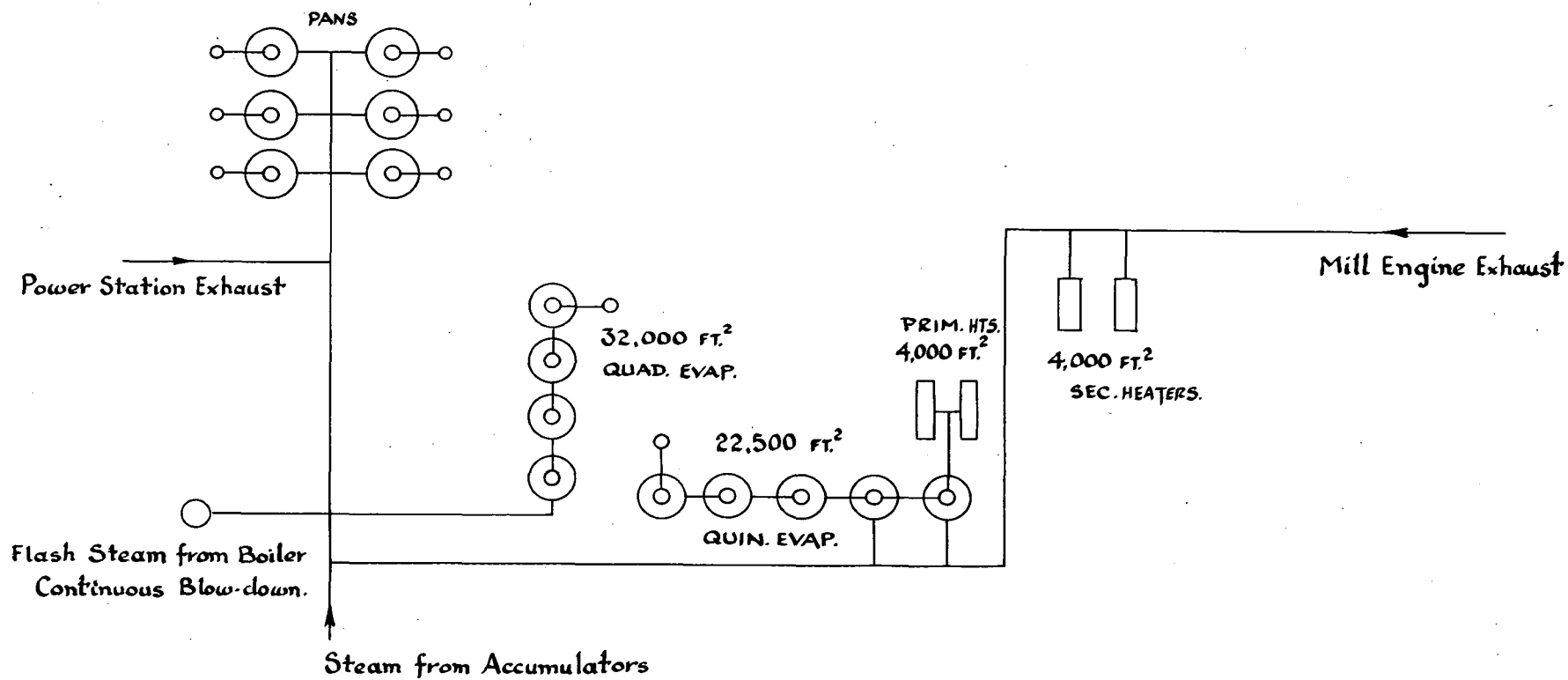


CHART III

FACTORY STEAM LAYOUT. DARNALL. 1965 (April)

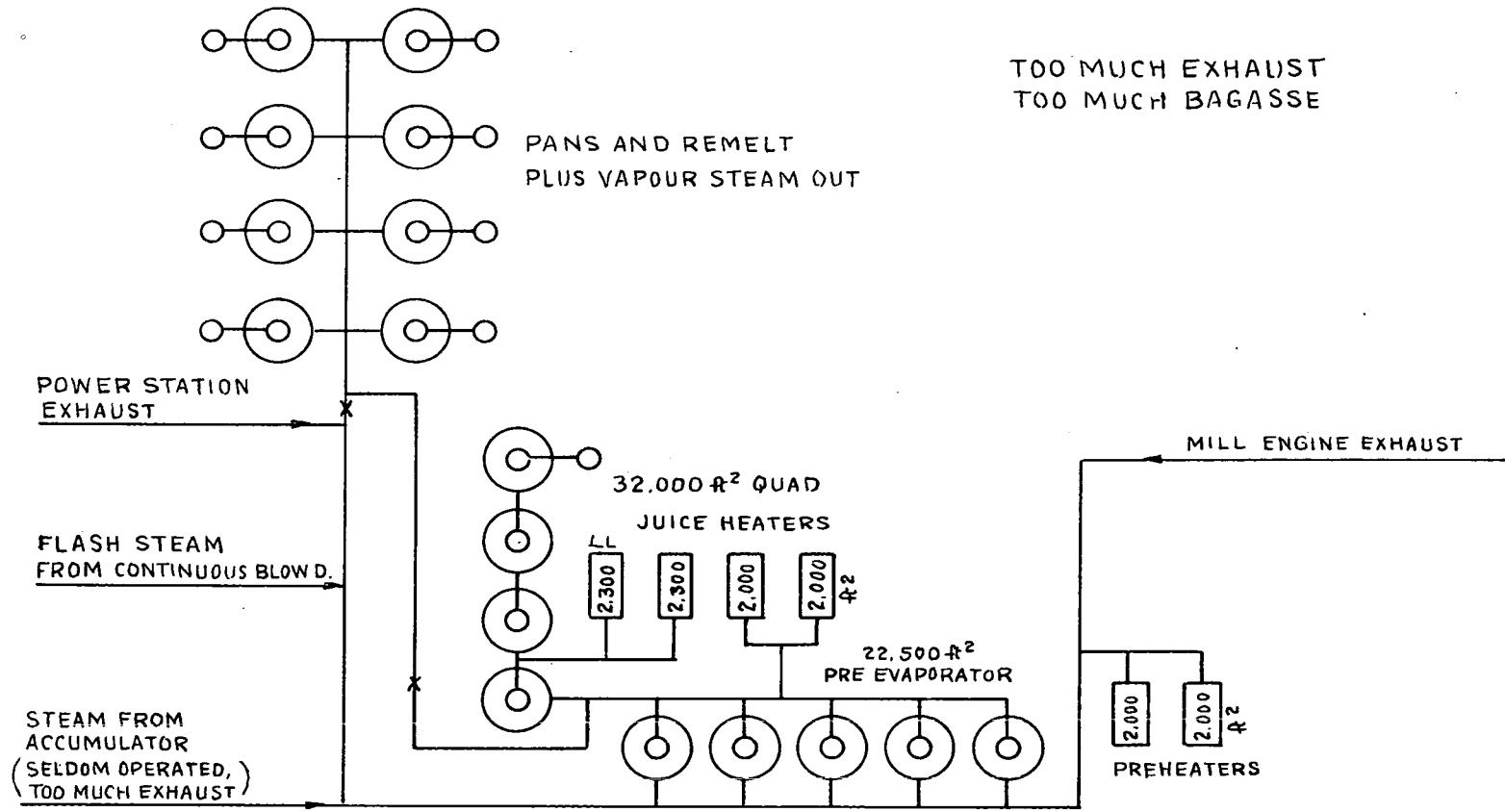
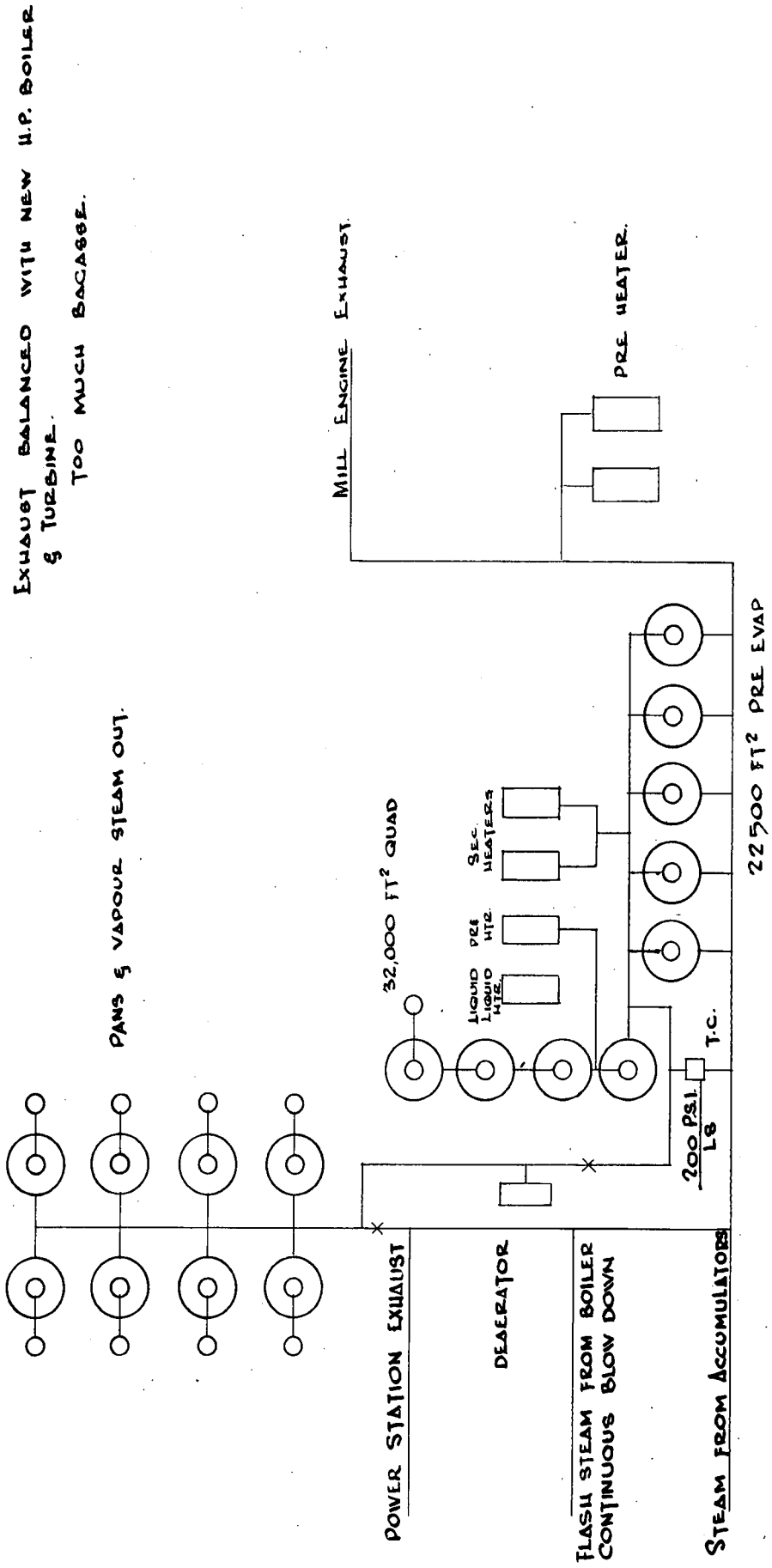


CHART IV

PROPOSED FACTORY STEAM LAYOUT

DARNALL 1966



Mr. Bentley (in the chair): It can be seen from Table I that the use of extra fuel diminished from 1958 to 1961 but from then on, despite additional throughput, it started to increase again.

Mr. Renton: The chief reason for the increase last year was the number of stops the factory made because of lack of cane.

Mr. Jones: When exhaust steam was short from the prime-movers what was the percentage and was it sufficient to allow for variations in throughput and avoid blowing-off?

Mr. Hulett: At the beginning we were very short and there was no blowing off. But until just recently

when we commissioned a new boiler, we were always blowing-off vapour.

Mr. Jones: So when you commissioned the new boiler you again had a shortage of prime-mover exhaust.

Mr. Renton: Yes, however, we have not had full load on our topping turbine yet as only one boiler has been operating on high pressure.

Mr. van Eck: Would you say that your steam accumulator helps to maintain your steam balance?

Mr. Hulett: It helps to even out the load on the boiler but I can't say it helps the steam balance. If we were starting from scratch I would not buy an accumulator.