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Gelsenberg - Benzin A. - G.

I. G. Farbenindustrie
High Pressure Experiments
Ludwigshafen July 30, 1943

PASTE HEAT EXCHANGERS

Very little consideration has been given to the question of using heat exchangers for the bituminous coal paste in Gelsenberg. Unlike with brown coal, no experience was available for the heat exchange of bituminous coal paste; moreover, the hydrogenation of bituminous coal at 700 atm lead to the anticipation of considerable difficulties, even without the use of the untried heat exchange.

In the Pölitz bituminous coal hydrogenation heat exchangers have been installed for heating the low concentration coal paste (the thin paste), by introducing it together with the gas, while the remaining coal was introduced into the cold pass of the exchanger as a thick paste. This method of operation has been found satisfactory in the experimental installations at Ludwigshafen and in Pölitz.

It was originally intended to relieve the preheater load in Gelsenberg by heating the coal paste with the normal solids content (46 - 47 percent) (including the glide oil) and the gas in heat exchangers (coal stall 706). Very good results have been obtained without making the changes in design, which would have had to be made if the paste stream had been divided, and would have consisted in connecting the heat exchanger into the paste pass, as may be seen in comparing with the stalls with no heat exchange (liquid phase stalls 701 and 702):

1). The coal paste with the gas (38 te paste + 3 te pasting oil + 31,000 m^3 gas) is heated up to 315°C without any resulting lowering of the K values up to now, after three months of operation and without causing any changes in the pressure differences. This means that no settling out or thickening processes could have been observed.

2). The pressure difference including the difference in the paste part of the preheater has become more constant by the omission of the paste gas and is no higher now than it formerly was. The temperatures can be distinctly more readily regulated, i.e. the stall can be operated more uniformly and will produce uniform amounts of let-down.

3). The temperature outside the hairpins was 10°C lower in the coal stall 706 at the beginning of the operations and is now 18°C lower after three months operation than in the stalls 701 and 702, without changing the thruputs. It is kept at 474°C in the stall 706, while in the stalls with no paste heat exchangers it had to be raised from 484° to 502°C. The temperatures of the circulating gas show a similar relationship: they remain unchanged at 540°C in stall 706 while in the stalls 701 and 702 they have been increased from 568 to 584°C. The outlet temperature from the preheater has been dropped during that time by 16°C, while it had been reduced by 24°C in the other stalls. The heat transfer coefficient in the hot pass has changed less in the stall 706 than in the stalls 701 and 702. We have to wait for information from other stalls before telling whether these results are merely accidental in nature. The principal thermal data are summarized in the table below and in the adjoining sheet of curves.

Heat Transfer Coefficients with and without Paste Heat Exchange

	With heat exchange after 6 days	With heat exchange after 83 days	With no heat exchange after 6 days	With no heat exchange after 83 days
Heat exchangers	210	210	215	210
Gas Hair-pins	11.4	10.8	9.0	9.8
Paste part	-	-	-	-
Middle pass	5.1	5.1	4.5	4.4
Hot pass	8.5	7.8	7.3	6.5
Thermocouple 144 mv/°C	22.6/435°	21.7/420°	22.6/435°	21.2/ 410°
S- thermocouple 144 mv/°C	10.5/474°	10.5/474°	10.8/484°	11.3/502°

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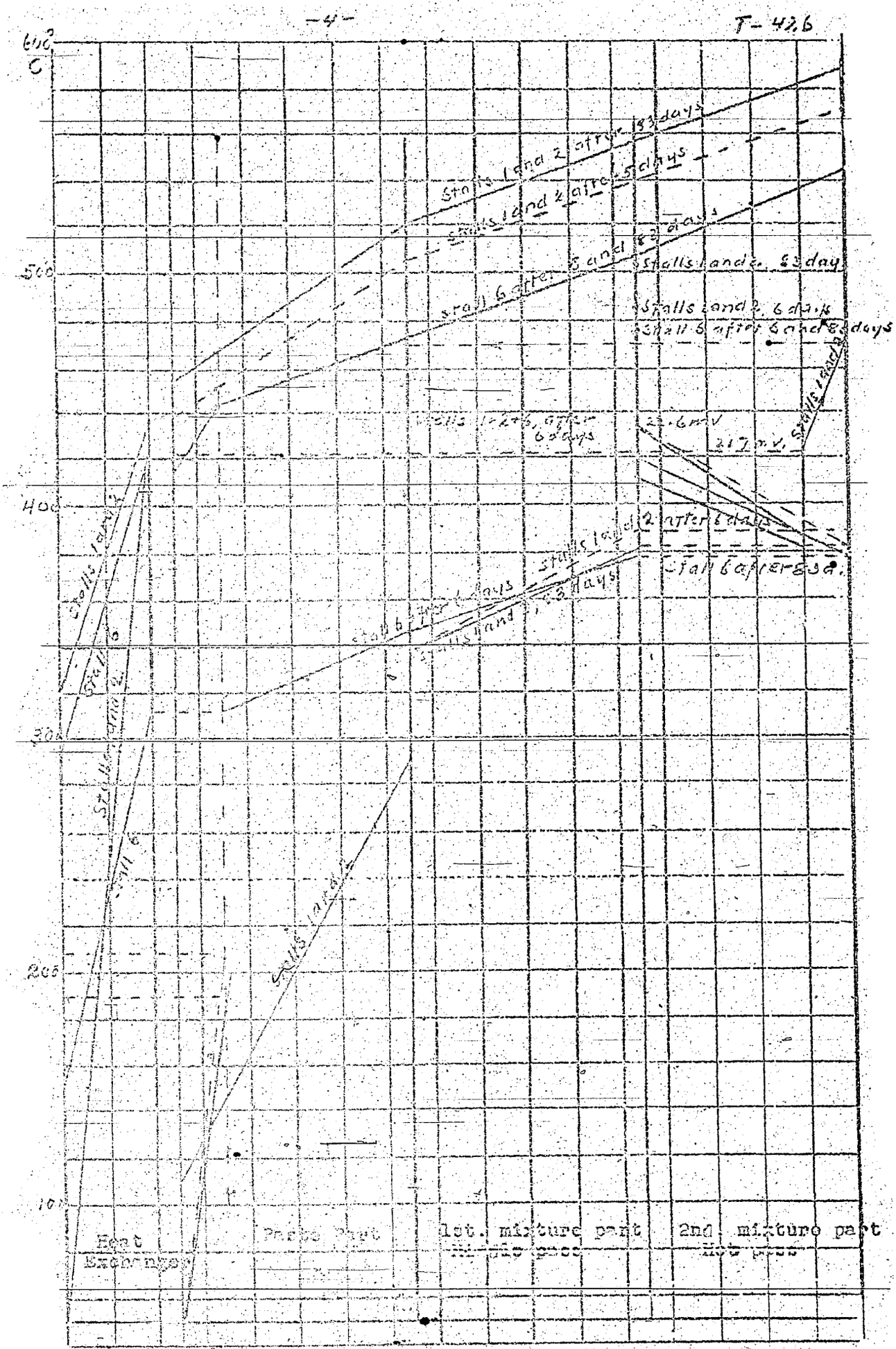

Comparison of preheater temperatures with and without paste heat exchange