Item #4

Report by Dr. Jeltsch, Sommer and Bunger of visit made to the Alkazid plant in Lutzkendorf, in regard to corrosion.

The reason for the visit was the occurence of corrosion in an aluminum pipe (October 31, 1938) which was shown to Dr. Jeltsch on the very day of his visit. The corroded part was immediately replaced and it was decided to carry out the final purification by means of the spare washer of the primary purification (November 1, 1938) in order to be able to inspect the washer of the final purification November 2, 1938. Since for other reasons the entire alkazid plant was not operating it was possible to inspect not only the washer but also the pumps pipes, and the washer of the CO_2 extraction which had not yet been operated with alkazid solution but only with water (November 2 and 3, 1938.).

Result of the inspection

1. Hot-liquid-pumps

The silumin casting of the pumps was of an unsatisfactory quality. Numerous pores could be observed in the casting. Compare picture #1: Cover of the casing, picture #2: impeller of the pumps. Near the clearance between impeller and the casing of the pump considerable corrosion of the casing could be observed. (Picture 3: cover of the casing). The casting is very porous at this place too. The silumin casting was eroded as a result of the rapid whirling of the liquid near the outlet clearance. The bond of the casing (represented by picture 1) obviously had a ring which was inserted at its inner side and fastened by two screws. The ring had disappeared whereas the screws could be observed in the remaining bond. This is apparently due to a repair which was carried out during the manufacturing of the pump.

Another pump which has not yet been operated with alkazid liquor but with water and which also had a very porous casting (Picture 5) showed numerous smaller points of corrosion in the form of white spots. The casting of the casing cover (Picture 5) was unsatisfactory. A scar several mm. deep can be observed on the surface of the cover, in addition to numerous round scratches of unknown origin.

2. Pipelines

One of the valves situated at the suction side of the pump showed some small holes caused by corrosion on the lower side of the valve disc, whereas the seat which consisted of niro-steel was unaffected.

A T-piece from the liquor pipe situated immediately before a pump was of a bright white color at its inside surface. Apparently the protective layer which usually is of a dull color was removed (Picture 6). A comparison of the welded seam with the adjoining sheet shows probably a slight decrease of the thickness of the walls compared with that of the welded seam. The beginning of a hole like corrosion could be observed at the surface.

The ends of the T-piece seem to be especially affected. Picture 7 shows very clearly the difference between the bright aluminum and that which preserved its protective layer. The piece carrying the protective layer is immediately under the packing.

3. Lower part of the column

The cone underneath the boiler of the column of the final purifi-

cation showed point-like corrosion extending to its lower end. In addition the surface of the metal sheet was covered with numerous scratches. They are filled with a black deposit as well as the point like scars. It is to be assumed that the scars are due to the rolling procedure. The cone underneath the boiler of the CO_2-extraction which was operated with water and not with liquor showed a similar appearance, such as numerous pointlike corrosions and parallel extended scratches. The surface was partly of a yellow-brown color whereas the corroded areas and scratches were filled with a white partly rusty product. Apparently the product consists of aluminum oxide which is dyed black by traces of FeS if the column was operated with liquor whereas it is dyed light brown by Fe_2O_3 in the CO_2-extraction column, which was operated with water.

4. Steam-carrying bend made of aluminum situated between silumin valve and V_4A-steam-jet

The corresponding bend of the column of the primary extraction was already corroded sometime before. The bend of the final extraction (Picture 10 and 11) showed occasional corrosion at the end adjoining the V_4A-pipe. The welded seam was corroded too. The surface of the opposite end of the bend was roughened due to corrosion. (Picture 11)

The corresponding bend of the CO_2 column (Picture 12) which was filled with water during the operation of the column with water but was not operated with steam shows numerous uriformly distributed corrosion, which are accumulating in the welded seam.

The steam-valves (made of silumin) are more or less leaking, with the result that with the steam turned off, the alkazid liquor can enter the pipes and form diluted liquors with the always present steam condensate. The openings of the jet are much too large considering the small output of the column and the small volumes of steam which were injected. With the low velocity of the steam which leaves the jet it is possible that the liquor flows through some holes into the aluminum bend. By subsequent dilution with steam condensate the diluted liquor will cause corrosion trouble.

5. Bottom of the boiler

The bottom of the boiler of the final purification, especially the ends of the pipes, are partly of a bright or brass like color. The conclusion was drawn that the protective layer was absent. The bottom and the lower ends of the boiler pipes had a rough inner surface. There was no difference to be observed between the boiler of the CO_2-extraction unit and that of the final extraction.

Conclusions

The cause of the observed corrosions may be retraced to the following circumstances:

1. The exceptionally long operation of the plant with probably corrosive water, which remained in the apparatus for a considerably long period of time.
2. Dilution of the liquor by condensed water vapor at the outlet for the live steam. The steam jet is too large considering the small output of the plant with the result that, even during operation of the plant, liquor can enter the steampipe. The employed steam was rather moist. The leaking steam pipes (Made of silumin) favored a dilution of the liquor.
3. Unsatisfactory casting of the silumin pumps which caused the occasional corrosivity of the liquor.

Actions which will be taken

1. The hitherto not operated purging column of the CO_2-extraction is operated with recirculating steam condensate, to which 40-50 g of bichromate per cu. m. were added. It is to be hoped that the corrosion troubles will be eliminated by this procedure. With the water completely drawn off, the column is operated with steam condensate to which water glass was added in accordance with our instructions. Finally the column is kept under gas pressure. 1 liter waterglass per 1 m³ liquor is admitted to the liquor of the refreshing systems of the primary and final extraction. Before adding, the water glass must be diluted in the ratio 1:10. All silumin pumps will be filled with diluted water glass solution and after a short recirculation will be kept for several days under the same condition.
2. The holes of the steam injector are closed by V_4A sheets in such a manner that only the holes of the butmost circle are kept open.
3. The eroded areas of the silumin pumps are repaired by inserting rings made of V_4A. It is advisable to employ pumps with replaceable lining which in addition is protected by inserted rings of V_4A.