vice in the last reactor encountered by the feed, and catalyst fines in the amount of 0.5 m^3 were found in the high-pressure separator.

Difficulties were encountered in cleaning the reactors, because of the close spacing of the distributor nipples and perforated wells, and also because of the lack of any possibility for regenerating the catalyst in the sealing device. In this connection, the perforated wells were removed, and the distributor tray was covered with a bed of porcelain balls. Measures were taken to strengthen the seal baskets.

The organization of rising flow in the reactors eliminated the formation of "crust" in the inlet bed of catalyst, and the hydrogen-rich gas circulation ratio was lowered from 200 to 110-130 m^3/m^3. In turn, this made it possible to take out of service one compressor with a capacity of 420 kW, to lower the resistance in the reactors and in the system as a whole from 1.5 to 0.8-1.0 MPa, and to increase the capacity of the block.

DIESEL FUEL AND NAPHTHA STABILIZER WITH CROSS-FLOW PACKING

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A distinctive feature of the operation of the stabilizer in the L-24-7 hydrotreating unit is that it operated alternately on a diesel fuel cut and a naphtha from Karachaganak condensate. The process conditions in stabilizing these two products are considerably different. For example, the stabilization of the diesel fuel cut is performed at a pressure of 0.068 MPa, the naphtha cut at 1.18 MPa. The respective vapor densities are 5.4 and 28 kg/m^3. In this connection, even with an identical volume of vapor, the vapor load factor (F-factor) [1] in stabilizing the naphtha is greater than that in stabilizing the diesel fuel by a factor of approximately 3. Also, the operation of the stabilizer is characterized by large liquid loads and small vapor loads. Because of the weak inertial properties of the vapor stream, which flows in a low velocity referred to the entire cross section of the tower (0.15 m/sec), it does not provide adequate turbulization of the liquid phase.

Under these conditions, the existing designs for tray-type contact devices do not provide the required efficiency of contact between streams over such a wide range of variation of vapor loads, particularly with a high liquid load. Therefore, it was proposed that the tray-type contact devices in the stabilizer should be replaced by regular (stacked) packing, operating in the cross-flow regime of heat and mass transfer. The cross-flow mode of interaction ensures independence of the sections for passage of vapor and liquid flow, so that with a given liquid load, the vapor flow velocity can be increased (for example, in the packed bed, to 0.7-2 m/sec or higher).

Of the various cross-flow packing blocks, two designs with helical motion of the vapor are of interest [2]. The positioning of the packs in the horizontal section of the stabilizer (Fig. 1) ensures that the vapor will come into contact three times with the downflowing liquid. On the whole, counterflow is maintained in the vessel. The vapor moves from stage to stage through sector cutouts in the horizontal distributor baffles. Owing to the increase in vapor velocity, greater turbulization is achieved in the distributed liquid film flowing along the packing surface.

Above each stage, which consists of three T-shaped packing blocks positioned in the cross section of the tower, a low-head liquid film distributor is installed; the design of this distributor is shown in Fig. 2 [3]. It consists of a distributor plate with openings, under which a bent deflector tongue is attached by means of a bayonet joint. A jet of falling liquid forms a thin film with a well-developed contact surface on the plane of the deflector; this is particularly important for cross-flow interaction. The washing of the packing surface in the film flow regime, in combination with turbulization by the vapor flow, makes it possible to increase the phase contact efficiency.

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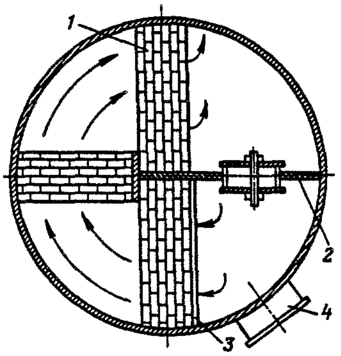

Fig. 1. Position of blocks of regular packing in horizontal section of stabilizer: 1) block of regular packing, panel type; 2) vertical gas-impermeable baffle; 3) overflow weir of distributor plate; 4) hatch for installation and maintenance. Direction of vapor flow is indicated by arrows.

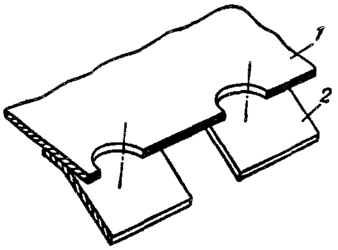

Fig. 2. Design of low-head liquid film distributor: 1) distributor plate with opening; 2) inclined deflector tongues.

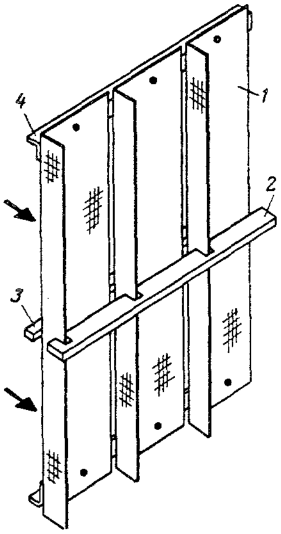

Fig. 3. View of regular cross-flow packing: 1) stamped, profiled, packing elements; 2) spacer; 3) clamping strip; 4) angle-iron stiffening bar. Direction of vapor motion is indicated by arrows.

The packing block consists of panel-type regular cross-flow packing (Fig. 3) — a set of stamped, profiled elements made of stainless steel screen or expanded metal sheet [4], attached by means of spacers. The height of the panel is selected so as to be equal to the height of a specific packing contact stage, as determined from the given vapor velocity. Selection of the other dimensions of the packing panel are governed by the need to bring in the internals through the existing process manholes.

The spacers also serve as horizontal distributors for the liquid. They provide additional turbulization of the downflowing film. On the reverse side of each panel there are angle-iron stiffening bars to provide the necessary mechanical strength. The packing panels are installed in each contact stage in vertical rows with their planes perpendicular to the direction of vapor motion.

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