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DEVICE FOR DYNAMIC TESTING OF METALS AND ALLOYS IN LIMITED HEAT CARRIERS AT HIGH PRESSURES AND TEMPERATURES

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UNEDITED ROUGH DRAFT TRANSLATION

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ABSTRACT The article gives details of a unit permitting corrosion tests of metals and alloys in organic heat transfer media at temperatures up to 400-450°C, pressures up to 50 atm, and calculated velocities from 1.4 to 5.7 meters/sec. ~~(See Fig. 1)~~

The unit ~~pictured on the following page~~ has been used successfully under the following experimental conditions: temperature 320°C; pressure 8 atm; organic heat transfer medium--monoisopropyldiphenyl with 0.1% water; duration of operation--500 hours. Orig. art. has: 4 figures.

AFSC FORM AUG 66 4 (Test form under revision) AFSC (AAFD)

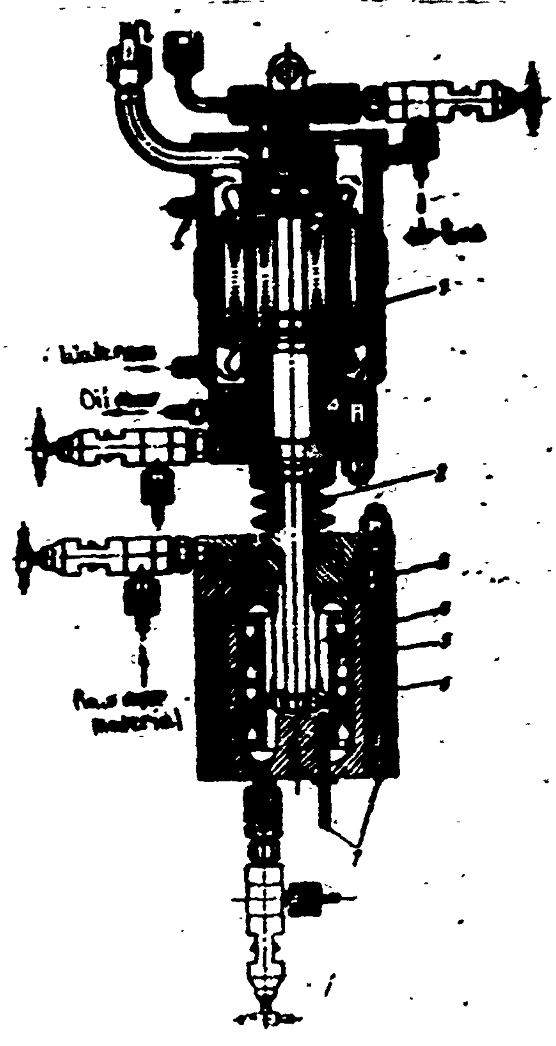

Fig. 1. Scheme of a unit for dynamic tests of metals and alloys in organic heat transfer media at high pressures and temperatures: 1 - drive; 2 - throat; 3 - autoclave; 4 - directional apparatus; 5 - cell; 6 - screw; 7 - thermocouple housing.

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To investigate the corrosion stability of metals and alloys in organic heat carriers, the materials must be tested in conditions approaching real ones. For this purpose are being created various devices-mixers, allowing under lab conditions to carry out dynamic investigations.

In literature [1] are given various schemes of dynamic tests in mixers. Their deficiency consists in the fact, that it is difficult exactly to determine the rate, with which samples are mixed relative to corrosive media, because in the boundary zone around the samples there is always a decrease in rate. In addition, in some systems the sample is additionally affected by a centrifugal force [2]. In the mixer are simultaneously tested only several samples.

We have created a device, which allows to carry out corrosion stability investigations of metals and alloys in organic heat carriers at temperatures up to 400-450°C, pressures up to 50 atm and calculated rates from 1.4 to 5.7 ms. The testing conditions in this case are considerably closer to real working conditions of metals and alloys: along stationary samples moves the heat carrier. Absent in this case are cavitation and centrifugal forces. This device appears to be a small scale contour for corrosion testing of

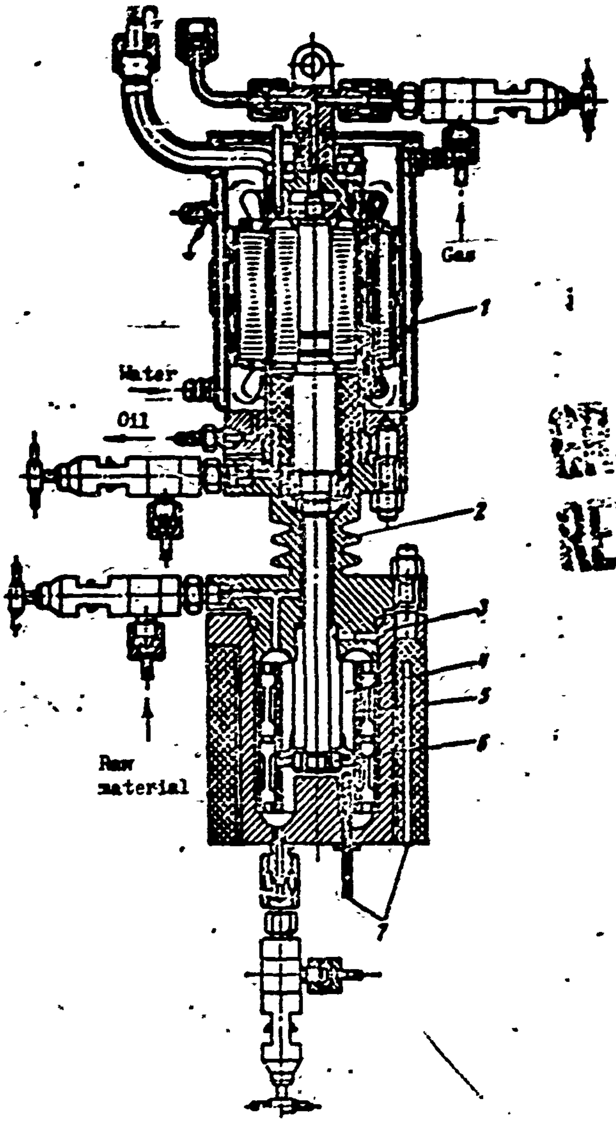

Fig. 1. Scheme of the device for dynamic testing of metals and alloys in organic heat carriers at high pressures and temperatures: 1 - drive; 2 - orifice; 3 - autoclave; 4 - guiding apparatus; 5 - box; 6 - screw; 7 - pocket for thermocouple.

metals and alloys in organic heat carriers.

But from contours, designated for similar purposes, it differs by considerably smaller dimensions, lesser complexity in preparation, adjustment and exploitation, as well as by the fact, that for testing of materials in this installation is required a small amount of heat carriers (0.3 liters) in comparison with the amount, required when carrying out tests on a contour (tens of liters), which is important when investigating experimental batches of organic heat carriers.

The proposed device (Fig. 1) for long lasting corrosion tests in an organic heat carrier consists of the following basic units: drive, finned orifice and autocave. Within the autoclave is situated a screw, assuring the movement of the liquid, and guidance apparatus, which untwists the stream of liquid, thus creating a static pressure, necessary for the circulation of the heat carrier.

Over the guiding apparatus is fitted a box, consisting of internal and outer holder (Fig. 2). The inner holder has 20 longitudinal slots of identical section 5 X 8 mm uniformly arranged over the circumference. In the grooves of inner and outer holder are made twenty rows of lots at two slots in each row. They are intended for fastening of samples with a dimension of 40 X 10 X 1mm, made from sheeted material, along the axis of the groove. The heat carrier moves over the grooves and streams around the samples from two sides exactly along their surface.

Fig. 2. Holder for fastening samples. (Graphic is not reproducible).

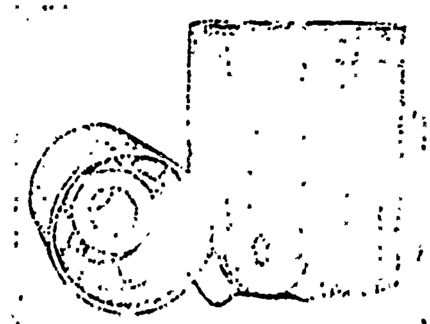

Fig. 3. Guiding apparatus, screw and beaker. (Graphic is not reproducible).

According to report [3] the rate of the heat carrier within the diffusor

$$U_{\text{d}} = \eta D n P,$$

where η — conditional hydraulic efficiency of the screw; D — screw diameter; n — number of revolutions of the screw; P — step-by-step ratio.

However when determining the rate of the heat carrier around the sample it is necessary to consider the ratio of free section surface in the plane of the screw an d sectional area of the annular space. Then in general form the rate of the heat carrier around the sample

$$U = \eta D n P \frac{\pi (D^2 - d^2)}{4k(F - dt)},$$

where d — diameter of bushing; k — number of grooves (k = 20); F — area of groove; t — thickness of sample.

The change in rate of motion of the liquid along the samples is carried out by setting the screw with another step-by-step ratio.

At such a fastening method the samples do not experience any foreign loads, caused by rotation of the liquid or sample; in this case is also absent cavitation, observed during the rotation of the samples. To prevent 40 samples from falling out on the outside over the holder is ditted a beaker (Fig. 3). All details, coming in contact with organic substances, are prepared from stainless steel 1KH18N9%, which possess high corrosion resistance in organic heat carriers.

In role of drive in the device is used the drive from a lab isothermal reactor R-A5-31 (developed at the Leningrad branch of NIIKHimmash under the leadership of N. Ye. Vishnevskiy), which is intended for hydrocarbon hydrogenization processes, hydration of fats and other processes, taking place at high pressures and requiring intensive circulation of reacting substances.

For vacuuming the device prior to the process of filling same

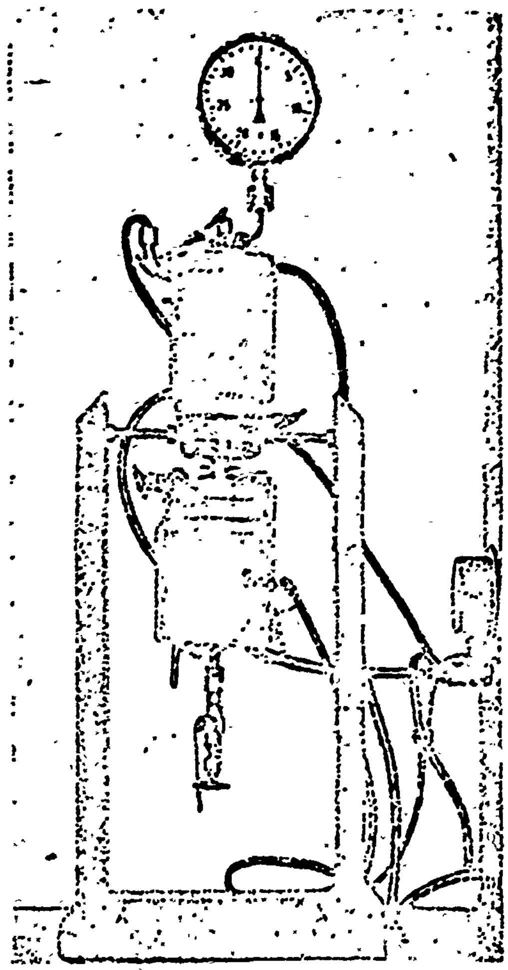

Fig. 4. Device for dynamic testing. (Graphic is not reproducible).

with inert gas, pouring of 0.3 liters of organic heat carrier and for draining same after completion of the tests are provided valves.

The device for dynamic testing of metals and alloys in organic heat-carriers at high pressures and temperatures (Fig. 4) was planned, prepared and successfully tested at the following regime: temperature 320°C, pressure 8 atm, organic heat carrier – monoisopropyldiphenyl with 0.1% of water; duration of operation 500 hrs.

Literature

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