Thus, our investigation has established that composite materials of heterogeneous structure containing PSr40 silver alloy as a solid metallic lubricant operate satisfactorily under unlubricated friction conditions in a vacuum and with a restricted supply of lubricant in air. The materials are already being used in the frictional units of certain types of machine.

LITERATURE CITED


WEAR OF SINTERED COMPONENTS OF TRACTOR HYDRAULIC SYSTEMS

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Systematic observations of the operation of 50 tractors on cotton-growing farms in the Tashkent and Syrdarnysk regions of the Uzbek SSR have demonstrated that the gear pumps of the dividing and collecting hydraulic system and of the hydraulic booster of the driving gear are the least reliable units of these systems. Some 36% of all breakdowns of these hydraulic systems are caused by the gear pumps with their couplings. As a result of gear pump breakdowns tractors and machines are put out of action, thereby reducing output in various agricultural operations. The main cause of pump breakdowns is wear of the surfaces of frictional components. Very severe wear is experienced by bushings of rocking mechanisms, as a consequence of which a great deal of the expensive bronze used in them is wasted. Thus, there is an urgent need to explore the possibility of employing new bearing materials with the aim of increasing the reliability and useful life of the frictional pairs in the pumps of tractor hydraulic systems.

Taking into account the cost factor, seven of the most promising sintered iron-base materials were chosen for investigation, and their physicomechanical properties were determined (Table 1).*

Test bushings were produced by double-ended pressing in die sets under a pressure of 7-9 tons/cm². The bushings, which had a porosity of 18-20%, were sintered for 2 h in a hydrogen atmosphere at a temperature of 1150 ± 5°C.

*The following alloys are referred to in this article: ZhGr2, a sintered iron-base bearing material made from a charge containing 2 wt.% of graphite; ZhGr3, the same with 3% graphite; ZhGr2D2.5, the same with 2 graphite and 2.5% Cu; ZhGr2D2.5F0.5, the same with 2 graphite, 2.5 Cu, and 0.5% P; ZhGr1DL5F0.5MoS2, the same with 1 graphite, 1.5 Cu, 0.5 P, and 8% MoS2; ZhGr3Tss4, the same with 3 graphite and 4% ZnS; ZhGr3D1.5K0.8, the same with 3 graphite, 1.5 Cu, and 0.8% S; Br. OTsS5-5-5, a Cu-5% Zn-5% Pb-1.5% Ni alloy (bronze); and AMO-7-3, an Al-7% Cu-3% Sn alloy (estimated) — Translator.

In order to conduct comparative performance and wear resistance tests on experimental pump components under laboratory stand and field service conditions, trial batches of pumps were prepared fitted with frictional components made of various materials:

a) standard pumps with Br. OTs55-5-5 bronze bushings;
b) experimental pumps with AMO-7-3 aluminum alloy bushings;
c) experimental pumps with bushings made of sintered ZhGr2D2·5F0.5, ZhGr3Tss4, and ZhGr3DL.5K0.8 materials of 18 and 20% porosity.

The running-in of the experimental gear pumps and the determination of their operating characteristics were performed in a KI-4200 stand. Next, eight of these pumps were tested in the same stand under accelerated conditions. The performance of the gear pumps was assessed by the pressure head developed by them and by their coefficient of discharge. During the operation of a pump its pairs of rubbing components experience wear, which has an adverse effect on their sealing, resulting in increased leakage of the working fluid and a fall in effective pressure.

The performance of pumps constructed from different materials can be conveniently compared by plotting their indicator diagrams. In our work a specially designed pressure gauge was used for plotting indicator diagrams of the small-sized experimental NSh-10 pumps. With the aid of such diagrams it proved possible to examine in some detail the process of pumping of the working fluid by the experimental pumps under various loading conditions and assess the operating performance of the new composite materials in the frictional units of the pumps. The results yielded by this study demonstrated that the performance of the experimental pumps fitted with sintered bushings was comparable to that of pumps with aluminum alloy or bronze bushings.

Measurements of torques transmitted by the driving shafts of the pumps under identical conditions of operation at pressures in the system ranging from 1.0 to 12.0 mN/m² showed that much less power was required to operate the experimental pumps with sintered bushings than the standard pumps with bronze frictional components. This was apparently due to the self-lubricating ability of the porous sintered bearing materials, which substantially reduced mechanical losses associated with the operation of the pumps.

Comparing the thermal conditions of operation of the experimental and standard pumps, it was found that the steady-state temperature attained in the friction zones of the pumps with sintered components was generally some 30°C lower than that reached in the pumps with bronze bushings, and this too was due to the self-lubricating power of the sintered porous bearings. Apart from this, the presence in the sintered materials of such components as graphite and phosphorus promoted the formation on the bearing surfaces of stable phosphate and graphite-oil films protecting the parts from cold and hot galling.

To verify the results of the laboratory study, field tests were carried out under cotton sowing conditions. In a special test program T28Kh4 tractors fitted with experimental pumps operated for 3380 h on cotton farms in the Tashkent and Syrdarnysk regions of the Uzbek SSR. Periodically the operating characteristics of the pumps were checked and the wear of all the working surfaces of their rubbing components was measured. In both accelerated tests without a contaminant...