Volume-Displacing Detanders

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The world economic crisis has made the need to operate efficiently in all areas of human activity especially pressing. This is particularly noticeable in the field of non-renewable energy. For example, Russia itself expends signficantly more than one GW for transporting billions of cubic meters from the source to the enduser alone, not including energy for processing. Similar energy expenditures for energy transportation are required in other industries such as metallurgy industries, chemical industries or fossil fuel-powered generating plants.

As a rule, high performance turbine detanders in the 0.3 to 17 MW range are employed to capture the overpressure of natural gas. The maximum demand in many regions can be satisfied with lower performance detanders in the 8 to 300 KW range, with an occasional 1 MW exception. This level of performance can be achieved with exhaust gas temperatures from approx. 150°to 400°C. Turbine-based detander s have an excessively low efficiency in this performance range. The high costs of control systems, infrastructure and operating personnel degrade its cost effectiveness. Volume-displacing detanders are much more inviting here.

Gerotor-based detanders have been used in the USA and Europe since 2007. Produced by Ener-G-Rotors, Inc. and StaRotor, Inc., these machines are employed to capture the energy of low-temperaturs gases in the 65°to 150°C range and with pressure differentials of 0.07 to 1.5 Mpa.

At low pressure differentials, volume-displacing detanders have an efficiency of over 26 percent. At pressure differentials over 0.8 Mpa, efficiency can exceed 60 percent. That makes them very attractive for commercial use and justifies the investments in the utilization technologies for low energy sources (heat, gas and liquid).

Unfortunately, experience in developing volume-displacing detanders is rather limited in Russia. Nonetheless, there are new initiatives for developing such machines in the R&D companies NAMI, VNII-Motoprom , SKB RPD VAZ. The author, Ivan Pyatov, participates in the development of these machines in his company, OOO “REAM-RTI“. Figures 1 and 2 show a rotating piston machine of the trochoidal type. Its output exceeds 25 KW. At a pressure differential of 3.0 Mpa and at 3,000 RPMs, this machine operates at efficiencies in excess of 70 percent.

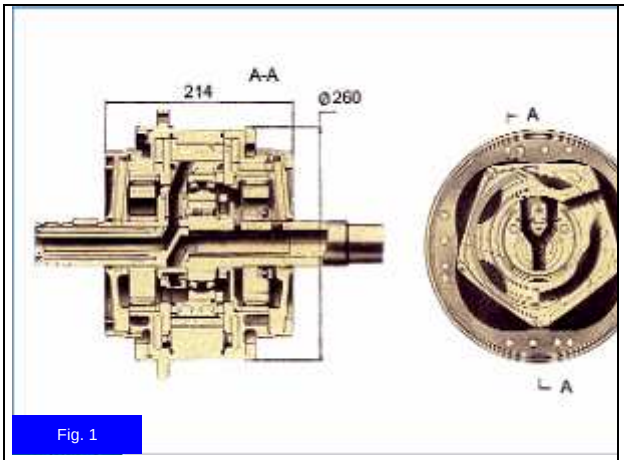

Fig. 1

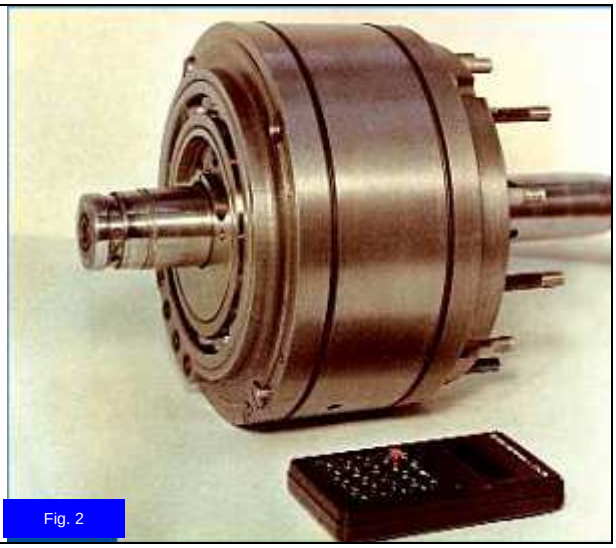

Fig. 2

Figures 3 and 4 show a Gerotor detander developed by Ivan Pyatov and his staff at OOO “REAM-RTE“. Its output at 3,000 RPMs is greater than 300 KW. This machine is the basic single-piston element of an industrially realized multi-phase pump/compressor (MPM200/600) for transporting gas/liquid mixtures. Extrapolating test results for this machine moving air (without liquid) at a pressure differential of 1.0 Mpa indicates an efficiency exceeding 80 percent.

Fig. 3

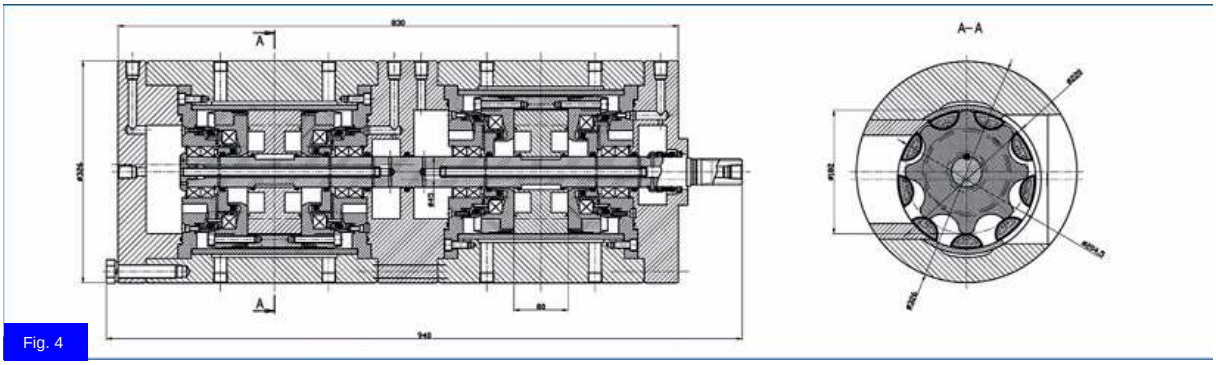

Fig. 4

These results could be improved even more using a sealing concept developed by Ivan Pyatov based on very low-friction rubber seals with a dry friction coefficient of approx. 0.1 for metal-to-rubber contact. REAM-RTI produces varieties of rubber with extremely low coefficients of friction and distributes these throughout the world.

Such devices could be especially interesting for the automotive industry as a Gerotor detander can capture up to 80 percent of the energy from exhaust gases and could be used as a low temperature steam drive for the tribrid (diesel/electro/heat) drive proposed by Boris Schapiro.

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