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ABOUT THE APPLICATION OF THE PRINCIPLES OF THE ACCELERATION OF A LIQUID FLOW IN A HELICAOID PIPE TO THE MAIN PIPELINE TRANSPORT

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This article is devoted to discovering the principles of a liquid flow in a helicoid pipe to the main pipeline transport. The main idea of a helicoid pipe was given. The advantages and the disadvantages of the applicability of such kind of pipe in the main pipeline transport were formulated. It is also proposed to learn deeper the possibility of application the helicoid pipes in the liquid environments.

Victor Schauberger (June 30, 1885 – September 25, 1958) is a great Austrian inventor, physicist, naturalist and philosopher whose works are important for hydraulic science. Working as a huntsman in a logging company, Viktor Schauberger, back in the distant 30s of the last century, received a patent that applied only to the water transport of logs, coal and ore. This scientist designed and installed water gutters with spiral notches similar to gun rifles. He showed that when rotating water decreases hydraulic resistance.

A special feature of the Schauberger's built system of rafting logs was the form of this system - most of all it resembled the natural bends of a river, and not straight segments as the shortest distance between two points. In the section of the gutter there was also a rounded shape, but not a part of the circle. According to Schauberger, observations of the natural water flows in streams and rivers prompted him to reflect on the principles of creating such a system.

Schauberger's invention is a ready-made technical solution to increase the capacity of any pipeline. According to the professor of hydrodynamics, Poppel from Stuttgart (Germany), as a result of his experiments, conducted in the 50s of the last century, in some helicoidal pipelines under certain pumping modes of ordinary water, it is possible to significantly reduce the hydrodynamic resistance of a fluid flow.

The ideas of the Austrian inventor Viktor Schauberger are extremely important for the designers of modern gas pipelines, oil pipelines, water lines of hydro stations and all other types of pipeline transport. We are talking about using the phenomenon of swirling flow in pipelines, which is still not used as a positive effect. This approach can be used to reduce the dynamic resistance of main pipelines and water lines of hydroelectric power plants. Swirling the flow along the central axis using elementary butterfly inserts or placing a curled spring inside the pipe can significantly reduce the energy costs of moving the contents of any transport pipe. The cost of upgrading the transport pipe is minimal. At the moment, a huge part of the energy, produced in the world, is used precisely for pumping oil and gas products. Reducing these energy costs through trunk transportation, even if only by a few percent, can be of immense importance.

The main parameters associated with the operation of a modern transcontinental high-pressure gas pipeline are approximately as follows: the diameter of the transport pipe is up to 1420 mm, the wall thickness is about 18 mm, the pipe is designed for a potential pressure of 75 atmospheres, the speed of the transported gas is up to 90 km per hour, the gas temperature after the compressor rises at 20 degrees, the standard distance between compressor stations is 100-200 km. When installed inside the segments of the pipeline twisting inserts butterflies can achieve an angular velocity of the axial rotation of the transported gas up to 300 revolutions per minute. Centrifugal forces provide a long central axial channel with reduced pressure and dynamic resistance. The same effect can be achieved with the help of a regular spiral inserted inside the pipe. The effect of the twist depends on the diameter of the pipe, the cross section and pitch of the helix, the viscosity of the working fluid, speed, temperature and pressure.

When a fluid or gas moves in such tubes with butterflies-inserts, a long dynamic spiral helicoid is formed inside the tube, along the axis of which an abnormal increase in the kinetic energy of the fluid or gas occurs. This profile of the pipe, called the helicoid, was first described and made by Viktor Schauberger, denoting it as a profile resembling the shape of the horns of the African antelope Kudu.

With the same cross-section of 2 pipes and the same pressure of the working fluid, they produce completely different velocity and flow rate in a laminar and turbulent-swirling axial flow, which is a helicoidal movement of the fluid. The total water flow in a pipe with a screw twisted flow will be higher, and this effect is created for the following reasons.

The first reason is that the cause of any fluid movement lies in the pressure inequality on its boundary surfaces. This pressure inequality is the driving force for the fluid. The movement itself is directed towards less pressure. There is a direct ordering of the Brownian motion of a liquid or gas in the whirl of a vortex. Chaotic

vectors of thermal motion of molecules line up strictly parallel to the axis of rotation. For example, bullets or projectiles in the rifle barrel also behave as they move in axial rotation, so that real ammunition acquires much higher energy and in the end swirling bullets and projectiles simply fly farther.

The second reason is that centrifugal forces right in the center creates a discharge zone, where most of the working fluid has the least hydrodynamic resistance. The central axis of the vortex in the pipe is a zone of anomalous flow acceleration. The temperature of this flow in the center decreases somewhat, since this part of the thermal energy of the flow is used for its self-transportation.

Schauberger's ideas can be used to supply water from a reservoir to hydro-turbine hydroelectric power plants. According to the source [2], with a helical twist of water flow, the kinetic energy of a real water flow can be increased by about 2 times, and therefore the height of the dam can be reduced by 2 times, while maintaining the same power of the electrical units.

A mathematical model of this kind of transformation of fluid motion was first developed by a Russian scientist, prof. I.S. Gromeka (1851 – 1889) in the work: "Some cases of motion of an incompressible fluid" (1881), but was unjustly forgotten. A talented prominent Russian scientist A.Ya. Milovich devoted his entire scientific life to the study, development and promotion of hydrodynamics of a vortex motion. Professor Milovich went further, and from the complex mathematical model of a screw motion, I.S. Gromeki turned to real hydrodynamic models and calculations of physical processes.

The helical motion of a fluid is a motion in which the lines of the vortices at all their points coincide with the lines of the currents. Each fluid particle not only moves progressively along its path, but also rotates around the axis of a tangent to this path at the point of position of the particle itself. In natural phenomena, this happens literally. When changing the boundary conditions and the appearance of an obstacle or interface in the flow path of a fluid flow, the fluid tries to maintain the absolute speed of movement of its particles and at the same time ensure a zero penetration rate deep into this surface. Fluids in the literal sense of the word have to begin to twist and wriggle out of themselves in the form of spirals, forming vortex cords, rollers, along which the flow rolls along the interface. This natural mechanism of transformation of the flow when the external conditions change with the conservation of the energy of the flow is realized by a screw motion.

The result of this rotation is a shift of successive layers of fluid relative to each other in the direction normal to the translational velocity, which causes the movement of all its mass in the plane normal to the main direction. There is a rotation of the flow around its longitudinal axis, and the kinetic energy of this movement is exactly equal to the kinetic energy of the longitudinal flow.

The theory of the screw movement of a fluid gives the possibility of significant penetration into the mechanism of turbulence, as in the mechanism of overtones when considering sound, therefore there is reason to think that studying this type of motion will really bring us closer to a true understanding of the phenomena we observe in liquids.

The domination of the fluid flow in hydraulics and the reliance on the loss of pressure only viscosity and friction made the idea of the vortex motion of the fluid not fully taken into account and therefore not part of the kinetic energy of the transverse circulations of the fluid its vortex motion is used.

The idea of combining translational and rotational motion for liquid and gas is very effective and this idea is already fully applicable for wide use in any kind of modern pipeline transportation. However, the idea of real use of axial rotation of the fluid during the operation of the main pipeline transport is currently not used due to the complexity of the implementation in the manufacture of pipes, cleaning the pipe cavity from sediments, conducting intra-inspection pipe inspection and therefore at the present stage is in the theoretical plane without leaving beyond the scope of practical application.

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