SHUKOS COMPONENTS LIMITED

UNCOMMON SIMPLICITY INTO INNOVATION ™

HOW DOES THE SHUKOS VALVE WORK ?

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While promoting and discussing the adjustable electromagnetic fluid flow control valve with our partners and customers, some would like to know more about this technology without getting too much of the technical details. This document has been designed for this purpose.

1. History of the invention

After realising how little opening is needed to control gas flow of cooking appliances we came to the conclusion that a traditional rotational valve, with its dimensional tolerances and grease inside, will not be able to provide consistent and accurate output when controlled by an electric motor.

Since it requires such a minor change in dimensions to alter the flow, we have turned our attention to nano-structures – a magnetostrictive material which changes its dimensions when exposed in a magnetic field (http://en.wikipedia.org/wiki/Magnetostriction). After analysing the property of such materials and dimensional requirements for the application we came to the conclusion that the magnetostrictive movement will not be sufficient to alter the flow within the required limits and manufacturing tolerances. The thermal expansion will be comparable with the displacement and will create large errors of the output. Also such materials are expensive and would make the valve unacceptable for the industry.

Then we looked at making a material which would satisfy our needs and finally came up with a simplified idea: "What if we scale up the polarised nano-structure to the size of a steel washer and create an offset magnetic field around it. This would force the washer to position itself accordingly and at the same time would operate as a tap for fluid ?..." This solution works very well and underlines the main operation principle of the invention.

2. Principle of operation

If we would place a ferromagnetic core between two poles of an electromagnet and make the surfaces of these poles parallel to the surfaces of the core, then the magnetic force applied to the core would work to move the core to the magnetic center between the poles (Fig. 1) thereby creating a linear movement.

A diagonal truncation of the poles creates an offset pass for magnetic flux and therefore the magnetic forces applied to the core will generate a rotational torque, which would try to position the core in such way to shorten the airgaps between the poles and the core (Fig. 2).

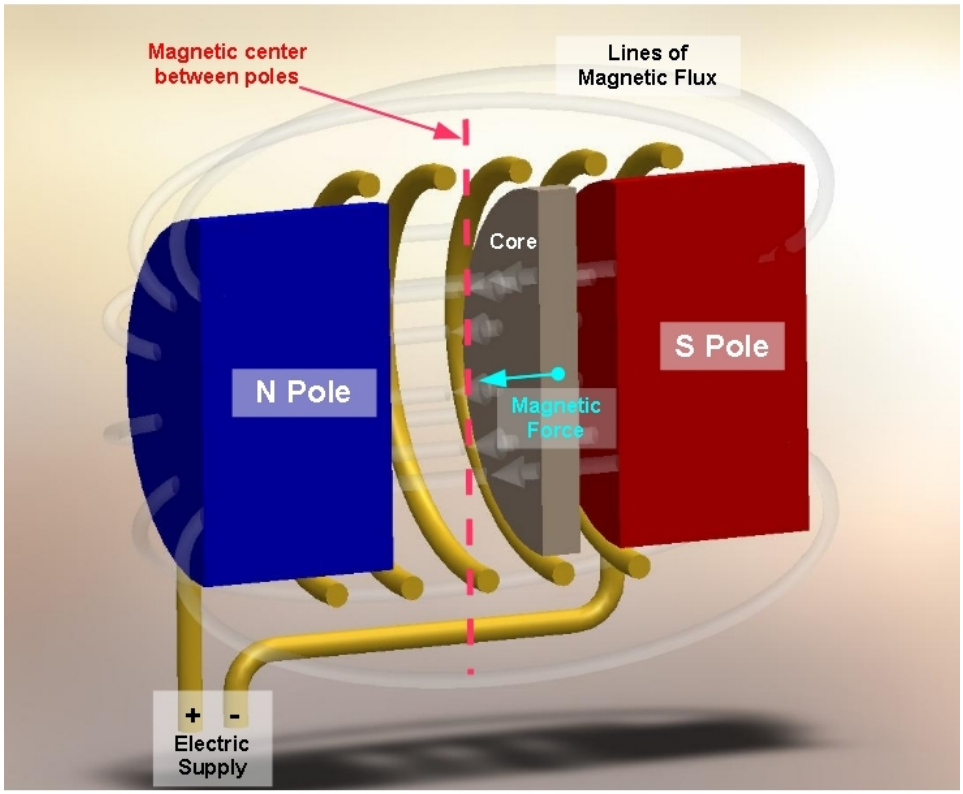

Fig. 1. Conventional electromagnetic device

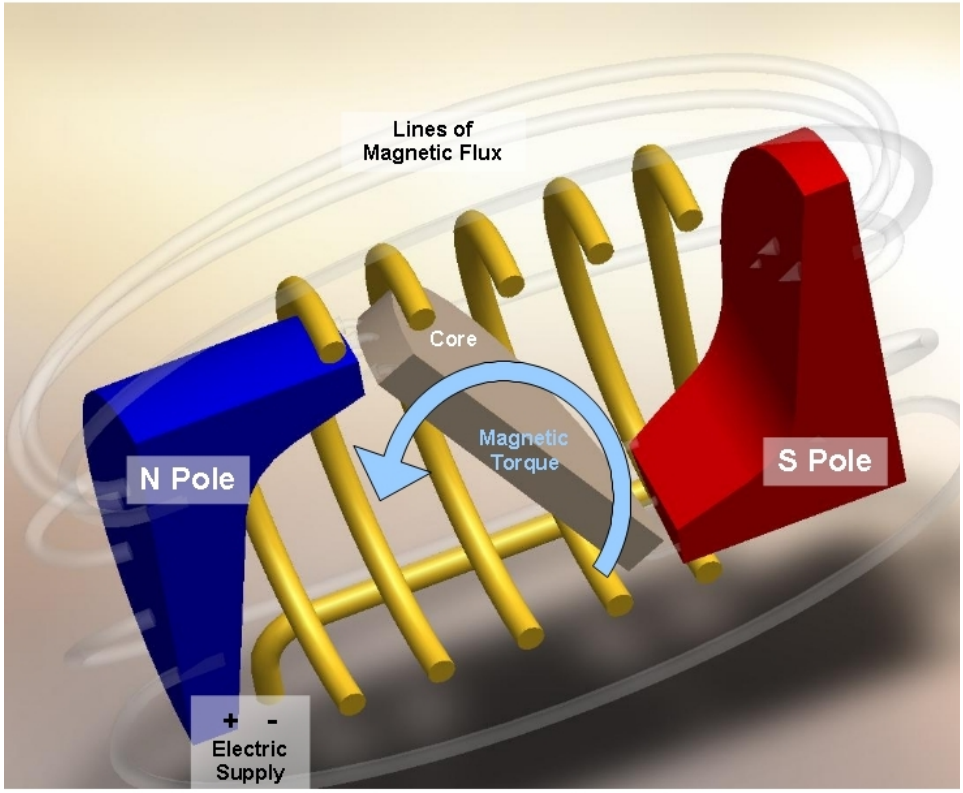

Fig. 2. Electromagnetic device with truncated poles and rotating core

Furthermore, if we use this rotational-like movement of the core to alter the cross-section area exposed to the fluid we are able to meter its flow (Figs. 3 and 4).

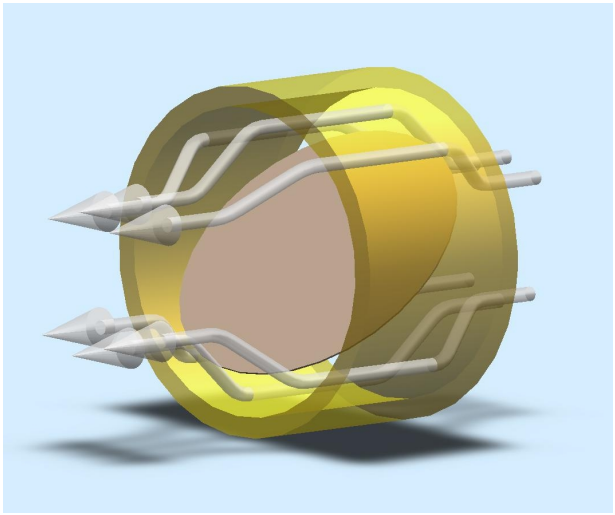

Fig. 3. Core controls the flow around inner diameter of the tube

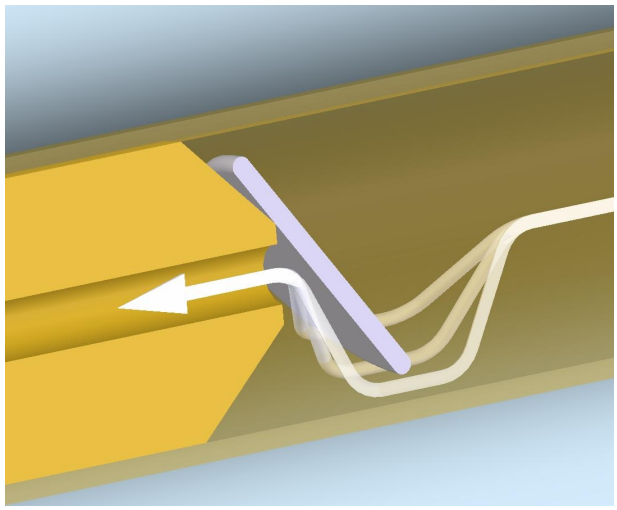

Fig. 4. Core controls flow through the orifice

3. Factors determining the abilities of the valve

Apart from magnetic forces and torques there are several other factors which determine position of the core (occluder) and consequently flow rate through the valve. These factors are:

- forces created by the fluid pressure and flow itself as well as the force of the spring;
- cross-section areas of the orifices and passageways for the flow;
- airgaps for the magnetic flux;
- dimensions and tolerances of the critical parts;
- and most importantly the matrix of relationships between all of this parameters.

Therefore having such large arsenal of variables while designing the valve, we believe that it could satisfy a wide range of customer requirements including shut-off, relief and, of cause, variable flow options in a single device.

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