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esf
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OP Vzdělávání pro konkurenceschopnost
SPŠS
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Hydraulic Machinery

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3.1 Radial Piston Pumps and Motors

Construction

Radial piston pumps are a type of piston pumps, where pistons are, unlike with the axial piston pumps, arranged in a radial direction, symmetrically around the drive shaft. The shaft is usually hollow and eccentric.

The types, where the cylinders are filled from inside of the pump, are called inside impinged radial piston pumps. Those, which are filled from outside, are called outside impinged radial piston pumps.

Operation

The way of operation can be seen on the picture. The positions of the outer ring with pumping piston and the hollow shaft are eccentric, thanks to which the different strokes of the piston are enabled. The suction process begins at the inner dead centre (IDC). As the shaft rotates, the suction area is filled with liquid. After it gets to the outer dead centre, the liquid starts to be driven out again.

Radial piston pumps can also function as a radial piston motor, which is driven by the water flow.

Advantages and disadvantages

Radial piston pumps are very efficient and highly reliable. They work very quietly. They can generate quite high pressure (up to 1,000 bars) and because of hydrostatically balanced parts very high load at lowest speed is possible. There are now axial internal forces at the drive shaft bearing.

The main disadvantage in comparison with the axial piston pump are bigger radial dimensions, which can be partly compensated with smaller size in axial direction.

Vocabulary

piston pump – pístové čerpadlo

radial piston pump – radiální pístové čerpadlo

piston – píst

axial piston pump – axiální pístové čerpadlo

shaft - hřídel

drive shaft – hnací hřídel

hollow shaft – dutý hřídel
eccentric – výstředný, nesoustředný
cylinder – válec
dead centre - úvrať
inner – vnitřní
outer – vnější
rotate – rotovat, otáčet se
suction – sání
liquid – tekutina
drive (drove, driven) – hnát
efficient – výkonný
reliable – spolehlivý
generace – vytvářet
pressure – tlak
up to – až
balanced – vyvážený
load – zatížení, zátěž
speed – rychlost
axial – axiální, ve směru osy
internal forces – vnitřní síly
bearing – ložisko
radial – radiální, kolmý k ose

4 Rotary Vane Pumps and Motors

4.1 Rotary vane pumps and motors

A rotary vane pump is a type of a positive-displacement pump, invented by a Canadian engineer Charles C. Barnes in 1874.

Basic description

Rotary vane pumps contain two or more vanes on a rotor, which rotates inside a cavity. The rotor is placed in the cavity eccentrically. The vanes can have various lengths. They are usually tensioned (using a spring) so that they can keep contact with the walls during the rotation. They divide the cavity into two chambers.

Way of operation

Because the rotor of rotary vane pumps is placed inside their cavity eccentrically, the vanes have to slide into and out of it to keep contact with the walls and seal the chambers. As the vanes rotate, the chamber on the intake side increases in volume and is filled with fluid, which is driven in by the inlet pressure (often the pressure from the atmosphere is sufficient). After the chamber gets to the discharge side of the pump, it starts decreasing in volume, and the fluid is forced to flow out of the pump. Each rotation of the vanes conveys the same volume of the fluid.

Some vane pumps can be also used as a vane motor. In this case the rotor is forced to spin by the unbalanced pressure of the fluid on the vanes.

Application

Rotary vane pumps are often used in some high pressure car equipment, such as superchargers, power steering and automatic transmission boxes. Midrange fluid pressure applications include fountain drink dispensers or espresso coffee machines. Sometimes also low pressure applications can be seen, such as secondary air injection used for automobile emissions control, or in some air conditioners, where it pumps a refrigerant.

Vocabulary

rotary vane pump – rotační lamelové čerpadlo

positive-displacement pump – objemové čerpadlo

vane – lamela

cavity – dutina
eccentric – výstřední, mimostředový
tensioned – napjatý
spring – pružina
chamber – komora
slide – klouzat
seal – těsnit
intake – sání
volume – objem
increase in volume – nabývat na objemu
decrease in volume – ztrácet objem
fluid – kapalina
drive – hnát, pohánět
inlet – vstup
inlet pressure – vstupní tlak
sufficient – dostatečný
discharge – výtlak
forced – nucen
convey – dopravit
vane motor – lamelový hydromotor
spin – otáčet se
unbalanced – nevyvážený, nerovnoměrný
application – využití
supercharger – turbodmychadlo
power steering – posilovač řízení
automatic transmission box – automatická převodovka
midrange – střední, středního rozsahu
fountain drink dispenser – výčepní zařízení, výčepní automat
coffee machine – kávovar¨
secondary air injection – vhánění přídavného vzduchu
automobile emissions control – kontrola emisí motorových vozidel
air conditioner – klimatizační zařízení
refrigerant – chladivo, chladicí kapalina, chladicí plyn

5 Gear Pumps and Gear Motors

5.1 Gear Pumps and Gear Motors

Basic information

Gear pumps are a type of positive displacement pumps, which use gears to pump fluid. They are one of the most common types of hydraulic pumps. They are also often used for pumping various chemicals with certain viscosity. They belong among the pumps, which convey a fixed amount of fluid with every rotation.

Operation

Rotating gears develop underpressure on the intake side, making the fluid to flow in. Then it is conveyed to the discharge side, where the gears push it out. The meshing of the gears has to be very tight so that the fluid could not leak backwards.

Types

Two main types of gear pumps are designed.

- external gear pumps, using two external spur gears
- internal gear pumps, using one external and one internal spur gear.

Gear motor

Some gear pumps can also work as a motor. Such a motor has two gears, one is driven and the other is idler. High pressure fluid flows aroung the gears to the outlet port. The driven gear rotates, meshing with the idler gear, and does not allow the fluid to flow back.

gear pump – zubové čerpadlo

positive displacement pump – objemové čerpadlo

gear – ozubené kolo

pump – čerpat

fluid – kapalina

hydraulic pump – hydraulické čerpadlo

viscosity – viskozita

convey – dopravit

fixed – stálý

amount – množství

develop – vytvářet
underpressure – podtlak
intake – sání
discharge – výtlak
meshing – proplétání
mesh – proplétat se
leak – unikat, prosakovat
backwards – nazpět
external gear pump – klasické zubové čerpadlo
internal gear pump – excentrické zubové čerpadlo
spur gear – ozubené kolo s přímými zuby
gear motor – zubový hydromotor
driven gear – poháněné ozubené kolo
idler gear – vložené ozubené kolo
pressure – tlak
outlet port – výstup, vývod

6 Rejstřík