Chapter 8

Rotary Actuators

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1 General

Rotary actuators output a swivel movement via a shaft when pressurised with fluid regardless of the type or design of the unit. The angle the rotary actuator moves through is limited by fixed or adjustable stops. Hence the range of applications in which rotary actuators may be used is limited.

The compact and robust design and the possibility of transferring large torques makes the rotary actuator particularly useful for applications under rough operating conditions.

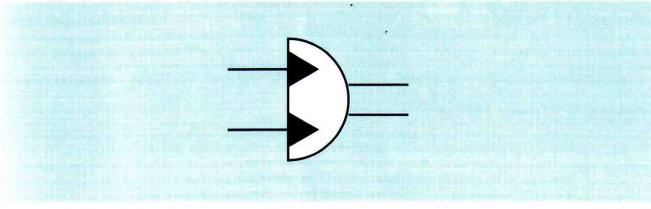

Fig. 1

2 Types

In a similar way to hydraulic motors with rotating output movements, rotary actuators may be categorised into

- vane type
- radial/tangential piston types and
- axial piston types.

2.1 Vane model

The vane rotary actuator is particularly economically designed, as a round housing may be used due to the way the central output shaft with single or double rotary vanes has been designed.

In addition a through shaft may be used in this drive in order to add on another output or display devices.

Vane rotary actuators may rotate through an angle of up to 280°.

Torque is produced by pressurising the rotary vanes with fluid and is maintained constant over the whole swivel range.

By using double vanes the torque produced may be doubled, but the swivel range is then decreased by about 60%.

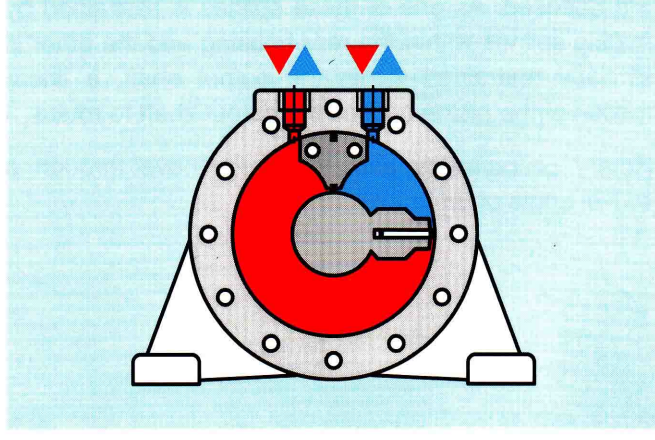

Fig. 2: *Vane type rotary actuator with single vanes*

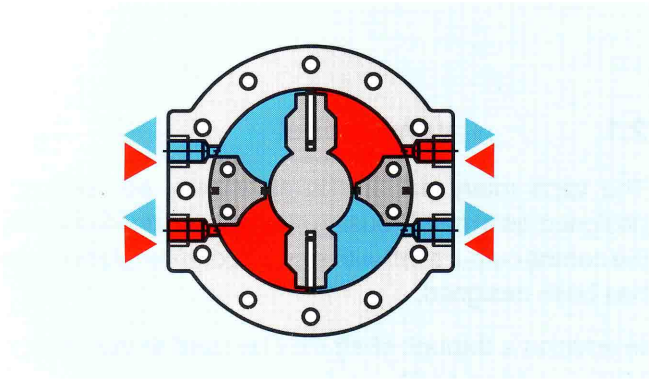

Fig. 3: *Vane type rotary actuator with double vanes*

2.2 Rotary piston/rotary actuator

In this model the fluid acts on the piston which has been lengthened to accomodate helical external splines of about 45° gradient. The helix angles of these two splines are opposed. As one of these splines is restrained by mating splines within the rear housing and the other is similarly restrained within the output shaft, a linear motion of the piston causes the output shaft to rotate.

Rotary piston/rotary actuators may move through a swivel angle of up to 720°.

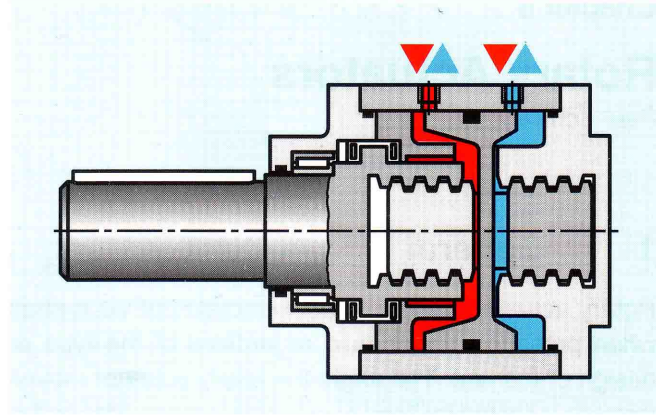

Fig. 4: *Rotary piston/rotary actuator with drive pivot operated by means of a thread*

2.3 Parallel piston/rotary actuator

In parallel piston/rotary actuators two pistons moving in parallel to each other are alternately pressurised with fluid. The force produced in this way is transferred to the output shaft via piston rods (similar to the way in which combustion engines work). These piston rods act at a tangent to the rotating output shaft.

Parallel piston/rotary actuators may move through a swivel angle of up to 100°.

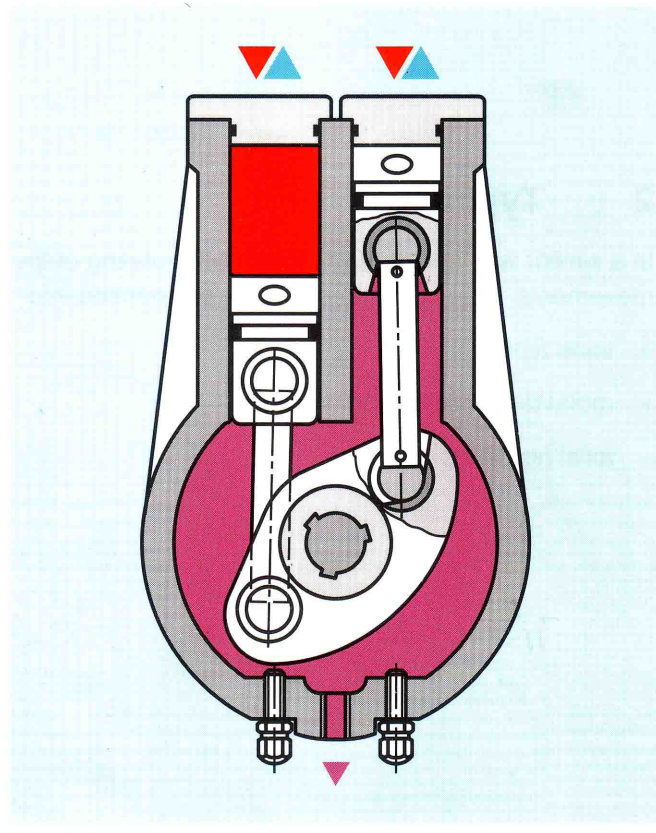

Fig. 5: *Parallel piston/rotary actuator*

2.4 In-line piston/rotary actuator with connecting rod drive

The design of an in-line piston/rotary actuator is similar to that of a double acting double rod cylinder without protruding piston rod ends.

The central piston part drives the output shaft via a connecting rod drive system. Piston, connecting rod and crankshaft are all situated in a sealed housing which is held together by flanges.

In-line piston/rotary actuators with connecting rod drives may move through a swivel angle of up to 180°.

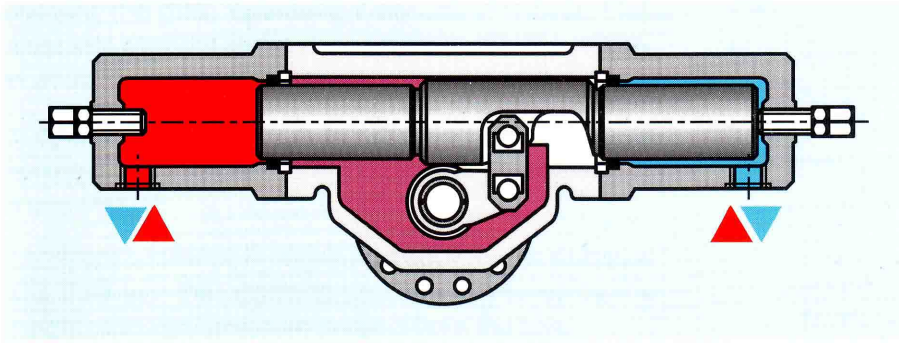

Fig. 6:
In-line piston/rotary actuator with connecting rod drive

2.5 In-line piston/rotary actuator with rack and pinion drive

In this design, the central part of the piston is formed into a rack. The interlocking pinion produces the output torque. A through shaft is possible with this model. Depending on the pinion ratio, swivel angles of 90, 140, 180, 240, 300 or 360° or even more may be achieved.

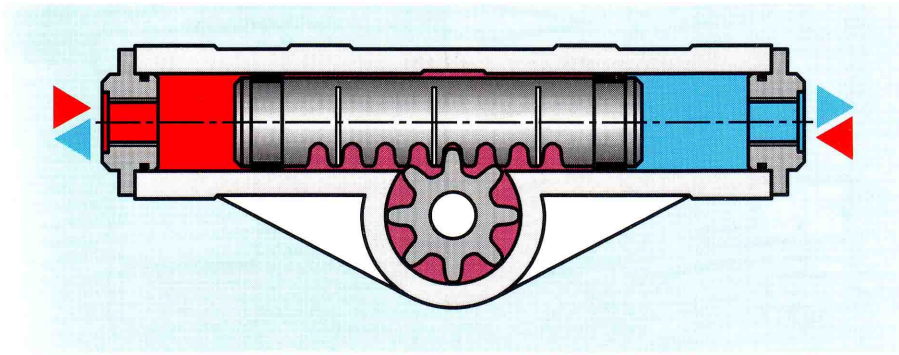

Fig. 7:
In-line piston/rotary actuator operated via double rod cylinder and rack and pinion output