

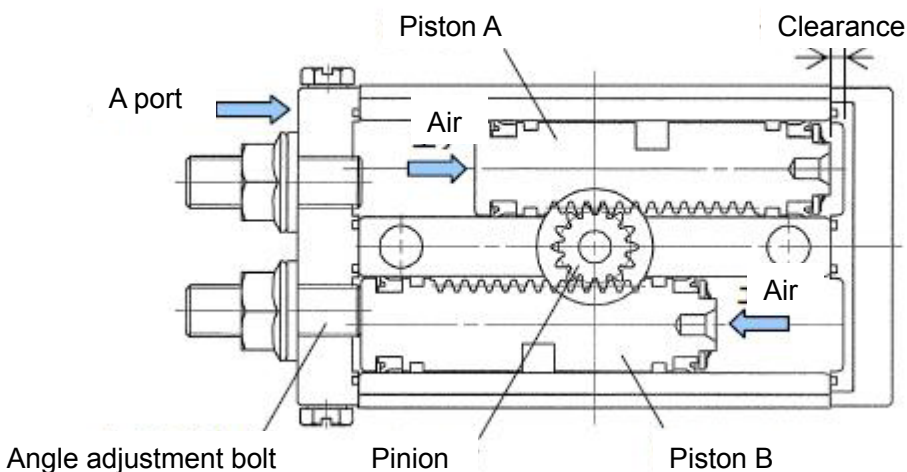
## Holding torque at the rotation end of the double rack type rotary actuators

Since the CRQ and MSQ series are the double rack type rotary actuators, there is no backlash of the gears. However, there is a trade-off that the holding torque at the rotation ends is half of that available during rotation. The reasons are as follows.

As shown in the figure below, when air is supplied to the A port, it will then produce a force acting on the left side of piston A moving it to the right and also on the right-side of piston B moving it to the left, so that the pinion rotates clockwise. As a result, during rotation, the thrust force of the two pistons act on the pinion to generate the effective torque specified in the catalog.

At the end of rotation, piston B stops when it contacts the angle adjustment bolt, whereas piston A moves further before it is stopped by the pinion because of the backlash between the teeth of the rack and pinion and the clearance in the direction of its movement. Therefore, at around  $1^\circ$  of rotation where piston A moves further to its end of stroke, the pinion only receives the thrust force from piston A, meaning that, the torque becomes half of that specified in the catalog. (The thrust force of piston B does not act on the pinion when it contacts with the angle adjustment bolt.)

This is same when air is supplied to the B port to rotate the pinion counterclockwise.



As explained above, this phenomenon occurs when the product uses the angle adjustment bolt. In other words, the halving of the torque can be avoided by adjusting the angle using external stoppers that prevent the piston coming into contact with the adjustment bolt.

This phenomenon does not cause a big problem if the product is used with a vertical rotating axis. On the other hand, if the product is used with the rotating axis in a horizontal direction to lift a load against gravity, due to the halving of the torque at the end of rotation, the product will not lift the load to the rotation end. As stated in the catalog, during product selection, it is required to select the product whose effective torque is 3 to 5 times bigger than the actual required torque under a resistance load condition.