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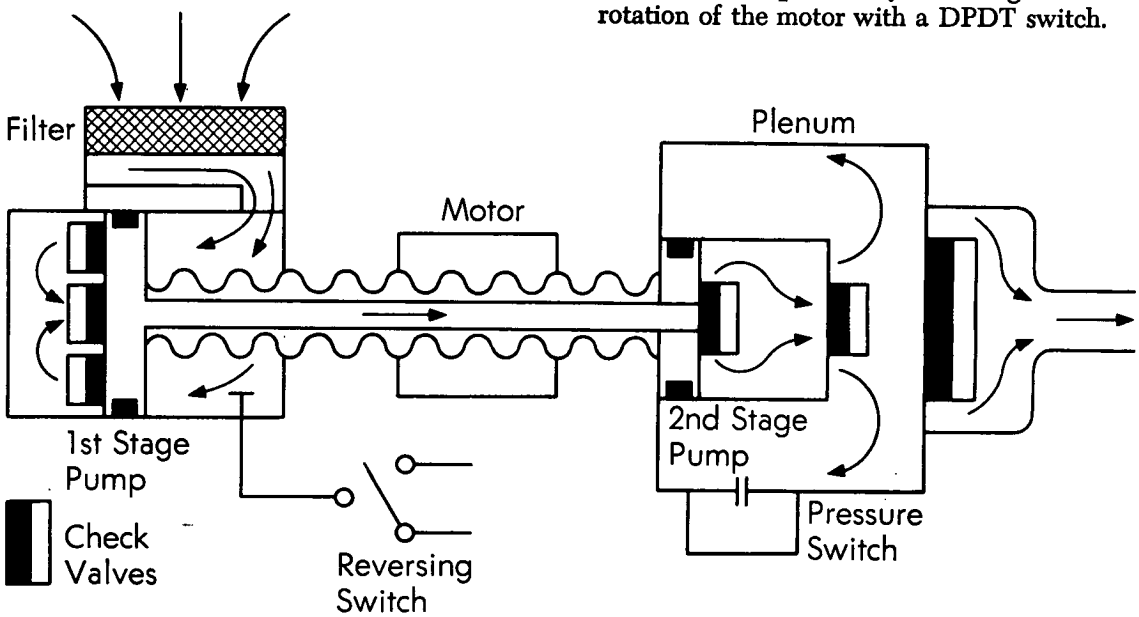
NASA TECH BRIEF

Ames Research Center

Two-Stage Coaxial Gas Compressor

The problem:

To raise the pressure of gases from a low ambient supply during space experiments by a system of low weight, size, and power input.



The solution:

Utilize a DC rotary-torque motor and a ball-screw drive shaft to activate the first and second stage of a miniaturized light-weight compressor, utilizing inertia forces to operate check valves.

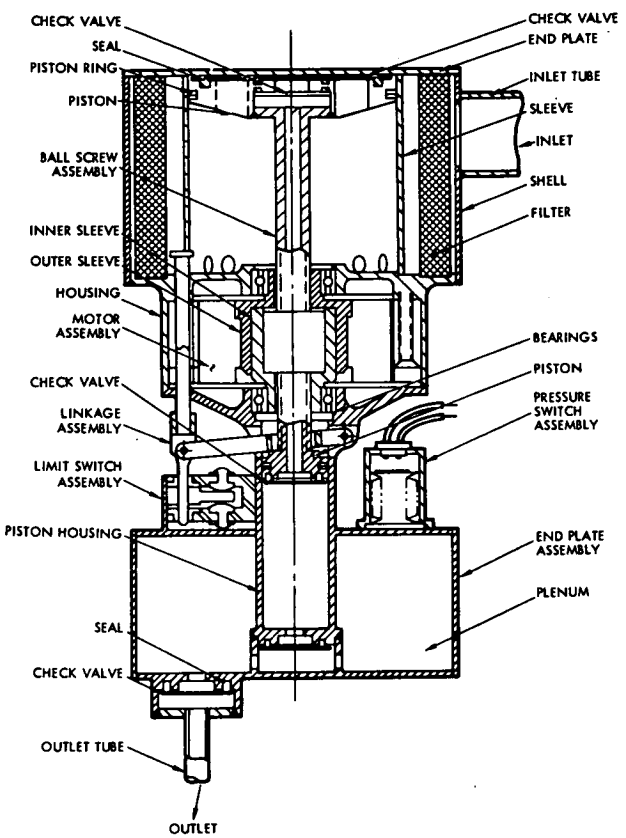
How it's done:

The two-stage gas-compressor assembly depicted in the diagram consists of an inlet filter, first- and second-stage pumps, DC motor, plenum, reversing switch, pressure switch, and associated valves. The DC torque motor, located centrally between the first and second-stage cylinders, simultaneously drives the two pistons by a hollow ball-screw shaft. Stroke reversal is accomplished by reversing the direction of rotation of the motor with a DPDT switch.

During the compression stroke, a negative pressure is created in the chamber behind the first-stage piston, allowing the atmosphere to enter the chamber through the inlet. During the suction stroke, atmospheric gas enters the compression chamber through a large check valve located on the face of the piston. The compression stroke then forces the gas through a second check valve located at the center of the piston, and the gas is transferred through the center of the ball-screw into the second-stage cylinder. The

(continued overleaf)

high pressure gas is then pumped into the plenum by the second-stage piston via the outlet check valve located at the end of the second-stage cylinder.



The check valves are supported by flat flexure plates with essentially zero, static spring loads. Piston movement actuates the check valves by utilization of the inherent forces developed by differential pressure and inertia. The low cracking pressure (virtually zero) is important for proper operation of the first-stage suction stroke because of the low ambient pressure differential available at the pump inlet.

Notes:

1. Lightweight and small size are attactive features for utility of the device in portable refrigeration systems or general laboratory apparatus requiring high compression-ratio pumps.
2. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B72-10210

Patent status:

No patent action is contemplated by NASA.

Source: William S. Wang, Harvey W. Wright, Jr., and Sam Huniu of
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under contract to
Ames Research Center

(ARC-10426)