

DIGITAL ENGINE

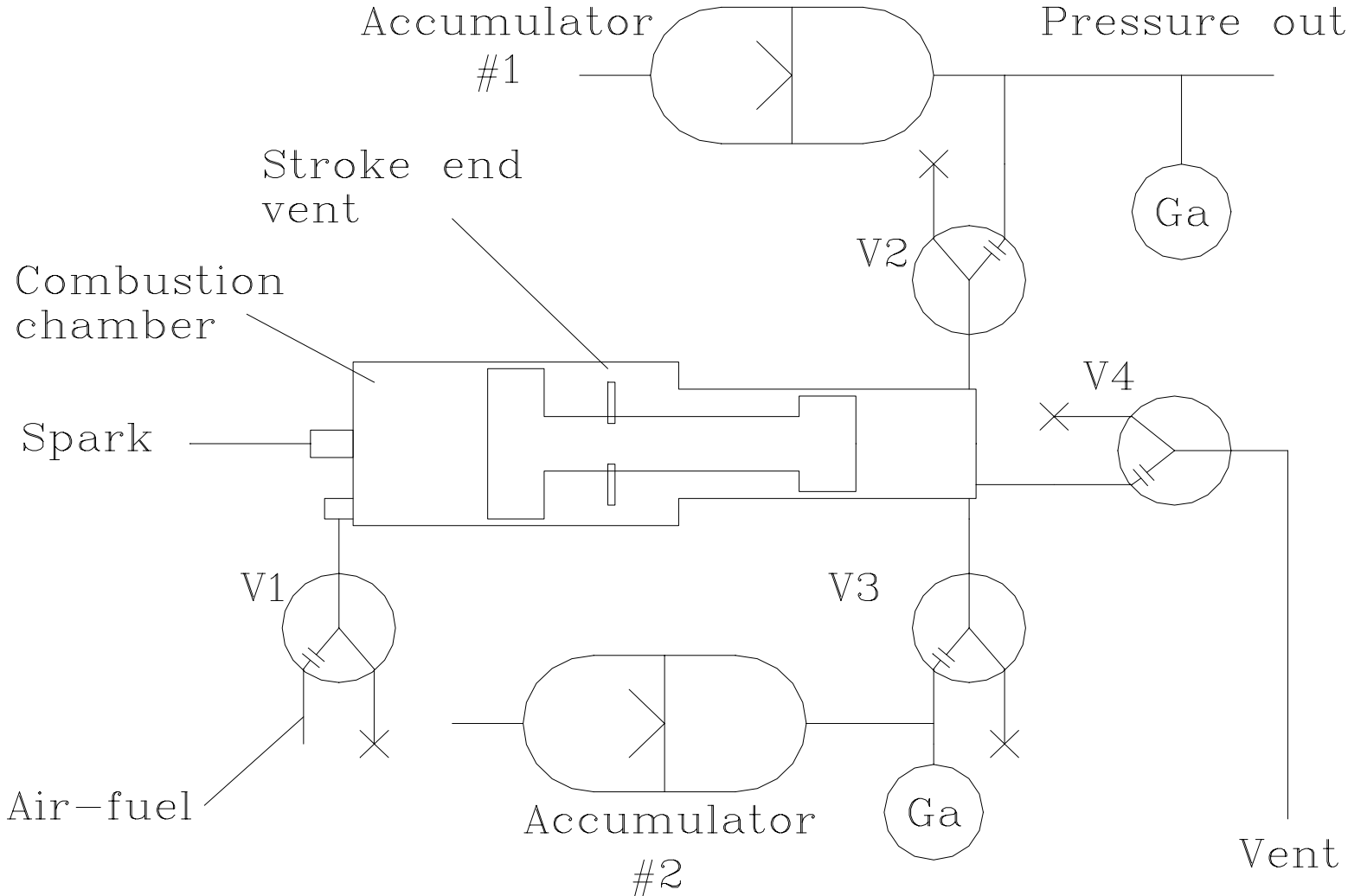
(USING HOMOGENOUS CHARGE COMPRESSION IGNITION)

by

KEN SHOULDERS

BODEGA, CA

DIGITAL ENGINE SCHEMATIC



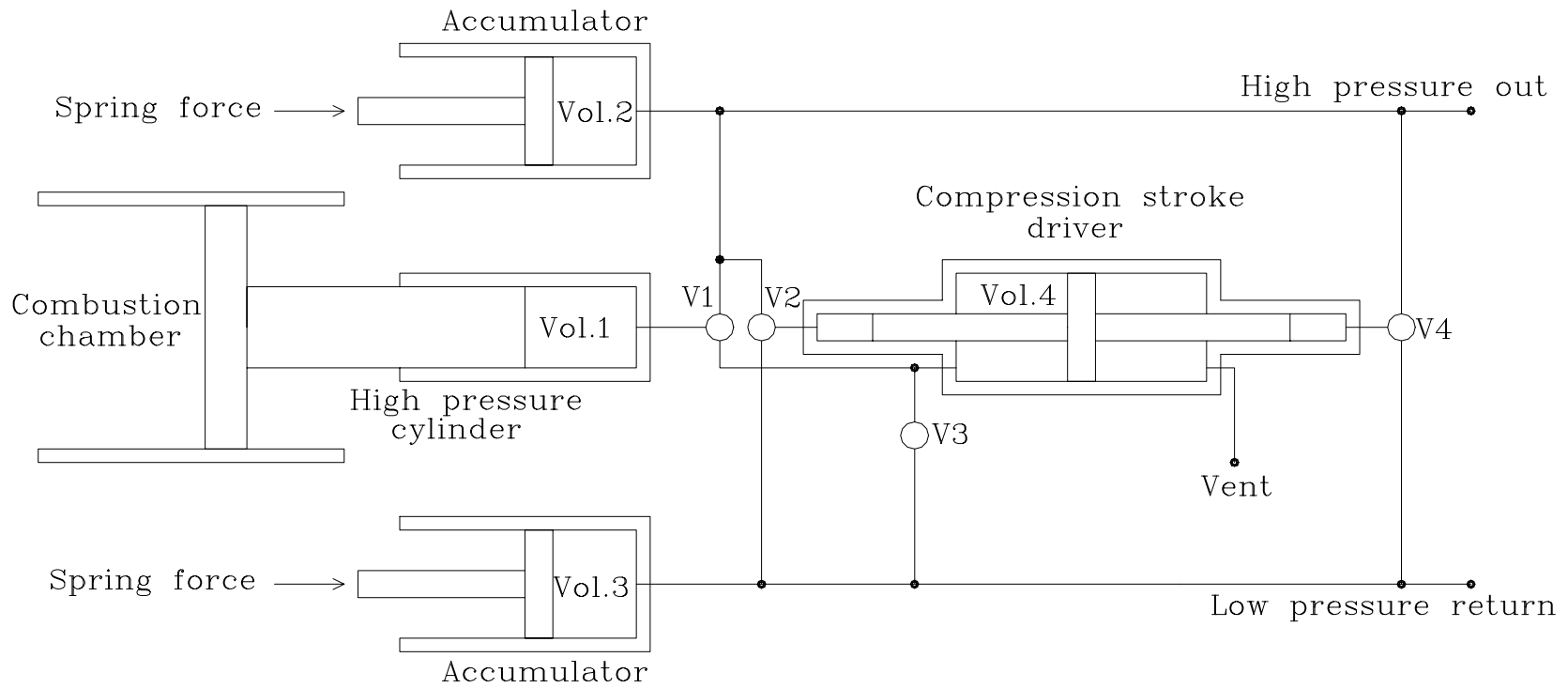
SEQUENCE:

- 1. Close main 2-way valves, V2 & V3, between the hydraulic cylinder and their sources.**
- 2. Establish proper air pressure for accumulator #2 and high-pressure storage accumulator #1.**
- 3. Open stroke end valve V4 in hydraulic cylinder.**
- 4. Add air pressure and small amount of gas fuel to combustion cylinder through V1 to move it to BDC thus emptying fluid in hydraulic pump end of cylinder. Close V1.**
- 5. Close BDC dump valve V4.**
- 6. Open 2-way valve V3 to drive piston into compression region.**
- 7. At proper position in compression cycle, fire spark for ignition of fuel and air.**
- 8. Record pressure vs. time in combustion chamber, compression chamber and high-pressure storage chamber.**
- 9. Record bounce characteristic of piston vs. time by using piston position indicator to determine loss of energy during cycle.**

THE COMPONENTS NEEDED FOR THE TEST ARE:

1. Cylinder for combustion and hydraulic pumping.
2. Piston for combustion and hydraulic pumping.
3. Small valve to dump the hydraulic fluid at BDC, V4.
4. Air admission system to push the combustion piston to BDC vent ports, V1.
5. Fuel mixer for air admission system.
6. Main electrically operated 2-way valves in the hydraulic flow path, V2 & V3.
7. Spark ignition system.
8. Detector of piston position (multi-electrode capacity diode bridge).
9. Pressure indicator for combustion chamber (capacity diode bridge).
10. Pressure indicator (capacity diode bridge) and fluid level for both high-pressure accumulator #1 and compression accumulator #2.

SCHEMATIC OF FLUID VOLUME BALANCE



DESCRIPTION OF FLUID COMPONENTS

Vol. 1: High-pressure hydraulic cylinder at end of combustion chamber piston.

Vol. 2: High-pressure accumulator (2,500 psi).

Vol. 3: Low-pressure accumulator (100 psi).

Vol. 4: Compression stroke driver to Vol. 1.

V1: Main 3-way valve for switching fluid into and out of Vol. 1.

V2: 3-way valve for charging compression stroke driver and relieving return stroke.

V3: 2-way valve for recharge of Vol. 4 (This could be a 3-way valve to isolate Vol.1).

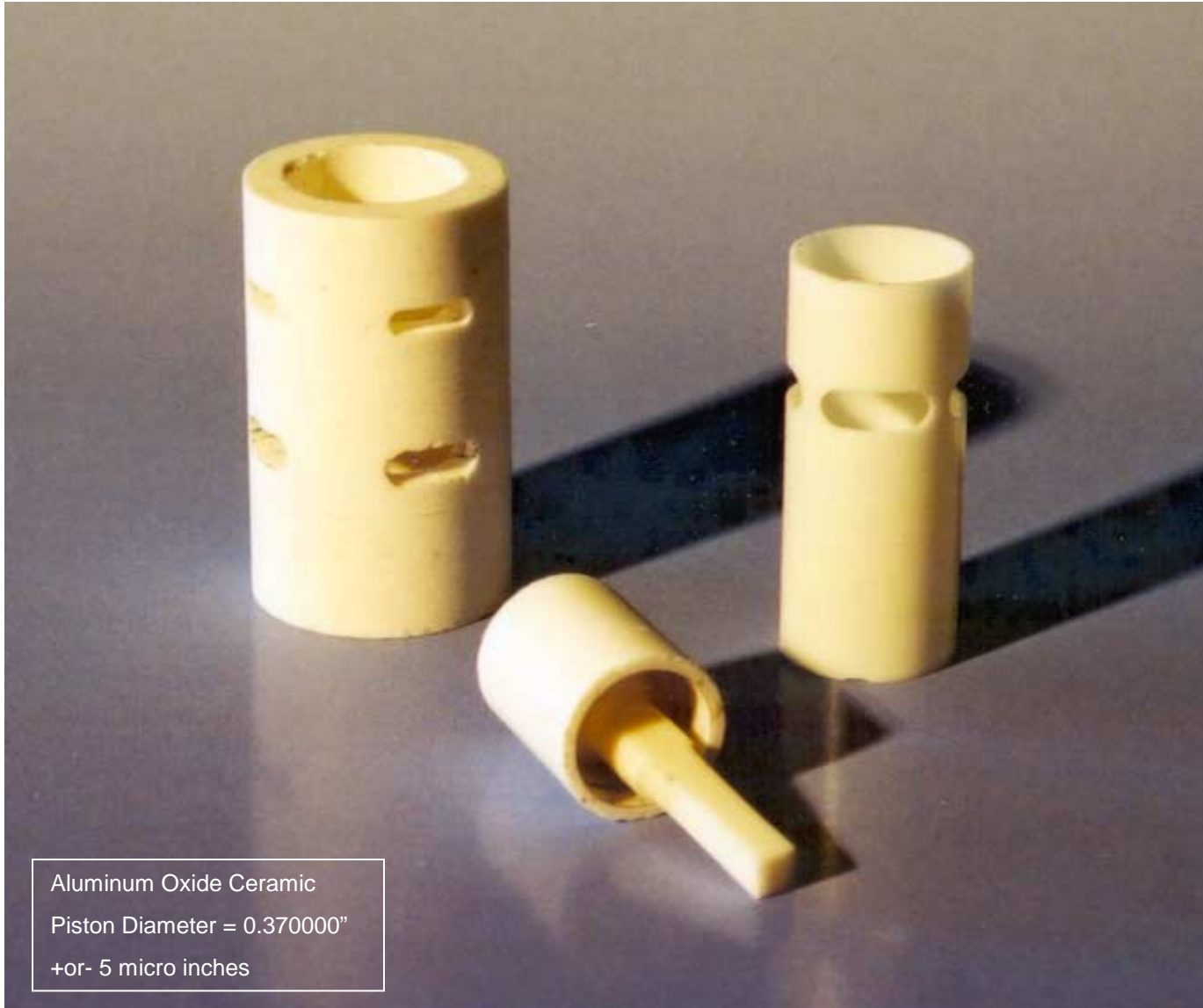
V4: 3-way valve for driving compression stroke and relieving return stroke.

VOLUMES:

The volume of Vol. 4 must be slightly larger than Vol. 1.

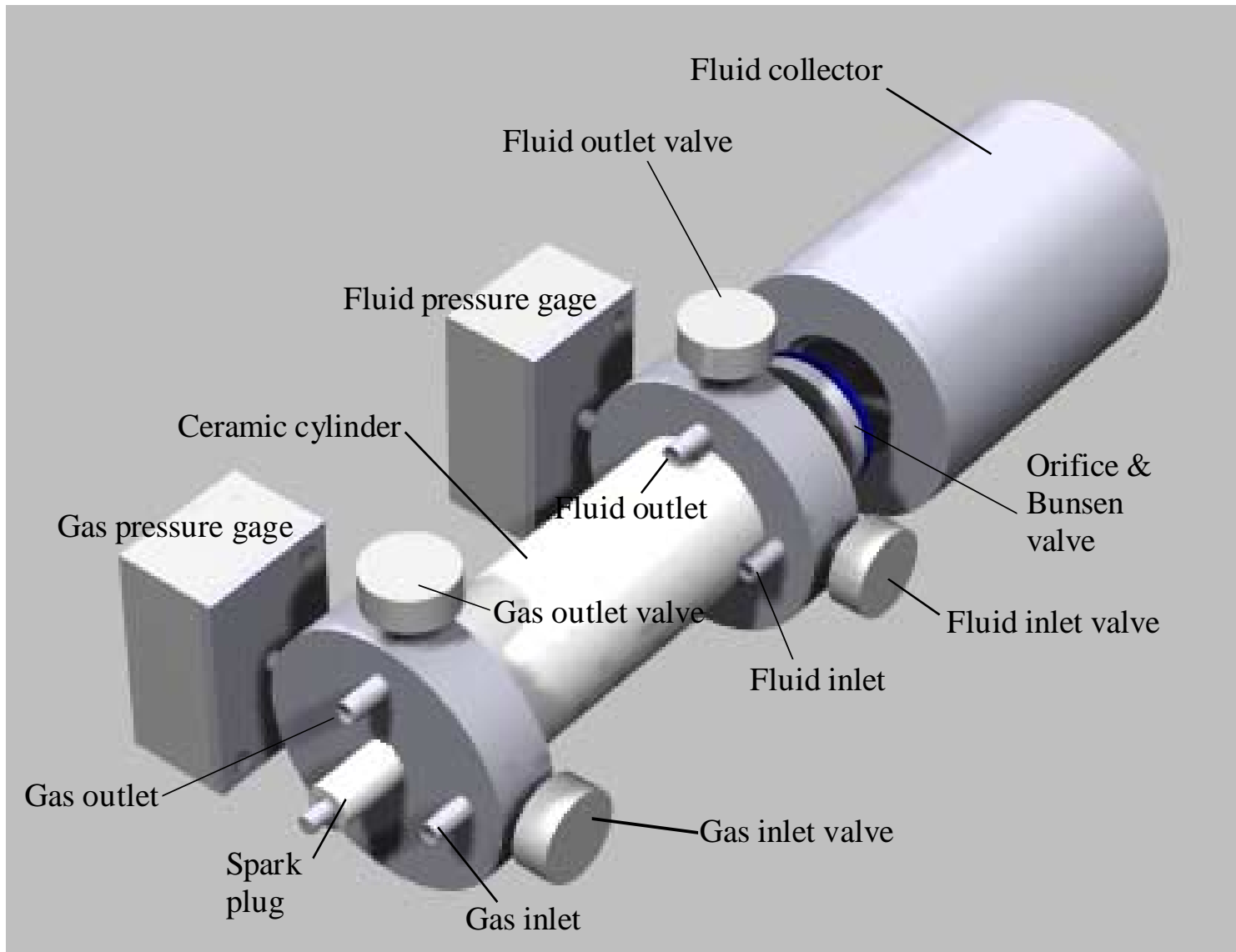
The volume of Vol. 2 & 3 must be slightly larger than Vol. 1.

CERAMIC CYLINDER, PISTON & SLEEVE VALVE



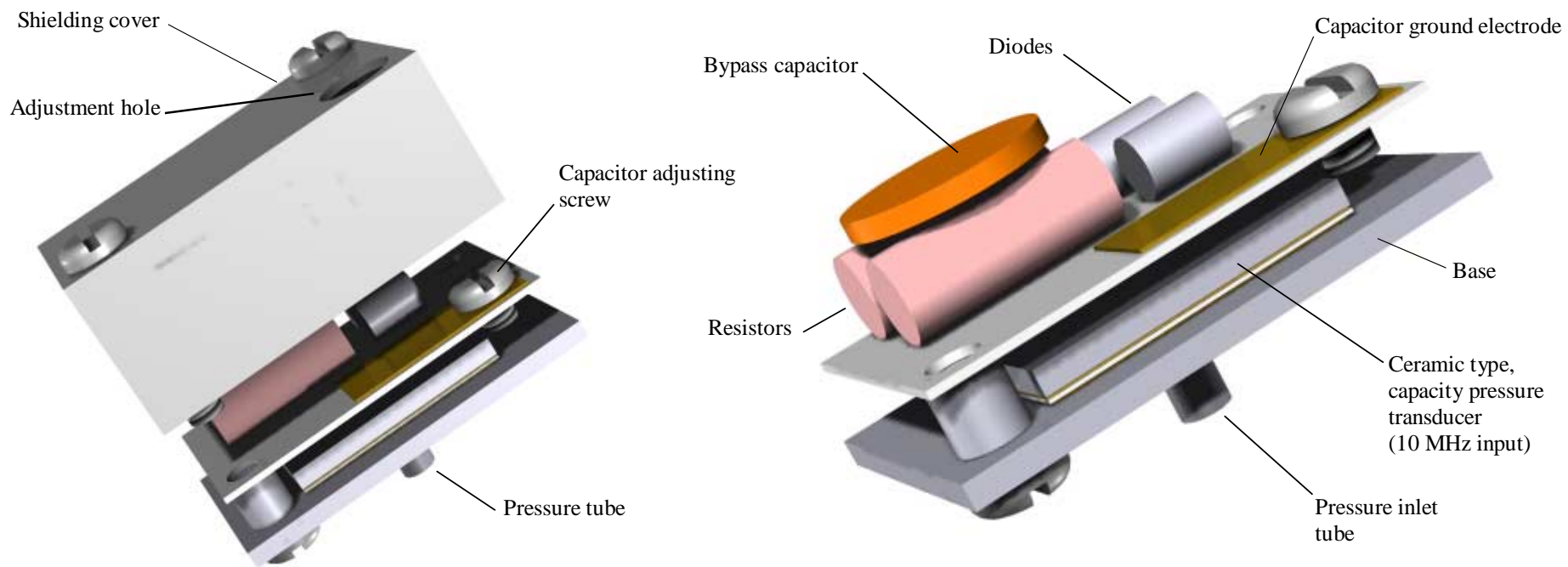
Aluminum Oxide Ceramic
Piston Diameter = 0.370000"
+or- 5 micro inches

HYDRAULIC VALVE FLOW TEST



CAPACITY PRESSURE TRANSDUCER

(FOR CYLINDER HEAD AND FLUID HEAD)



SLEEVE VALVE RADIAL FLOW TEST

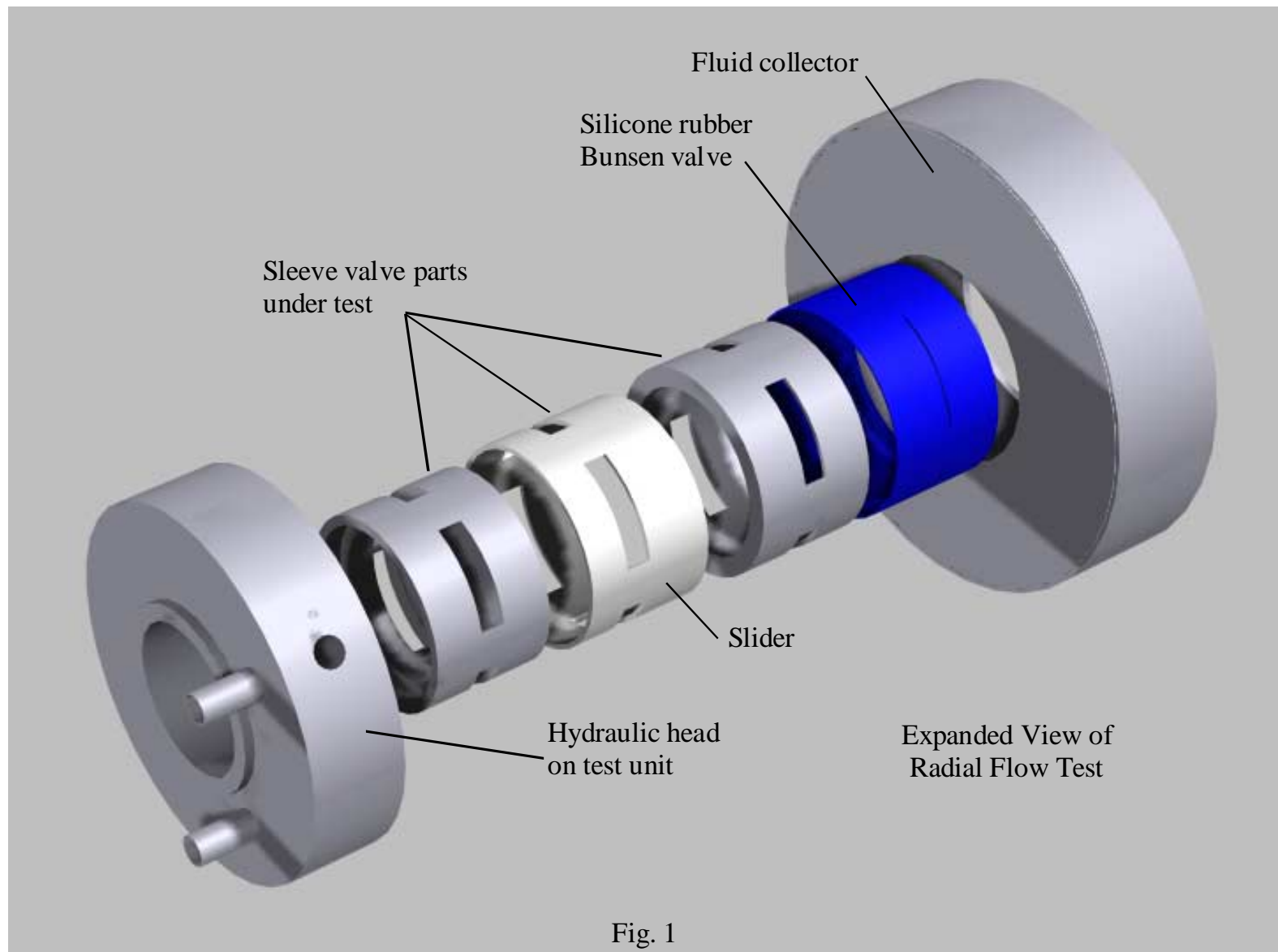
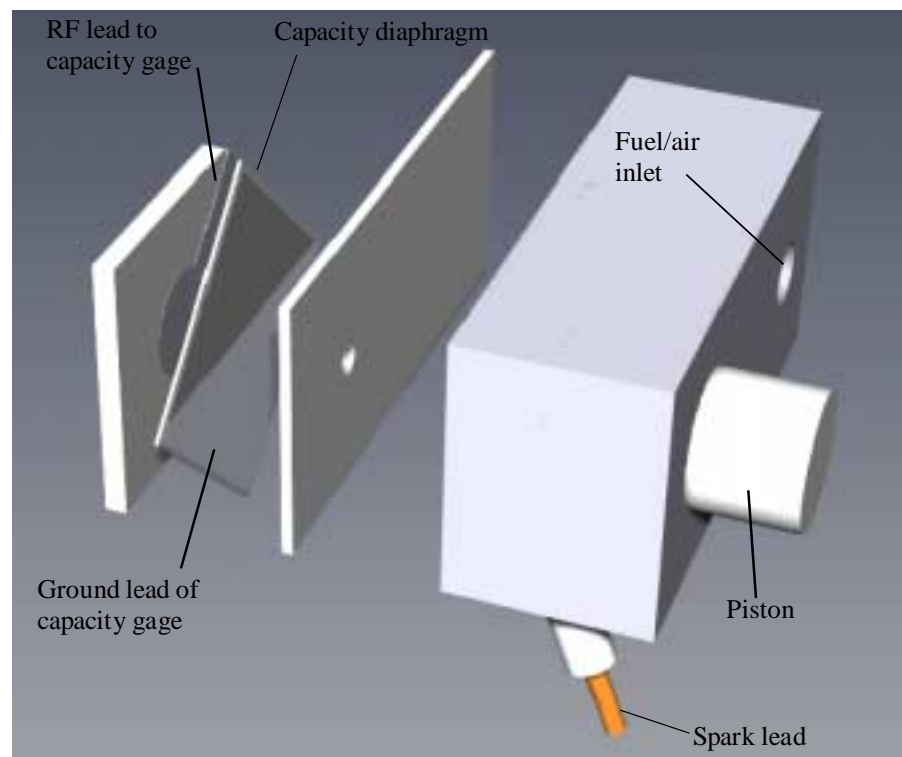
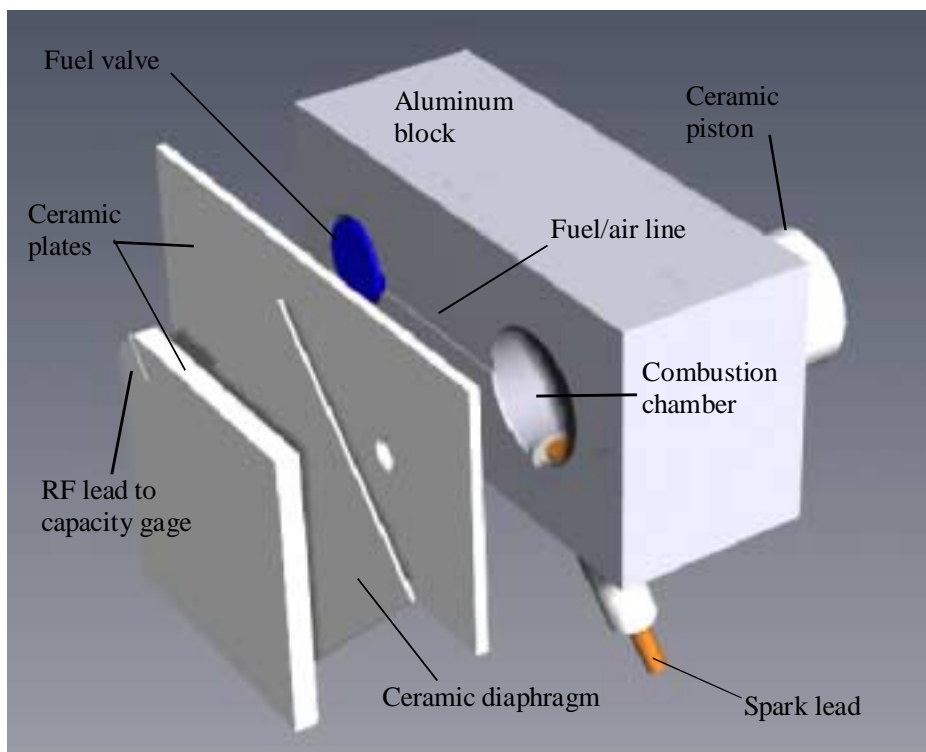


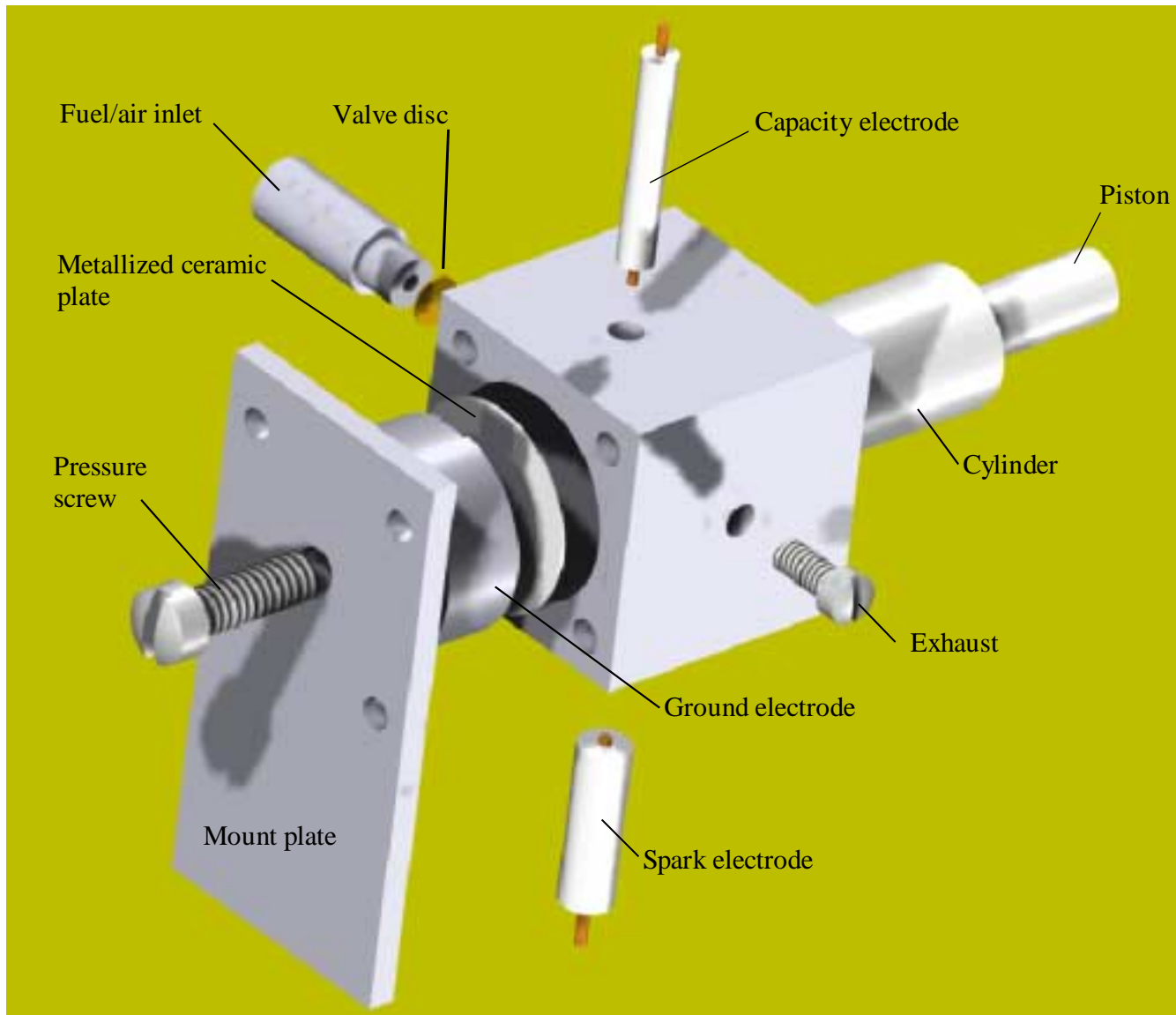
Fig. 1

PRESSURE TRANSDUCER

(FOR CYLINDER HEAD)

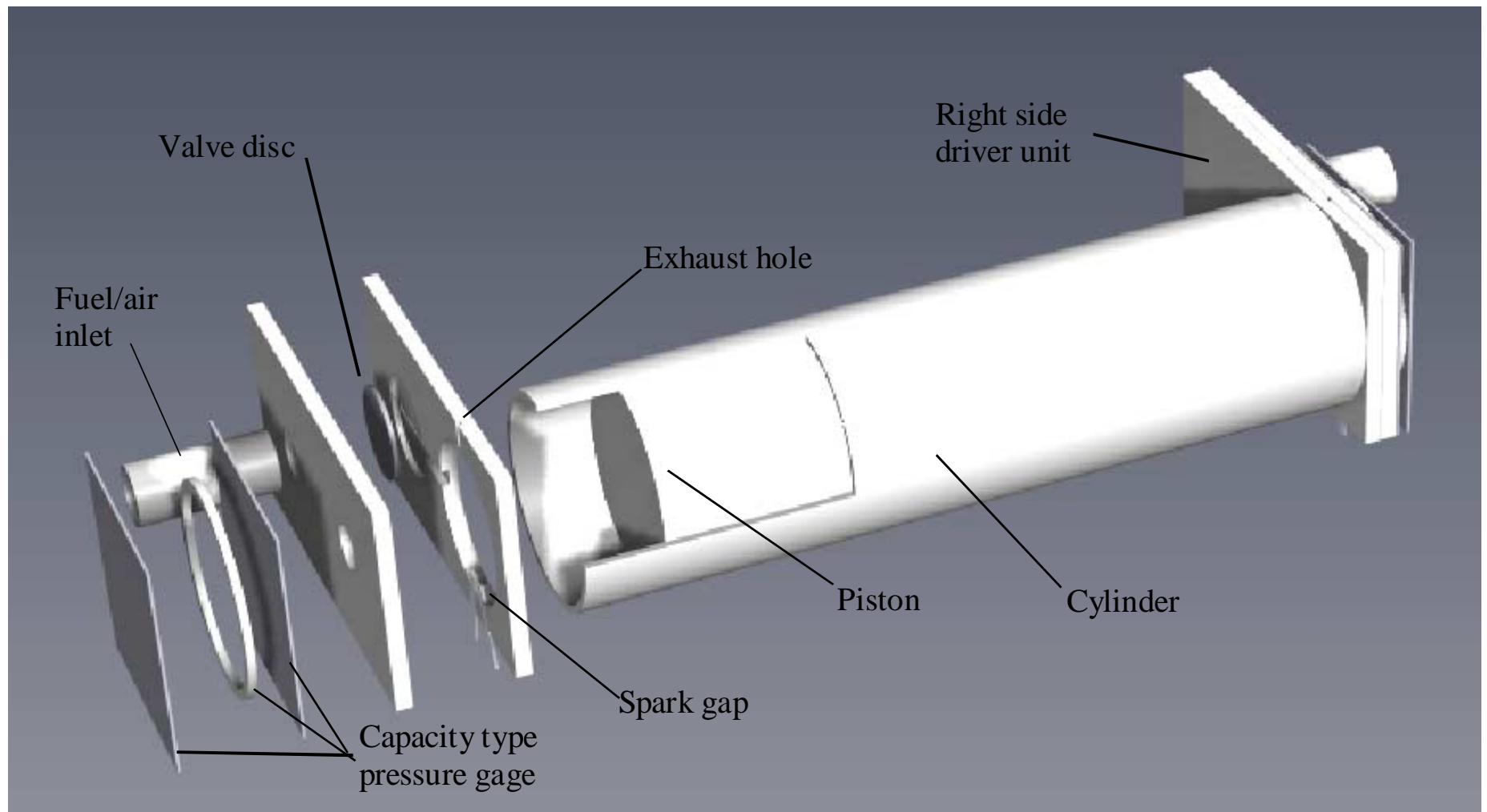


PRESSURE GAGE TEST UNIT



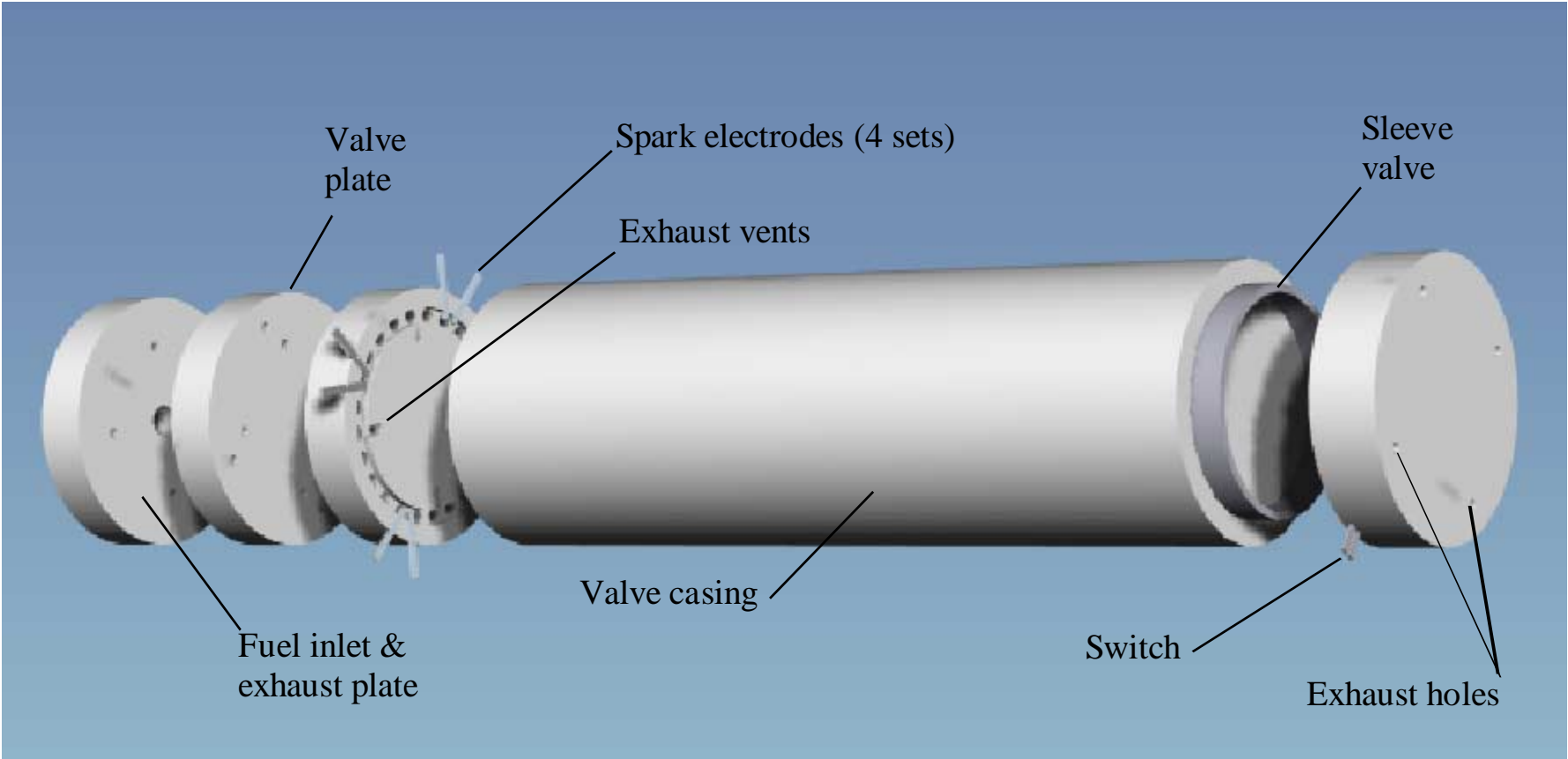
IMPULSE OSCILLATOR

(USING SOLID CERAMIC PISTON)



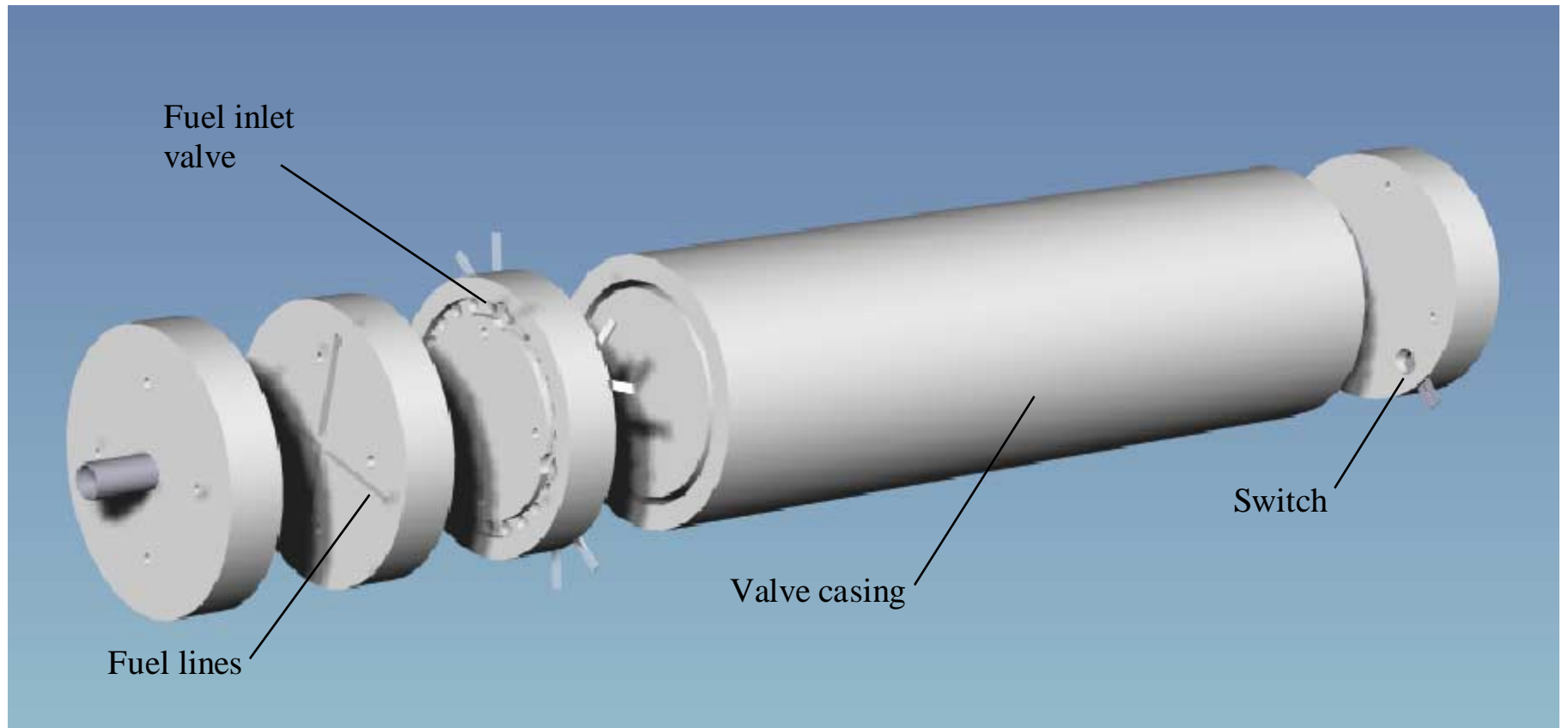
IMPULSE SLEEVE VALVE

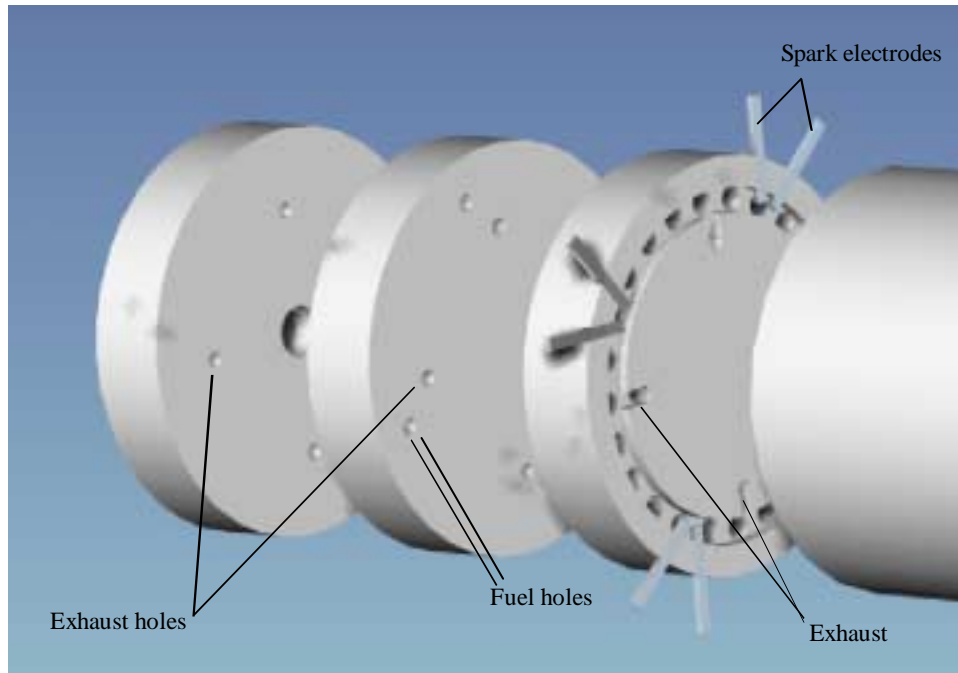
(COMPRESSION END ON RIGHT)



IMPULSE SLEEVE VALVE

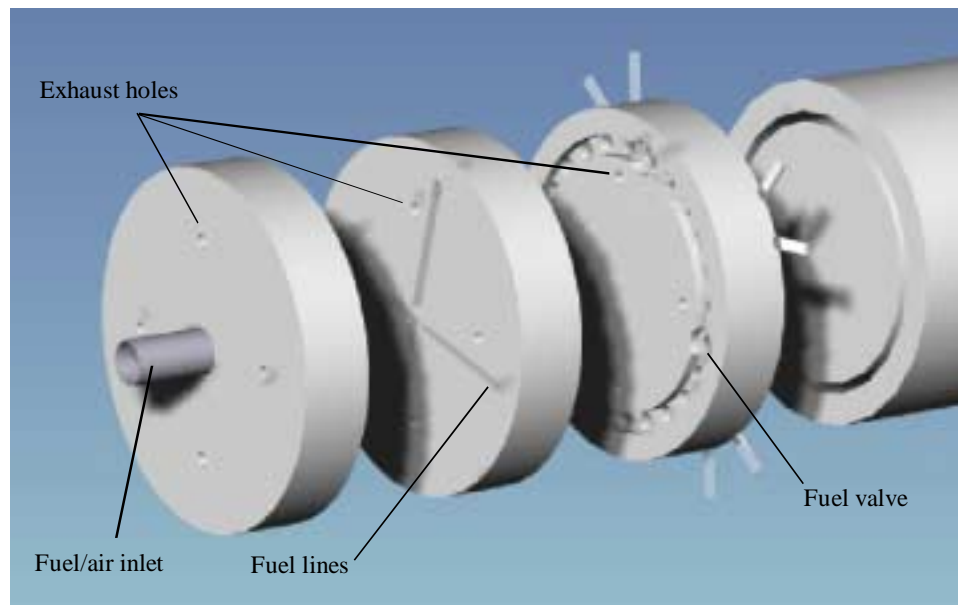
(COMBUSTION END ON LEFT)



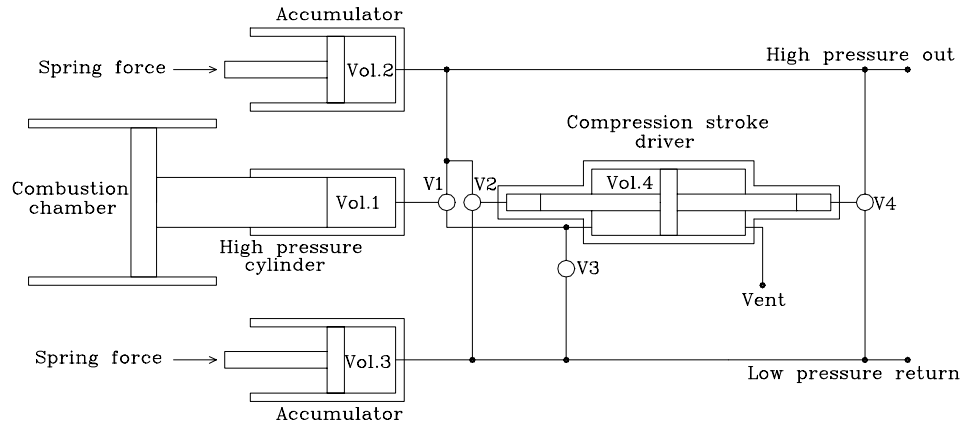


IMPULSE SLEEVE VALVE

(ENLARGED VIEWS OF COMBUSTION END)



Engine exhaust and intake sleeve valves operate independently under computer control as dictated by piston position and pressure sensors.



Description of Components:

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- Vol. 2: High-pressure accumulator (2,500 psi).
- Vol. 3: Low-pressure accumulator (100 psi).
- Vol. 4: Compression stroke driver to Vol. 1.
- V1: Main 3-way valve for switching fluid into and out of Vol. 1.
- V2: 3-way valve for charging compression stroke driver and relieving return stroke.
- V3: 2-way valve for recharge of Vol. 4 (This could be a 3-way valve to isolate Vol.1).
- V4: 3-way valve for driving compression stroke and relieving return stroke.

Valve Timing Diagram

All valves shown below function by using a single sleeve valve located over the Compression Stroke Driver

