pendulum piston arrangement the piston c.g. is allowed to oscillate in a circular
arc or, in another embodiment, oscillates about its own c.g.
To the second category belong the rotary piston machines of which the c.g. of the
power component (piston) moves at uniform or non-uniform speed in one direction
along a circular or differently shaped closed path. The power component (piston)
may also rotate at uniform or non-uniform velocity about its c.g.

4. Types of reciprocating piston and rotary piston machines

The working chamber volume of reciprocating machines (REM) may be varied as
follows:

1 a) A piston may have straight linear motion in a stationary cylinder. Alternatively,
the piston may be stationary and the cylinder may move to and fro.
A cover or cylinder head is usually firmly attached to the cylinder but may, if con­
venient, be replaced by a slide or rotary valve. Furthermore, a second piston may
replace the cylinder head or closing valve, as in certain opposed piston machines.
1 b) Straight cylinders may be given a to and fro motion — as on some oscillating
cylinder steam engines — alternatively the cylinder sleeve may reciprocate or rotate
for the purpose of opening and closing of the inlet and exhaust ports — as in sleeve
valve engines.

2. Pendulum-piston arrangements, although no longer produced as heat engines,
are also possible; the cylinders of these units have either a round or square section
bore arranged as a circular arc along which the appropriately shaped piston oscil­
lates. Vane type manually operated pumps with these characteristics are, for ex­
ample, still being made by the Allweiler Company.

3. Apart from the types indicated in 1 a and 1 b — with actual cylinders — and those
indicated in 2 — with partly rotating components — it is feasible to obtain recipro­
cating piston movement by way of a suitable screw thread but this type of machine
has apparently been ignored.

Arrangements in which the power component or working part of a chamber (piston)
is connected to other moving parts, do not seem to be very numerous. In old types
of reciprocating piston machines, which featured no rotating power output member,
chains or connecting rods usually linked the piston to a beam. However, in recipro­
cating piston machines with a rotating output shaft the connecting rod is linked
either directly to the crankshaft or indirectly by way of a beam, bell-crank or reversing
gear. There are very few instances in which a reciprocating piston acts either directly
upon suitable cams (or swashplates) or indirectly by way of interposed rollers.
Finally, there are the free-piston engines in which the energy is transmitted directly
by the piston to another working medium.
The familiar layout of reciprocating piston engines — in line, V, horizontally opposed,