

WHAT IS CLAIMED IS:

1. An internal combustion engine configured to have a piston reciprocating in a cylinder in which blow-by gases pass from a combustion chamber in the cylinder to an area external to the cylinder, the piston connected to a rod configured to reciprocate in a linear direction, wherein

the engine comprises a gas exchange chamber configured to trap the blow-by gases in a space between the cylinder and a chamber housing an actuator connected to an end of the rod.
2. The engine of claim 1, wherein the engine is configured such that the blow-by gases pass between the rod and a rod holder.
3. The engine of claim 1 or claim 2, wherein the gas exchange chamber is configured to prevent the blow-by gases from reaching the chamber that houses a fluid.
4. The engine of claim 3, wherein the fluid includes a liquid lubricant.
5. The engine of claim 3, wherein the fluid includes oil vapor.
6. The engine of any of claims 1-5, wherein the rod holder includes a bearing configured to allow the rod to slide along the linear direction against the bearing.
7. The engine of claim 6, wherein the bearing includes a bushing.
8. The engine of any of claims 1-7, wherein the actuator includes an electrical generator.

9. The engine of any of claims 1-7, wherein the actuator includes a mechanism configured to transform linear reciprocating motion of the rod to rotative motion.
10. The engine of any of claims 1-9, wherein the gas exchange chamber is included in a cylinder head.
11. An internal combustion engine comprising:
a piston connected to a rod and configured to reciprocate in a cylinder,
wherein the engine is configured to contain, in a gas exchange chamber, blow-by gases escaping from a combustion chamber in the cylinder through a space between the rod and a member surrounding the rod.
12. The engine of claim 11, wherein the member surrounding the rod includes a bushing configured to allow the rod to move linearly along an axis and prevent the rod from moving perpendicular to the axis.
13. The engine of claim 11 or claim 12, wherein the gas exchange chamber is configured to prevent the blow-by gases from contaminating a further chamber.
14. The engine of claim 13, wherein the further chamber includes a lubricant chamber.
15. The engine of claim 14, wherein the further chamber houses a mechanism configured to transform linear reciprocating motion of the rod to another form.

16. The engine of any of claims 11-15, wherein t
blow-by gases into the combustion chamber and to decrease emissions.
17. The engine of any of claims 11-16, wherein the gas exchange chamber includes an air inlet and an air outlet.
18. The engine of any of claims 11-17, wherein the gas exchange chamber includes a clean air chamber between the combustion chamber and an end of the rod.
19. The engine of any of claims 13-15, wherein the gas exchange chamber includes a seal configured to seal the gas exchange chamber from the further chamber.
20. An internal combustion engine comprising:
a piston connected to a rod extending from a first side of the piston, the piston configured to reciprocate in a cylinder having a combustion chamber formed between the first side of the piston and a head opposite the first side of the piston; and
a gas exchange chamber configured to contain blow-by gases passing, from the combustion chamber, through a space between and the rod and a member surrounding the rod.
21. The engine of claim 20, wherein the member surrounding the rod includes the head.

22. The engine of claim 20 or claim 21, v
reciprocating engine and the rod is configured to linearly reciprocate along an axis of the
cylinder.
23. The engine of claim 20 or claim 21, wherein the engine includes a single-sided
piston.
24. The engine of claim 20 or claim 21, wherein the engine includes a double-
sided piston.
23. An internal combustion engine comprising:
a cylinder including a combustion chamber;
a piston slidably mounted within the cylinder and configured to linearly reciprocate
along an axis in the cylinder;
a piston rod connected to the piston, the piston rod configured to linearly reciprocate
along the axis, and the piston rod having an end extending outside the cylinder; and
a gas exchange chamber, the gas exchange chamber configured to communicate gases
coming from the cylinder to another location in the engine.
24. The engine of claim 23, wherein the gas exchange chamber is arranged between the
cylinder and a chamber housing an actuator configured to extract work from motion of the
piston.
25. The engine of claim 24, further comprising:

a seal configured to seal the gas exchange chamber;
an actuator.

26. The engine of any of claims 23-25, wherein the gas exchange chamber is configured to communicate gases coming from the cylinder to an air filter.

27. The engine of any of claims 23-26, wherein the end of the piston rod extending outside the cylinder is configured to reciprocate between a first maximum travel position and a second maximum travel position, the first maximum travel position and the second maximum travel position being on the axis.

28. The engine of claim 27, wherein the first maximum travel position and the second maximum travel position are external to the cylinder.

29. The engine of any of claims 23-28, further comprising:
an air supply, wherein the air supply is configured to supply fuel-free air to the gas exchange chamber.

30. A linear reciprocating engine comprising:
a piston configured to linearly reciprocate along an axis in a cylinder;
a piston rod connected to the piston, the piston rod configured to linearly reciprocate along the axis;
a first chamber that includes a combustion chamber in the cylinder;
a second chamber that includes a gas exchange chamber;

a third chamber configured to accommodate :
outside the cylinder; and

a seal between the second chamber and the third chamber, wherein the seal is configured to prevent gases in the second chamber from entering the third chamber.

31. The engine of claim 30, further comprising:

a partition between the second chamber and the third chamber, wherein
the seal is provided in an opening in the partition, and
the piston rod is prevented from moving in a direction perpendicular to the axis.

32. The engine of claim 30, further comprising:

a ring member provided in the gas exchange chamber.