

May 10, 1949.

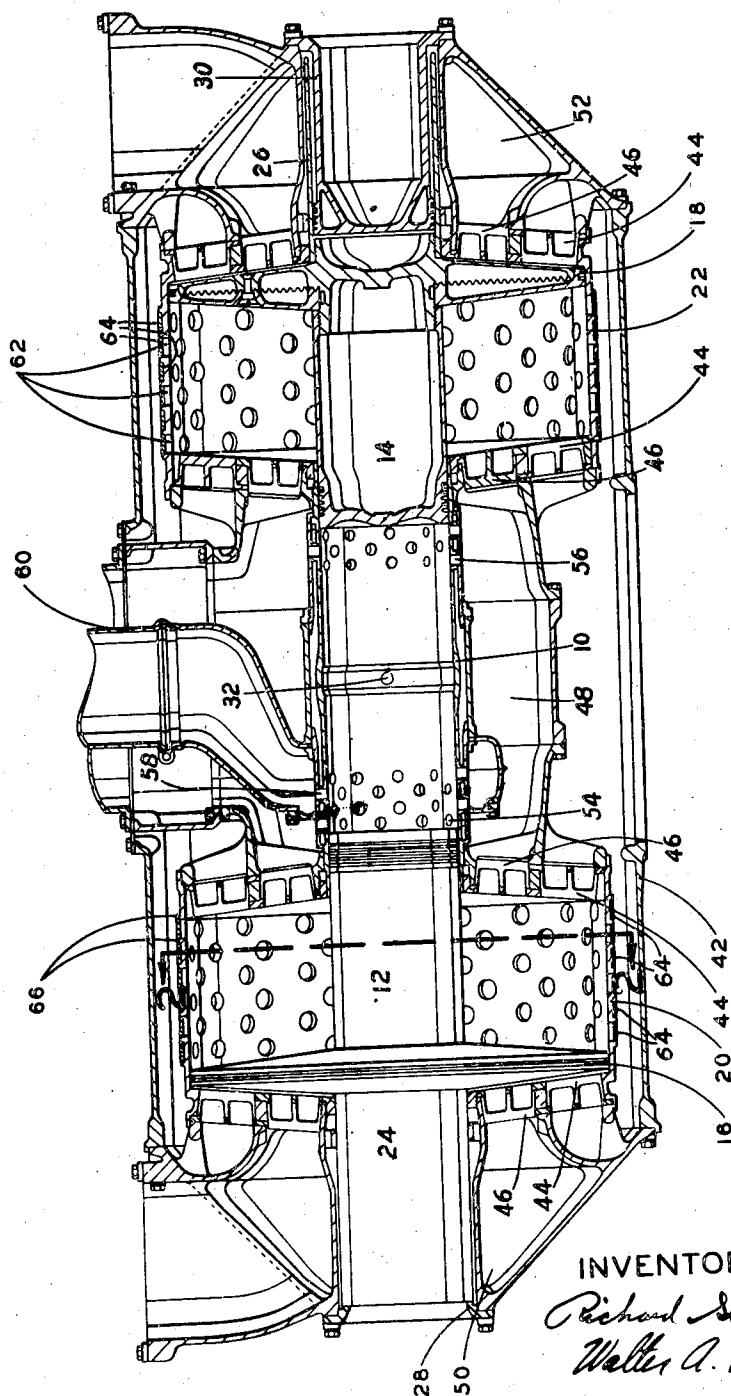
R. S. BUCK ET AL

2,469,712

CONTROL FOR SPILL PORTS IN FREE-PISTON UNITS

2 Sheets-Sheet 1

Filed Aug. 23, 1944



May 10, 1949.

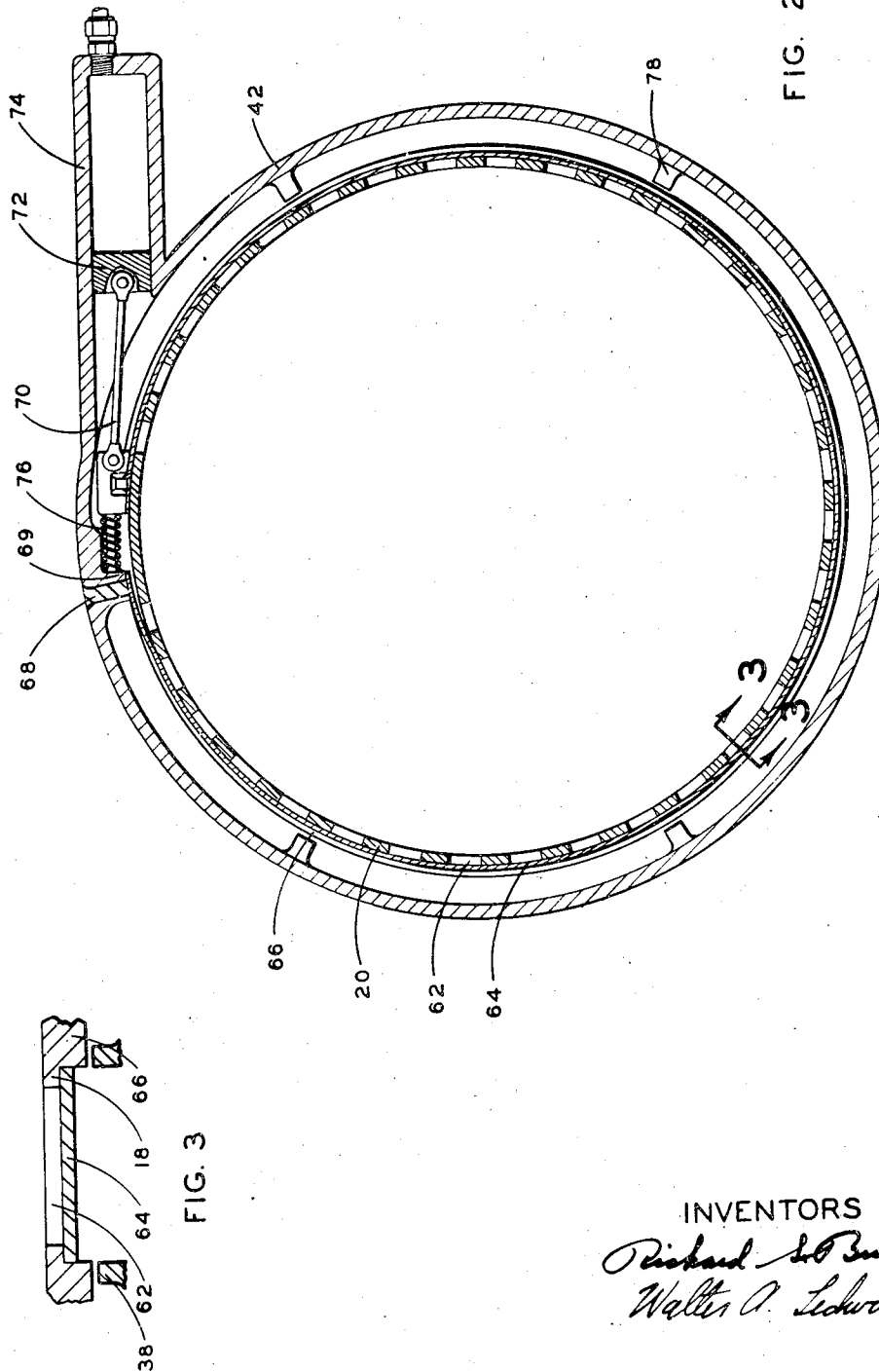
R. S. BUCK ET AL

2,469,712

CONTROL FOR SPILL PORTS IN FREE-PISTON UNITS

Filed Aug. 23, 1944

2 Sheets-Sheet 2



INVENTORS
Richard S. Buck
Walter A. Lechert

UNITED STATES PATENT OFFICE

2,469,712

CONTROL FOR SPILL PORTS IN FREE-PISTON UNITS

Richard S. Buck, Glastonbury, and Walter A. Ledwith, Hartford, Conn., assignors to United Aircraft Corporation, East Hartford, Conn., a corporation of Delaware

Application August 23, 1944, Serial No. 550,874

12 Claims. (Cl. 230-56)

1

This invention relates to a control for the spill ports of a free-piston engine-and-compressor unit.

The copending application of Kalitinsky, Serial No. 550,884, filed August 23, 1944, on which was issued Patent No. 2,441,272 of May 11, 1948, discloses a band extending around the compressor cylinder and movable circumferentially to open or close the spill ports in the compressor cylinder by which to adjust the effective volume of the compressor. A feature of this invention is a device for closing or opening the ports by radial movement.

Another feature is a band extending around the compressor cylinder and adapted to be moved radially away from the ports by tangential movement of one of its ends.

A feature of the invention is a device which can be moved quickly with a small expenditure of energy into open or closed position with respect to the ports.

Other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate an embodiment of the invention.

Fig. 1 is a sectional view through the free-piston unit.

Fig. 2 is a sectional view on line 2-2 of Fig. 1.

Fig. 3 is a fragmentary sectional view on line 3-3 of Fig. 2.

The unit shown includes an engine cylinder 10 having reciprocating pistons 12 and 14 to which compressor pistons 16 and 18 in cylinders 20 and 22 are integrally connected. Sleeves 24 and 26 attached to the compressor pistons complete the reciprocating piston assemblies. The sleeves in combination with stationary pistons 28 and 30 form air spring cylinders.

The piston assemblies are moved apart by the burning of fuel injected into engine cylinder 10 through one or more nozzles 32. Air compressed in the air spring cylinders on the power stroke returns the piston assemblies. The assemblies are always maintained at equal distances from the center of the engine cylinder by a linkage, not shown.

Intake manifold 42, which extends around the compressor and engine cylinders conducts air to intake valves 44 in the heads of the compressor cylinders, through which air alternately enters opposite ends of the cylinders. The compressed air leaves the cylinders through discharge valves 46, also at opposite ends of the compressor cylinders and passes into a central scavenge chamber 48 and end chambers 50 and 52. These chambers may be interconnected by a scavenge manifold, not shown.

Compressed gas from the scavenge chambers enters engine ports 54 and 56 which are uncovered by pistons 12 and 14 at the end of the

2

power stroke, thereby permitting air to be blown through the engine cylinder. Gas and air in the engine cylinders is discharged through exhaust ports 58 into exhaust manifold 60.

Each compressor cylinder has a number of axially spaced rows of spill ports 62 to permit discharge of air without compression from the cylinder. Each row of ports may be individually controlled by a band 64, Fig. 2, extending around the cylinder between projecting ribs 66 extending from the cylinder. One end of each band 64 is fixed as by a rivet 68 to a lug 69 on surrounding manifold 42, and the other end of the band is connected to the projecting rod 70 of a piston 72 moving in a cylinder 74, which may form a part of manifold 42.

Fluid under pressure admitted to the outer end of cylinder 74 will cause the band to be moved radially against the cylinder for closing the spill ports. A coil spring 76 between the ends of the spring may move the ends of the band apart for opening the ports by moving the band radially away from the cylinder. The intake manifold 42 which forms a casing around the compressing cylinder limits the outward movement of the band and assures a separation of the band from the cylinder throughout its length. Each row of ports 62 has a separate band so that each row is individually closed or opened. Guides 78 extending in from the manifold 42 at opposite sides of each band guide the band during its opening or closing.

Fluid may be admitted to the cylinder 72 for closing the band by a servo-motor which is in turn actuated by a master control of the type shown in the copending application of Kalitinsky, Serial No. 550,886, filed August 23, 1944, on which Patent No. 2,441,273 has been issued, May 11, 1948. Such an arrangement is claimed in said copending application and, not being a part of this invention, will not be described in detail.

The use of spill ports in controlling the stroke of a free-piston unit is claimed in the copending Cooper application, Serial No. 531,301, filed April 15, 1944, on which Patent No. 2,458,147 of January 4, 1949, has been issued.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described, but may be used in other ways without departing from its spirit as defined by the following claims.

We claim:

1. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially arranged ports, and a band extending circumferentially around said compressor cylinder and overlying the ports, and

means for moving said band radially to close or open the ports.

2. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially arranged ports and a band extending circumferentially around said compressor cylinder and overlying the ports, said band being movable radially away from the cylinder by substantially tangential movement of at least one end of the band and means for moving said one end of the band substantially tangentially.

3. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially arranged ports and a band extending around said compressor cylinder and overlying the ports, and means for moving said band radially away from the cylinder by endwise movement of at least one end of the band, and a casing around and spaced from said compressor cylinder and against which the band is moved.

4. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially extending ports, and a band extending around said compressor cylinder and overlying the ports, and means for moving said band radially to close or open the ports, one end of said band being fixed, and means for moving the other end of the band tangentially to cause the band to move radially away from the compressor cylinder.

5. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially extending ports, and a band extending around said compressor cylinder and overlying the ports, and means for moving said band radially to close or open the ports, one end of said band being fixed, means for moving the other end of the band tangentially to move the band away from the cylinder, and a casing around said compressor cylinder against which the band is moved.

6. A free-piston engine-and-compressor unit having an engine cylinder and piston, a compressor cylinder and piston, the compressor piston moving with the engine piston, said compressor cylinder having a number of axially spaced rows of ports, and a band for each row of ports extending around the compressor cylinder and overlying and closing the associated row of ports, at least one of said bands being movable radially away from and toward the cylinder to open or close the ports.

7. A free-piston engine-and-compressor unit having an engine cylinder and piston, a compressor cylinder and piston, the compressor piston moving with the engine piston, said compressor cylinder having a number of axially spaced rows of ports, and a number of closure elements, one for each row of ports, arranged around the compressor cylinder, each element being independently movable radially of the cylinder to open or close the ports.

8. A free-piston engine-and-compressor unit

having an engine cylinder and piston, a compressor cylinder and piston, the compressor piston moving with the engine piston, said compressor cylinder having a number of axially spaced rows of ports, a number of bands, one for each row of ports, extending around the compressor cylinder and overlying and closing the associated row of ports, each band being separately movable radially of the cylinder to open or close the ports associated therewith, and a casing around the compressor cylinder against which the bands are moved in opening the ports.

9. A compressor cylinder and piston, said cylinder having at least one row of circumferentially arranged ports, and a band extending around said cylinder and overlying and closing the ports and means for moving said band radially of the cylinder to close or open the ports.

10. A compressor cylinder and piston, said cylinder having at least one row of circumferentially arranged ports and a band extending around said cylinder and overlying and closing the ports, said band being movable radially away from the cylinder by tangential movement of at least one end of the band, and a casing around said cylinder against which the band is moved.

11. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially arranged ports and a band extending around said compressor cylinder and overlying and closing the ports, said band being movable radially away from the cylinder by substantially tangential movement of at least one end of the band, a casing around said cylinder against which the band is moved, and guides for the band.

12. A free-piston unit including an engine cylinder and piston, a compressor cylinder and piston, said pistons being interconnected to move as a unit, said compressor cylinder having at least one row of circumferentially arranged ports and a band extending around said compressor cylinder and overlying and closing the ports, said band being movable radially away from the cylinder by endwise movement of at least one end of the band, a casing around said cylinder against which the band is moved, and guides engaging opposite sides of the band.

RICHARD S. BUCK.
WALTER A. LEDWITH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
877,492	Doelling	Jan. 28, 1908
1,481,358	Dwyer	Jan. 22, 1924
1,579,782	Riesner	Apr. 6, 1926
2,016,613	Pescara	Oct. 8, 1935
2,038,442	Pescara	Apr. 21, 1936
2,064,976	Janicke	Dec. 22, 1936
2,090,709	Steiner	Aug. 24, 1937
2,108,890	Janicke	Feb. 22, 1938
2,139,425	Steiner	Dec. 6, 1938
2,147,935	Steiner	Feb. 21, 1939

FOREIGN PATENTS

Number	Country	Date
237,170	Germany	1910