Nov. 5, 1946. V. CRONSTEDT ET AL 2,410,428

PISTON CONSTRUCTION FOR COMPRESSOR UNITS

Filed July 23, 1943 3 Sheets-Sheet 1

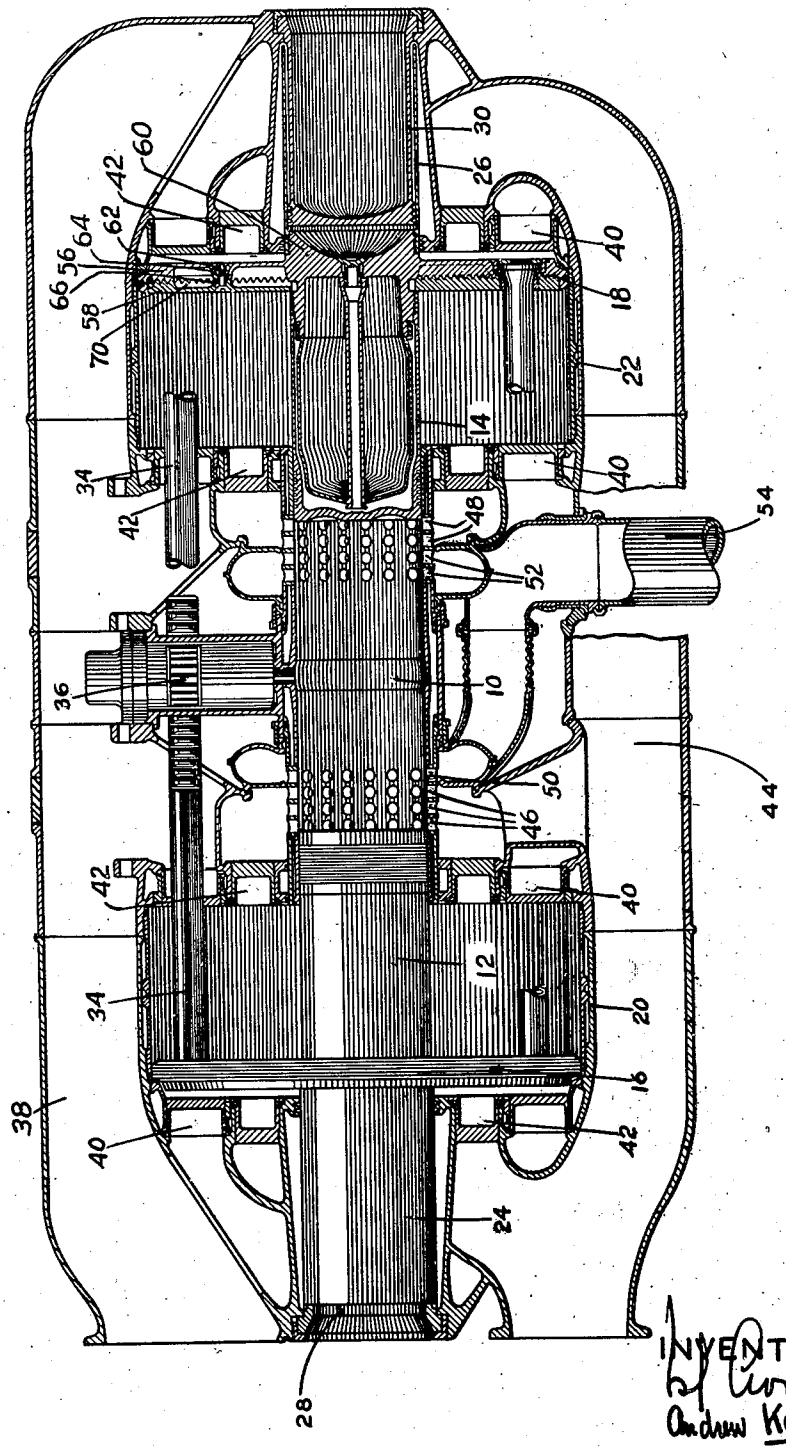


FIG. 1

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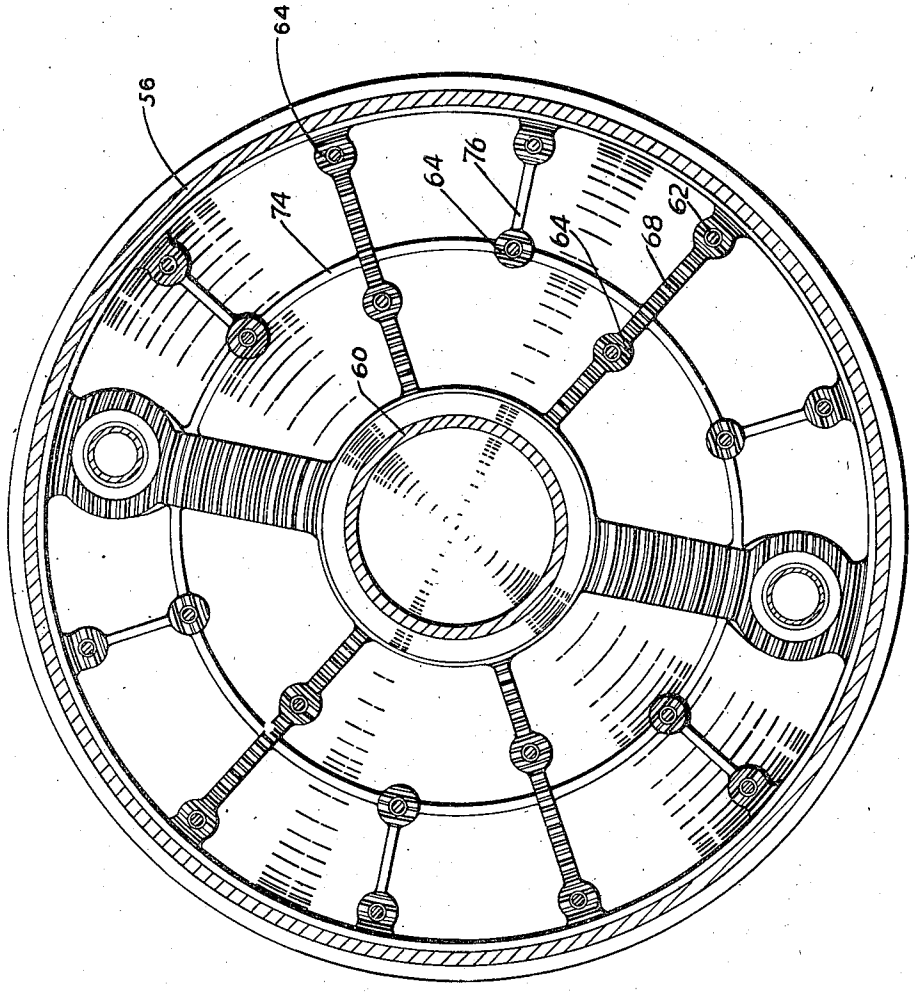


FIG. 2

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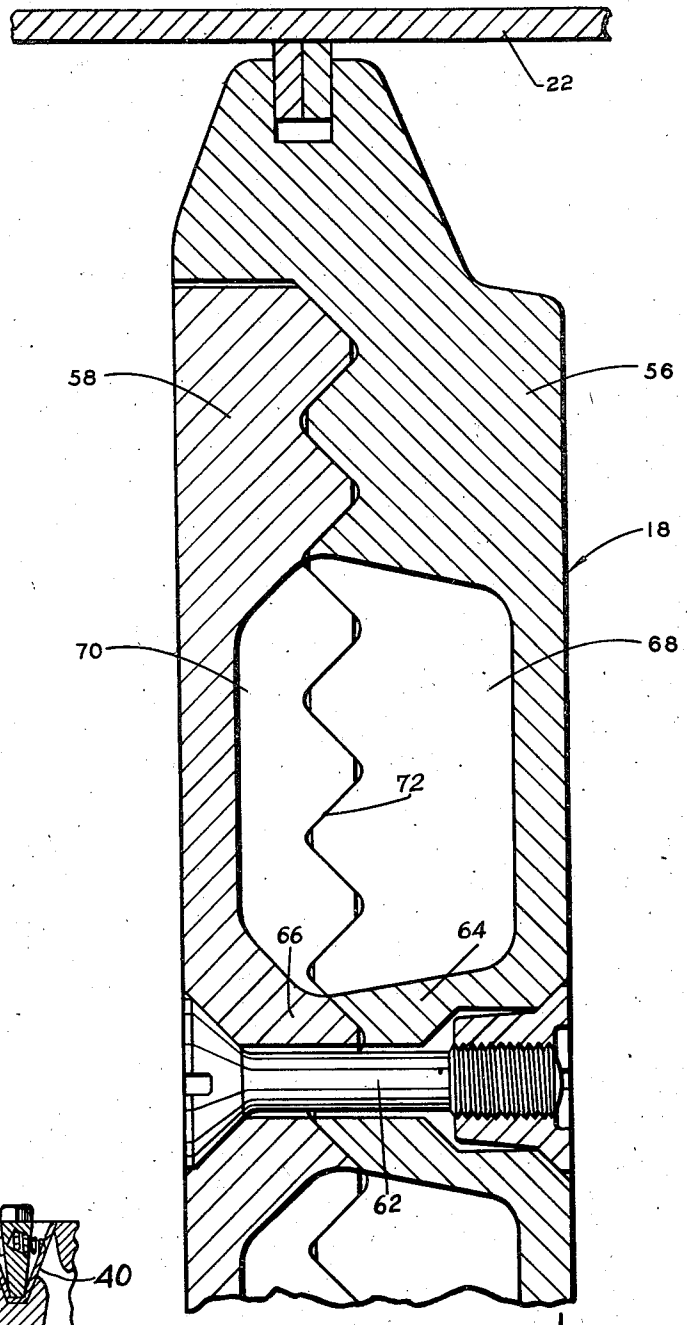


FIG. 3

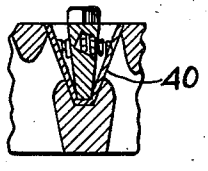


FIG. 4

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PISTON CONSTRUCTION FOR COMPRESSOR UNITS

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Application July 23, 1943, Serial No. 495,933

9 Claims. (Cl. 309—4)

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Large diameter pistons, particularly in high-speed machines such as the compressor pistons of engine-and-compressor units, are subjected to bending stresses resulting from the high acceleration of the piston at opposite ends of its stroke. An object of this invention is to reinforce the piston against shear resulting from these bending stresses.

The compressor piston must be thick enough to carry sealing rings at its periphery and must have substantially flat side walls for minimizing the clearance volume at the ends of its stroke. Such a piston, if solid, is relatively heavy and requires the rest of the machine to be heavy in order to operate successfully. A feature of this invention is a piston which is made hollow to reduce weight and which is still strong enough to withstand the shear resulting from the bending stresses on the piston.

The rate of reciprocation of the pistons in a free-piston engine-and-compressor unit is dependent upon the weights of the moving parts. Lightening the piston to increase its rate of reciprocation may reduce the strength of the piston, particularly the large diameter compressor piston so that it is no longer strong enough to withstand the forces acting on it. A feature of this invention is a reinforced piston which is light in weight.

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 longitudinal sectional view through a free-piston unit showing the pistons therein.

Fig. 2 is a sectional view through one of the piston assemblies, showing one side disc of the compressor piston in elevation.

Fig. 3 is an enlarged longitudinal section of a part of the piston.

Fig. 4 is a sectional view through the intake valve.

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. 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

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a linkage, which may include racks 34 extending from the compressor pistons and engaging a pinion 36.

Intake manifold 38 conducts air to intake valves 40, see Fig. 4, through which air alternately enters opposite ends of the compressor cylinders. The compressed air leaves the cylinders through discharge valves 42, similar to valves 40, and also at opposite ends of the compressor cylinders, and passes through scavenge manifold 44 through ports 46 and 48 which are uncovered by pistons 12 and 14 at the end of the power stroke, thereby permitting air to be blown through the engine cylinder and exhaust ports 50 and 52 into exhaust manifold 54. Valves 40 and 42 may be the type shown, for example, in Huff Patent Number 1,599,414, dated September 14, 1926.

Each compressor piston 16 and 18 is made up of opposed discs 56 and 58, the former being integral with a hub 60 on which the engine piston 14 and air spring or sleeve 26 may be mounted. Disc 58, forming the inner surface of the compressor piston is clamped against disc 56 by the engine piston and is also held in place by bolts 62 extending through opposed bosses 64 and 66 on discs 56 and 58 which hold the discs in spaced relation. Both discs have opposed radially extending ribs 68 and 70 engaging each other. The contacting surfaces of bosses 64 and 66 and ribs 68 and 70 are provided with serrations 72 to prevent any relative movement between the discs. These serrations or grooves are at right angles to the radius of the disc as shown and thus resist shear stresses in the discs.

Either or both discs may also have circumferentially extending ribs 74 and other radially extending ribs 76 which are not thick enough to engage with the opposite disc but which act as reinforcement for the disc on which they are formed. The ribs may extend between adjacent bosses 64 on disc 56 or bosses 66 on disc 58. These bosses act as spacers for the opposed discs 56 and 58 and prevent buckling of the discs when bolts 62 are tightened.

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 departure from its spirit as defined by the following claims.

We claim:

1. A piston including opposed discs having ribs on the adjacent surfaces engaging each other and serrations on the adjoining rib surfaces.

2. A piston including opposed discs having ribs

on the adjacent surfaces engaging each other and serrations on at least a part of some of the ribs.

3. A piston including opposed discs, and a number of interengaging serrate ribs on the adjacent surfaces of the discs.

4. A piston including opposed discs, and a number of radial interengaging serrate ribs on the adjacent surfaces of the discs.

5. A piston including opposed discs having a number of interengaging serrate bosses on the adjacent surfaces and fastening means engaging said bosses to hold the discs together.

6. A piston including opposed discs having a number of interengaging serrate bosses on the adjacent surfaces, and bolts extending through said bosses to hold the discs together.

7. A piston including opposed discs having a number of similarly arranged ribs on the adjacent surfaces, said ribs having interengaging teeth and grooves to prevent relative movement between the ribs.

8. A piston including opposed discs having similarly arranged radial ribs on the adjacent surfaces, said ribs having interengaging teeth and grooves extending transversely of the ribs to prevent relative movement radially between the discs.

9. A piston including opposed discs having similarly arranged radial ribs on the adjacent surfaces, said ribs having interengaging teeth and grooves extending transversely of the ribs to prevent relative movement radially between the discs, and means for fastening the discs together with the teeth and grooves in engagement.

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