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R. E. BECKER
VACUUM CONTROL VALVE

2,914,034

Filed July 6, 1956

2 Sheets-Sheet 1

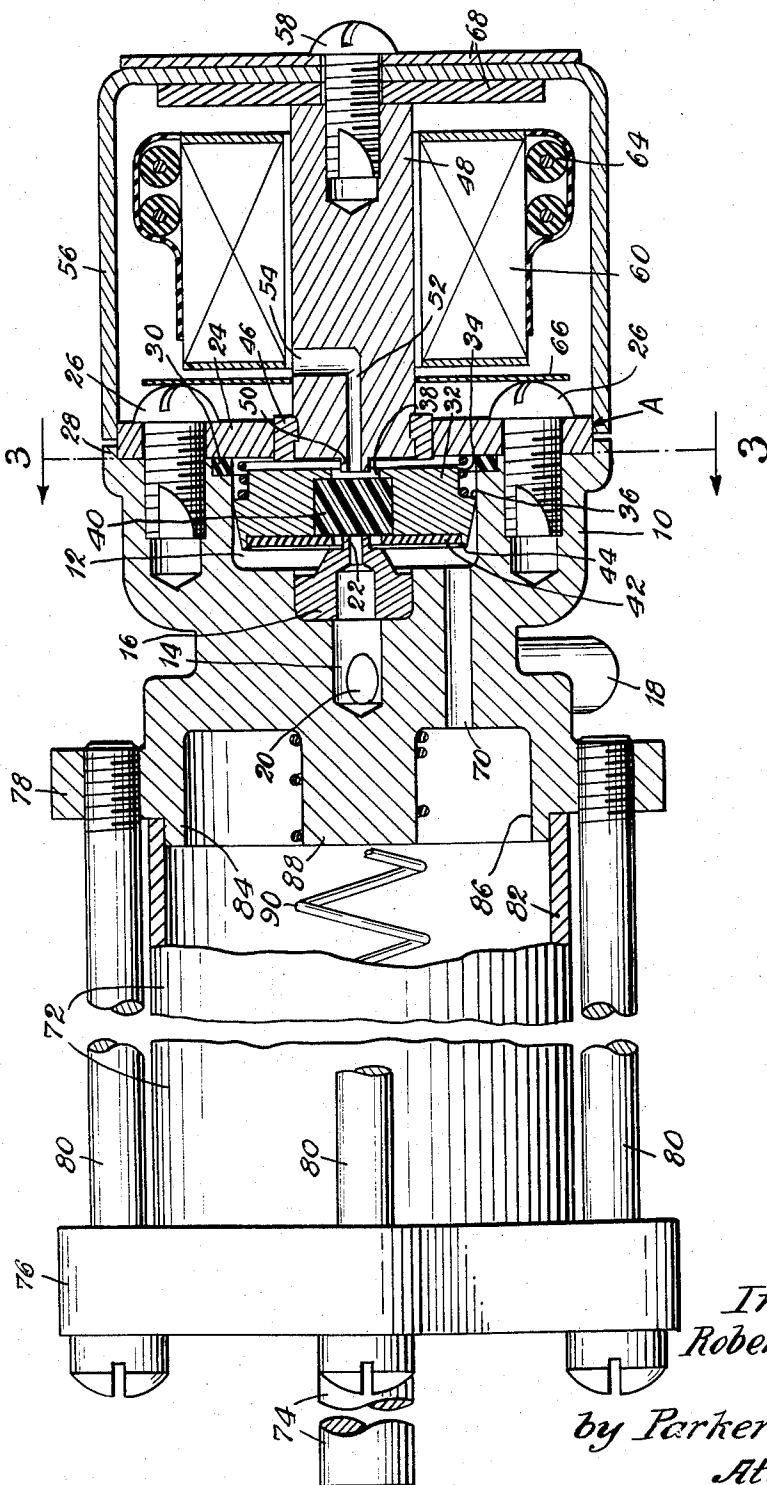


Fig. 1

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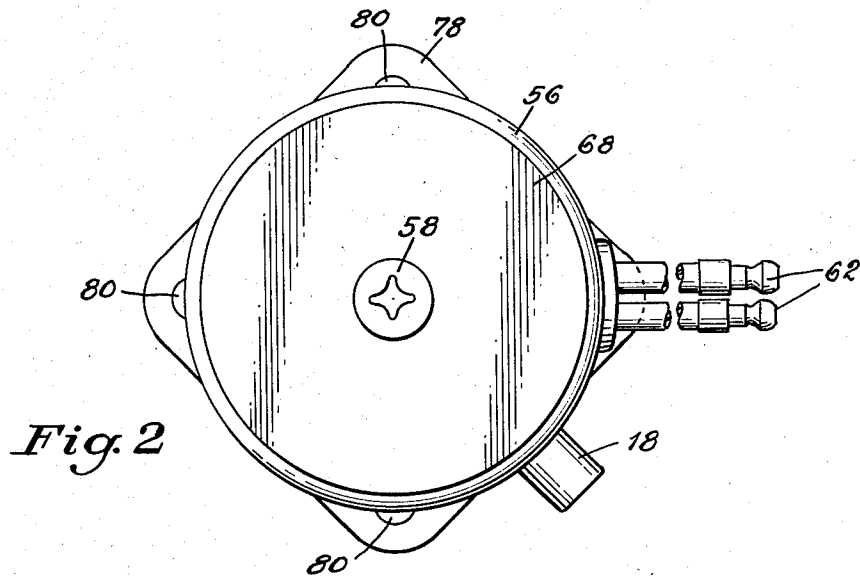


Fig. 2

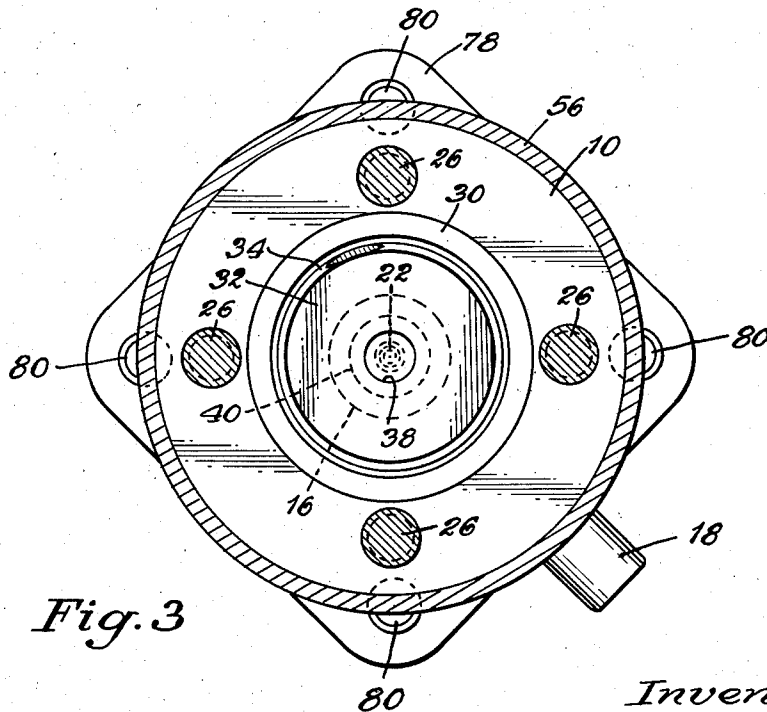


Fig. 3

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VACUUM CONTROL VALVE

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2 Claims. (Cl. 121—46.5)

This invention is in the field of vacuum-operated devices and is in the nature of a mechanism for controlling the vacuum communicated to such a device so that it can be alternately moved in one direction or another or to a succession of positions.

A primary object of my invention is a valve structure for first communicating a source of vacuum to a power cylinder and piston, and second for venting the power cylinder and piston, with a minimum number of moving parts.

Another object is a control mechanism of the above type for vacuum-operated devices or the like with a valve disc disposed between opposed valve seats, the disc being as small as possible so that the device will operate almost instantaneously so that inertia is not a problem.

Another object is a device of the above type in which the power cylinder is vented under the cover of a solenoid mounted on a unitary base, the volume of the cover being such that the device can be totally vented under it.

Another object is a device of the above type with a venting arrangement so that the solenoid cover can be easily mounted.

Another object is a device of the above type in which the power cylinder is generally aligned with or coaxial with the solenoid.

Another object is a disc valve in a device of the above type, constructed with a central unitary plastic insert which takes all of the wear caused by movement between two opposed closely spaced valve seats.

Another object is a device of the above type in which the solenoid has a core extended into the valve chamber so that the valve itself can be reduced substantially in size.

Other objects will appear from time to time in the ensuing specification and drawings, in which:

Figure 1 is a longitudinal section;

Figure 2 is an end view on a reduced scale; and

Figure 3 is a section along line 3—3 of Figure 1.

In Fig. 1 the device includes a base 10 which may be an aluminum die casting or other suitable metal. The base has a central cavity or valve chamber 12 and an axial bore or passage 14 which opens at one end into the chamber through a suitable seat insert 16 and communicated at its other end to a source of vacuum 18 through a side channel 20. The central passage has a substantial cross section, but the insert 16 reduces down to a much smaller opening and is shouldered on the outside to form a valve seat 22.

The central chamber opens away from the passage 14 and is closed by a suitable plate 24 held by a number of screws 26 or the like. The base may be shouldered or flanged at 28 to center the plate and a gasket or seal 30 may be provided inside of the screws to prevent leakage.

A valve disc 32 is disposed in the chamber and is biased toward the seat 22 by a coil spring 34 or the like which abuts the closing plate at one end and a shoulder 36 on the valve at its other end. The valve disc is quite small and has a minimum axial dimension. A central bore or opening 38 is provided through the disc and a plastic

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insert 40 is positioned in the bore and held by a disc or plate 42 which is held by crimping or rolling over the edge of the valve disc at 44.

The plate 24 closing the housing or base has a central collar fitted in an opening, shown at 46, which is crimped into an armature or core 48 extending outwardly axially from the valve chamber. A valve seat 50 is formed on the armature around a vent passage 52 which opens at 54 inside of a cap or cover 56 held on the base by a suitable screw or the like 58 threaded into the armature. The housing contains a suitable solenoid 60 around the armature which is connected by suitable leads 62 to a source of current, the excess wire being wound around the solenoid at 64 and covered by tape or the like, if desired. One end of the solenoid may be provided with a sheet metal disc 66 which is supported against the heads of the screws 26. Various end plates and spacers 68 may be used, if desired, on the housing.

The valve chamber is connected by a passage 70 to a power cylinder 72 having a suitable piston and piston rod 74 extending out of the housing in the opposite direction. The end plate 76 of the cylinder is connected to a flange 78 on the base by four bolts 80 spaced 90° apart with the bolt heads outward. A cylinder 82 is held between the plate 76 and the base against a guide or shoulder 84 and the base is countersunk at 86 to provide a pilot 88 for a suitable spring 90 which bears against the power piston at its other end.

The housing cover 56 could be vented by providing one or more openings or notches between the edge of the cover and the plate 24, or a continuous slight clearance could be provided if venting is desired.

The use, operation and function of my invention are as follows:

I provide a unitary device for controlling a source of vacuum to a valve or the like. For example, the power cylinder could be connected to the flap valve in an automobile heater or cooler. In this case a solenoid and spring alternately move a small disc valve a microscopic amount in either one direction or another between closely spaced valve seats to alternately vent a power cylinder or place it in direct communication with a source of vacuum.

The device is primarily designed and intended to be used in the automotive industry where space is an important factor. Therefore the unit must be small and compact, but at the same time, rugged, dependable and durable. Extensive maintenance must be avoided.

One of the important points is that the capacity of the solenoid housing is such that the power cylinder can be vented into it, although slight clearance could be provided between the solenoid cover and the base at any suitable point, for example at A.

Compactness is acquired by aligning the power cylinder and solenoid housing with the base sandwiched between. Looking at it another way, the power cylinder and solenoid housing extend in opposite direction from a unitary base. The core of the solenoid is brazed or otherwise connected to the plate which closes the valve chamber. The core or armature extends into the valve chamber and a central vent passage opens opposite a disc valve. The size of the valve is thus quite small and inertia is not a problem. Furthermore, quite accurate control of the valve is acquired because the device is not sluggish.

Extensive wear is side-stepped by making the valve surfaces plastic in the form of a central plug between the valve seats. The vent under the solenoid housing does not interfere with the top cap screw 58 and the connection for the top cap is much simpler. The movable valve in toto is quite a distance from the solenoid, which is accomplished by extending the armature. The mass of the

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valve itself is probably the most important point in obtaining accuracy and instantaneous movement.

While I have shown and described the preferred form of my invention, it should be understood that numerous modifications, changes, substitutions and alterations can be made without varying from the invention's fundamental theme. I, therefore, wish that the invention be unrestricted except as by the appended claims.

I claim:

1. In a vacuum operated valve unit, a base with a central chamber, and air passages opening axially into the chamber at its top and bottom, each opening having a valve seat, one seat and its passage being adapted to be in communication with a source of pressure differential, an axially thin disk valve in the chamber opposed to both seats and adapted to reciprocate between them to close one or the other, the axial dimension of the disk valve being slightly less than the distance between the valve seats, the disk valve, in all positions of movement, being within the confines of the chamber in the base, a spring in the chamber biasing the thin disk valve to close

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the said one seat and its passage, a solenoid mounted on the housing with a fixed core extending beyond the confines of the solenoid into and closing the chamber in the base so that when the solenoid is energized, the disk valve will be drawn by the core of the solenoid in the other direction to close the other seat and its passage, and a power cylinder on the housing having a passage communicating with the chamber so as to be controlled by the disk valve to be alternately put in communication either with the source of pressure differential or vented, depending upon the position of the disk valve.

2. The structure of claim 1 further characterized in that the axis of the power cylinder and the axis of the solenoid are generally aligned.

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