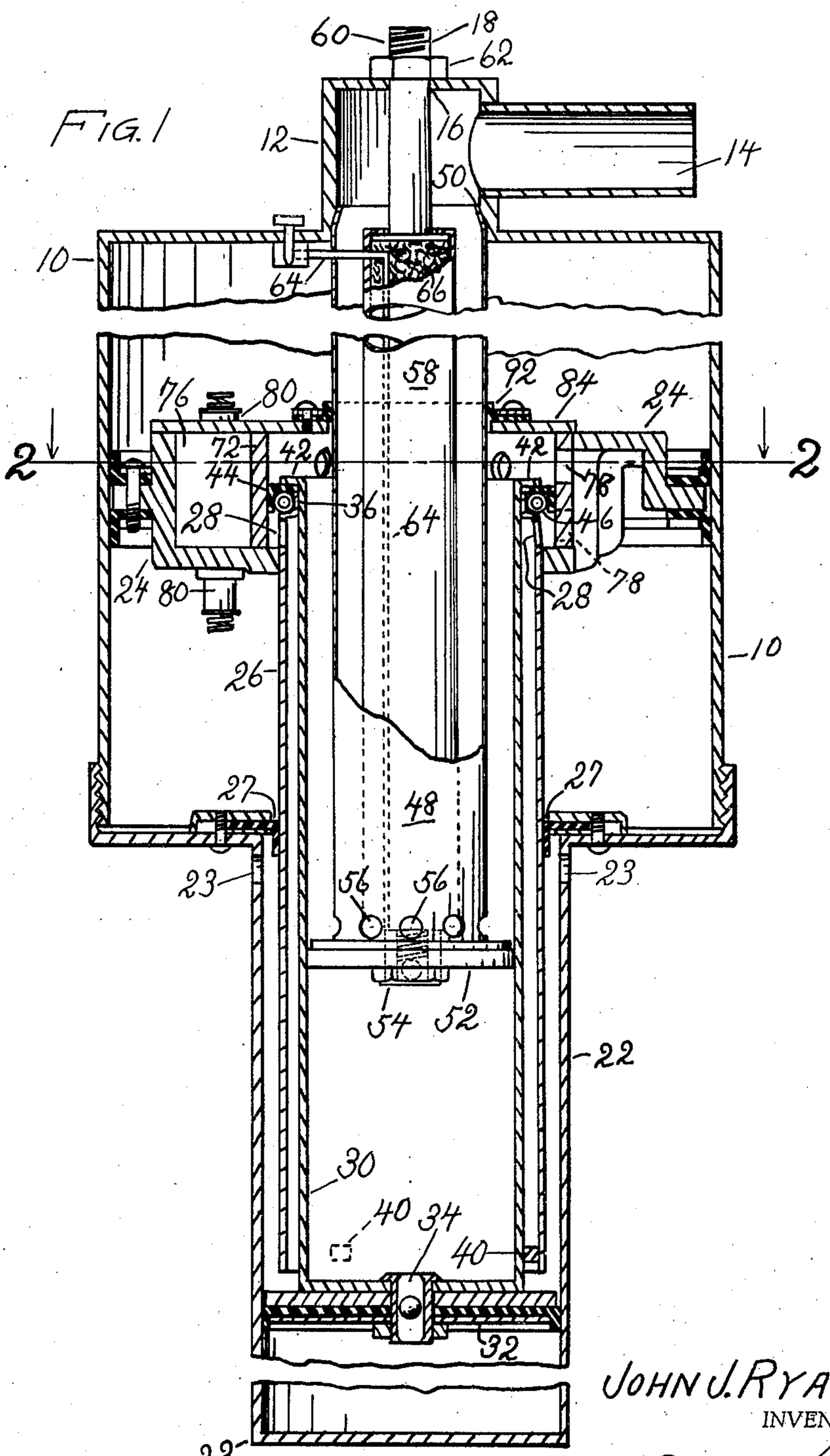
Aug. 2, 1938. J. J. RYAN 2,125,463

VACUUM MOTOR FOR OPERATING A PUMP

Filed Aug. 26, 1936 2 Sheets-Sheet 1

FIG. 1



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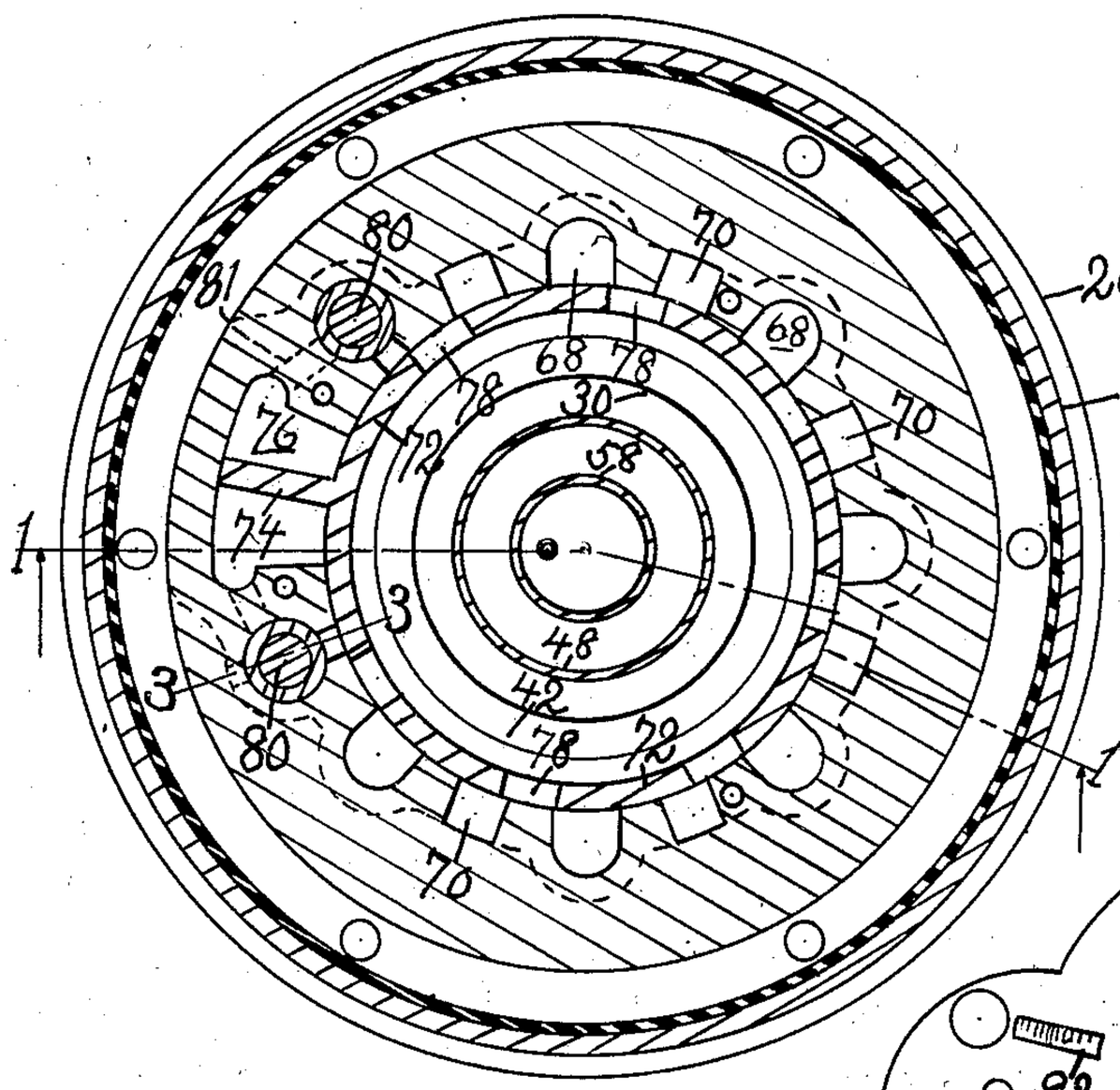

FIG. 2

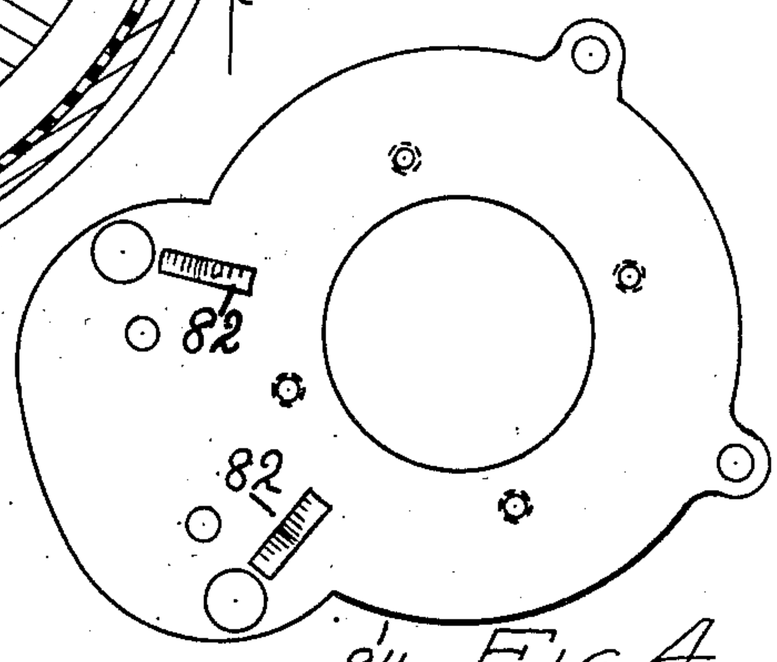

FIG. 4

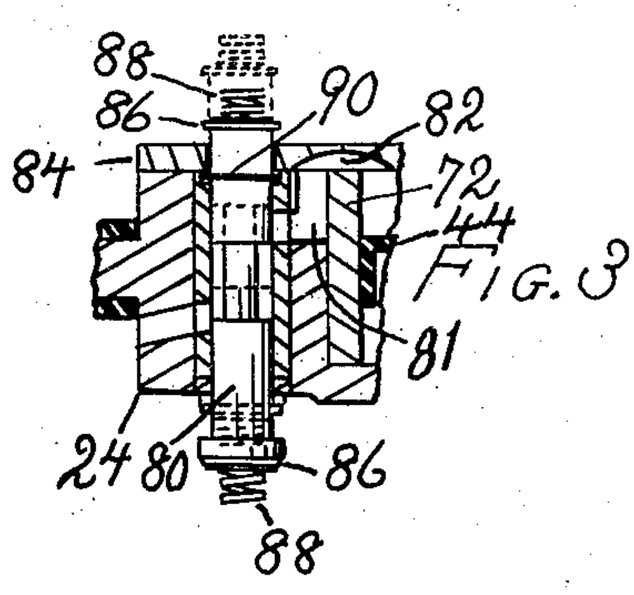

FIG. 3

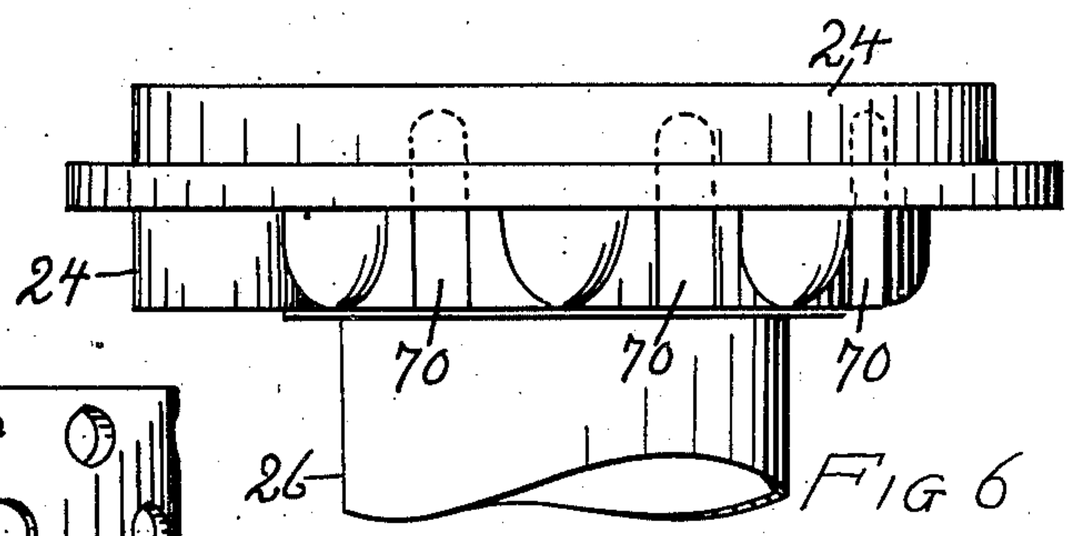

FIG 6

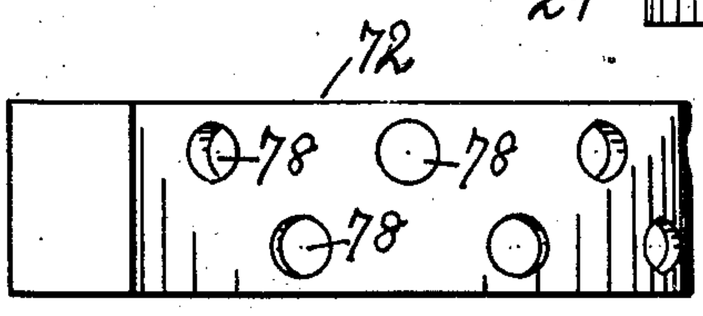

FIG. 5

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VACUUM MOTOR FOR OPERATING A PUMP

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8 Claims. (Cl. 121—123)

This invention relates to an improved vacuum operated pump which may be operated by suction from any source, but is especially adapted for use in conjunction with an internal combustion engine.

One of the principal objects of advantage and importance of the device of this invention resides in the provision of means whereby a low pressure pump and a high pressure pump are both concentrically positioned within a single casing.

Another and further important object of advantage resides in the provision of means for automatically operating the device.

Still another important advantage of the improved pump of this invention is the provision of means for cushioning the driving or vacuum piston at each end of its travel in the cylinder.

A still further object of importance resides in the provision of means for cooling the cylinders while the device is in operation.

Additional objects of advantage and importance will become apparent as the following detailed description progresses, reference being had to the accompanying drawings, wherein

Fig. 1 is a longitudinal section of a vacuum operated pump which embodies the invention. This view is taken on line 1—1 of Fig. 2, looking in the direction indicated by the arrows,

Fig. 2 is a vertical section taken on line 2—2 of Fig. 1, looking in the direction indicated by the arrows,

Fig. 3 is a fragmental section of the vacuum piston taken on line 3—3 of Fig. 2,

Fig. 4 is a bottom plan view of the vacuum piston plate,

Fig. 5 is an elevational view of the rotary valve, and

Fig. 6 is an elevational view of the vacuum piston, parts thereof being removed or broken away.

As shown in the drawings:

The reference numeral 10 indicates in general a vacuum cylinder which in the preferred embodiment of the invention has an open end and a closed end. Formed on the closed end thereof is a restricted projection 12 which is provided with two discharge openings 14 and 16. The discharge opening 14 is adapted to be connected with a source of suction for operating the device, while the other opening 16 allows the passage of a pipe 18 which conveys compressed air from the pump.

The peripheral surface adjacent the open end of the vacuum cylinder 10 is threaded to receive a correspondingly threaded head 20.

Projecting from the head 20 is an air cylinder 22 which in the preferred embodiment of the invention is formed integral therewith, as is best shown in Fig. 1. The vacuum cylinder 10 is of greater diameter than the air cylinder 22 and when joined the cylinders are in alignment as is clearly shown in the drawings. A plurality of air inlet ports 23 are at the upper end of the air cylinder 22.

Operably positioned within the vacuum cylinder is a piston 24 which has a tubular piston rod 26 extending into the air cylinder 22. The piston 24 and rod 26 are rigidly and firmly joined together to provide an air-tight joint. A plurality of air inlet openings 28 are provided adjacent the upper end of the piston rod 26. A conventional pliable washer 27 having the inner edge turned downwardly is provided to prevent the passage of air from the air cylinder 22 into the vacuum cylinder 10.

Positioned within the tubular piston rod 26 and rigidly secured thereto at both the top and the bottom is a tubular member 30. The lower end of the tubular member 30 extends below the end of the piston rod 26 and is adapted to have a pump piston 32 attached thereto. A ball check valve 34 is provided to allow the entry but prevent the escape of air from the interior of the tubular member 30 into the air cylinder 22.

The upper end of the tubular piston rod 26 is restricted to contact and form an air-tight joint, indicated by the reference numeral 36, with the upper portion of the tubular member 30. The lower ends of the piston rod 26 and the tubular member 30 are maintained in aligned relation by the spacing blocks 40, as is best shown in Fig. 1.

The extreme upper end of the tubular member 30 is turned outwardly at 42 to provide a means for maintaining a pliable washer 44 in operable position to prevent the passage of air into the upper portion of the piston 24. A coil spring 46 provides an expansive force against the pliable washer 44.

Secured within the vacuum cylinder 10 and extending downwardly into the tubular member 30 is a cylindrical member 48. The upper end of the member 48 is beveled to contact and form an air-tight joint 50 with the interior of the restricted portion 12 of the vacuum cylinder 10. The lower end of the cylindrical member 48 carries a pump piston 52. A conventional ball check valve 54 is associated with the piston to prevent leakage of compressed air. The check

valve 54 in association with a screw threaded nut provides a means for connecting together members 48 and 58 at their lower ends as is best shown in Fig. 1.

Located at the lower end of the cylindrical member 48 is a plurality of vacuum ports 56.

Positioned within the cylindrical member 48 and having ends projecting therebeyond is a tubular member 58 which serves as a passageway for conveying compressed air from the pump and also provides means for securing the cylindrical member 48 in position. The end of the tubular member 58 which projects through the end of the restricted portion of the vacuum cylinder is threaded at 60 and supplied with a nut 62. This construction provides a means for drawing the tapered end of the member 48 into the restricted portion of the cylinder 10 to form an air-tight joint. Additionally the threaded end 60 is adapted to be attached to a hose coupling or the like.

In the preferred embodiment of the invention a small valved pipe or tube 64 extends from the interior of the upper vacuum cylinder 10 to a point near the bottom of the tubular member 58. The function of the valved pipe 64 is to provide a means for removing oil from the tubular member and spray it into the vacuum cylinder. Steel wool 66 or other filtering medium is inclosed within the tubular member 58.

The vacuum piston 24 is provided with a plurality of spaced passageways 68 which lead to the top surface of the piston and a plurality of spaced passageways 70 which lead to the under side of the piston. The passageways 68 and 70 open on the inner surface of the piston 24 in alternate sequence as is best shown in Figs. 1 and 2.

Operably positioned in rotatable engagement with the inner surface of the piston 24 is an annular valve 72. A portion 74 of the valve 72 projects into a recess 76 in the piston and is adapted to be moved back and forth in said recess by suction, thus rotating the entire annular valve.

A plurality of apertures 78 in staggered alignment are formed in the annular valve 72. The apertures 78 are spaced to register with the passageways 68 and 70 in the piston. As the annular valve 72 is rotated and the apertures therein come into registry with the passageways 70 there is established an outlet for either the upper or lower portion of the cylinder 10.

Passageways 81 extending from the pocket or recess 76 to the top and bottom of the piston 24 are interrupted by pin valves 80, as is best shown in Figs. 2 and 3. These passageways are so located that when the pin valves 80 are moved to the end of their travel air is admitted to one side of the pocket 76, which houses the flattened portion 74 of the rotary valve 72, and suction is created on the other side thus moving the entire rotary valve so that the openings therein come into registry with the proper passageways for operating the piston.

The passageways leading to the top surface of the piston 24 are continued to the inner side of the rotary valve 72 by grooves 82 in the piston plate 84. The plate 84 is slightly larger than the diameter of the annular valve 72 which it covers.

Each pin valve 80 is provided with a restricted central portion and a small ring groove near each end. The purpose of the ring groove is to receive a spring wire ring 86 which prevents the pin from being withdrawn or forced from its socket.

Fixed in each end of the pin valves 80 is a coil spring 88 which serves as a cushioning member to lessen the impact of the pin against the end of the cylinder.

A spring washer 90 is positioned on each pin valve to prevent any possibility of the pin inadvertently moving from its proper operating position.

A pliable washer 92 provides a sliding air-tight joint between the piston plate and the tubular member 48.

In operation the incoming air which enters the ports 23 travels downwardly through the space between the restricted cylinder 22 and the hollow piston rod 26 and thence a portion travels upwardly between the hollow piston rod 26 and the tubular member 30 and provides a means for disseminating heat generated by these parts. The rarified air coming in contact with the cylinder 10 and the tubular members 48 and 58 provides a cooling medium therefor.

In operation the discharge opening 14 of the device is connected to a vacuum creating source such as the intake passageway of an internal combustion engine which provides the necessary operating energy. The pilot valves 80 control the vacuum to opposite sides of the fin portion 74 of the annular valve 72 which allows suction from the vacuum creating source to rotate the annular valve 72 so that the ports 78, 78 are in registry with the passageways 70, 70 thus evacuating the air from the lower portion of the cylinder. The air leaving the cylinder passes downwardly through the space between the member 48 and the member 30 then through the openings 56, 56 and thence upwardly between the member 48 and the member 58, and outwardly through the discharge member 14.

The piston 24 is forced downwardly until the pin valve 80 contacts the bottom of the cylinder. The movement of the pin or pilot valve opens the vacuum passageway on the opposite side of the pocket 76 and causes the annular valve to rotate sufficiently to align the ports 78, 78 with the passageways 70, 70. The piston 24 is then forced upwardly until the pin valve 80 contacts the upper portion of the cylinder. The operation of the pin or pilot valve 80 is clearly shown in Fig. 3.

It will be apparent from the foregoing that herein is provided a compact, sturdy and efficient vacuum operated pump which may be economically manufactured.

I am aware that various changes may be made in the embodiment of the invention here shown and described without departing from the principles and teaching involved and I do not purpose limiting the patent granted hereon other than is necessitated by the prior art and the terminology of the appended claims.

I claim as my invention:

1. In a vacuum operated pump, a reciprocating motor having a recessed piston, said piston being provided with a plurality of spaced passageways, opening into said recess, said passageways alternately leading to the top and to the bottom of said piston, an annular valve having a plurality of spaced ports therein positioned within said recess, and means for rotating said annular valve to cause the ports therein to move into and out of registry with the spaced passageways in said recessed piston.

2. In a vacuum operated pump, a reciprocating motor having a recessed piston, said piston being provided with a plurality of spaced passageways opening into said recess, said passageways alternately leading to the top and to the bottom of said piston, an annular valve having a plurality

of spaced ports therein positioned within said recess, and means for rotating said annular valve to cause the ports therein to move into and out of registry with the spaced passageways in said recessed piston, said means comprising a portion of said annular valve extending into a valved passageway between the air and the vacuum sides of said piston.

3. In a vacuum operated pump, a reciprocating motor having a recessed piston, said piston being provided with a plurality of spaced passageways opening into said recess, said passageways alternately leading to the top and to the bottom of said piston, an annular valve having a plurality of spaced ports therein positioned within said recess, and means for rotating said annular valve to cause the ports therein to move into and out of registry with the spaced passageways in said recessed piston, said means comprising a flattened portion of said annular valve extending into a passageway between the air and vacuum sides of the piston.

4. In a vacuum operated pump, a reciprocating motor having a recessed piston, said piston being provided with a plurality of spaced passageways opening into said recess, said passageways alternately leading to the top and to the bottom of said piston, an annular valve having a plurality of spaced ports therein positioned within said recess, and means for rotating said annular valve to cause the ports therein to move into and out of registry with the spaced passageways in said recessed piston, said means comprising a flattened portion of said annular valve extending into a passageway between the air and vacuum sides of the piston and a pin valve positioned in said passageway on each side of said flattened portion of the annular valve.

5. In a vacuum operated pump, a reciprocating motor having a recessed piston, an annular valve having a plurality of openings therein positioned within said recess, a pocket formed in the piston intermediate the ends of the passageways extending from the air to the vacuum sides of the piston, a flattened portion of the annular valve projecting into said pocket and separating said passageways, and a pin valve positioned in each passageway, said pin valves being adapted to concurrently open and close an air and a vacuum portion of each passageway.

6. In a vacuum operated pump, a reciprocating motor having a recessed piston, an annular valve having a plurality of openings therein positioned within said recess, a pocket formed in the piston intermediate the ends of the passageways extending from the air to the vacuum sides of the piston, a flattened portion of the annular valve projecting into said pocket and separating said passageways, a pin valve positioned in each passageway, said pin valves being adapted to concurrently open and close an air and a vacuum portion of each passageway, and means for preventing the free movement of said pin valves.

7. In a vacuum operated pump, a reciprocating motor having a recessed piston, an annular valve having a plurality of openings therein positioned within said recess, a pocket formed in the piston intermediate the ends of the passageways extending from the air to the vacuum sides of the piston, a flattened portion of the annular valve projecting into said pocket and separating said passageways, a pin valve positioned in each passageway, said pin valves being adapted on contact with the end of the cylinder to concurrently open and close an air and a vacuum portion of each passageway, and spring means for cushioning the impact of such contact.

8. In a vacuum operated pump, a reciprocating motor having a recessed piston, an annular valve having a plurality of openings therein positioned within said recess, a pocket formed in the piston intermediate the ends of the passageways extending from the air to the vacuum sides of the piston, a flattened portion of the annular valve projecting into said pocket and separating said passageways, a pin valve positioned in each passageway, said pin valves being adapted on contact with the end of the cylinder to concurrently open and close an air and a vacuum portion of each passageway, spring means for cushioning the impact of such contact, and a grooved plate covering the openings of the said passageways in the top of the piston.

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