Jan. 9, 1934. P. R. FORMAN 1,942,543

PNEUMATIC ENGINE

Filed Oct. 29, 1932

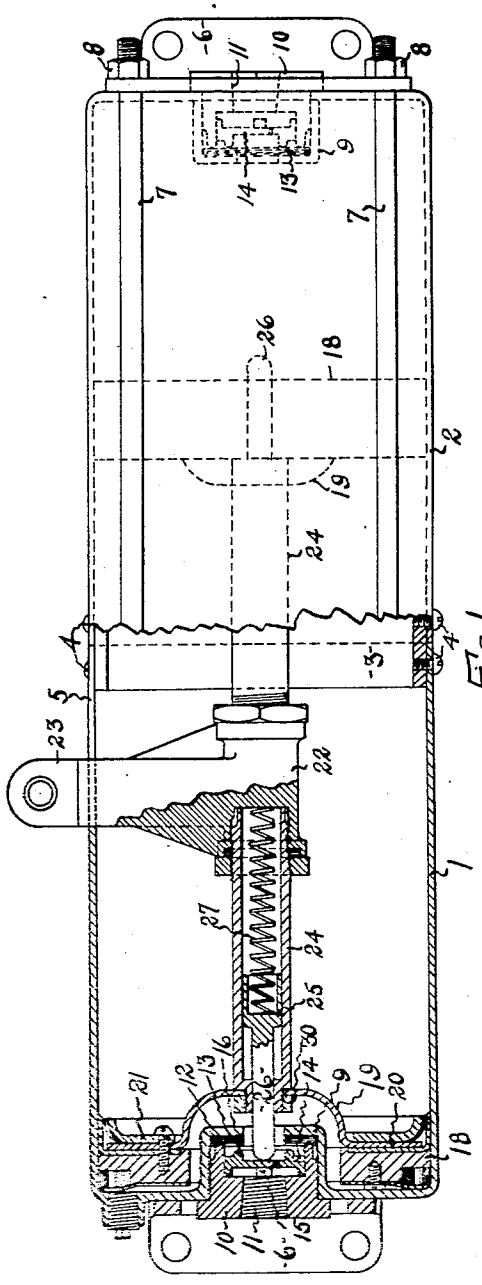


Fig. 1.

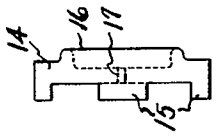


Fig. 4.

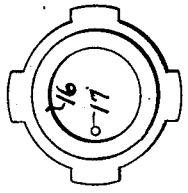


Fig. 3.

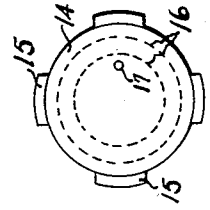


Fig. 2.

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PNEUMATIC ENGINE

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Application October 29, 1932. Serial No. 640,241

4 Claims. (Cl. 121—44)

This invention involves improvements in pneumatic engine, particularly of the type known as a vacuum engine.

The general object of this invention is to provide an exceedingly simplified form of pneumatic engine constructed so that at the beginning of its stroke it moves rapidly but towards the end of the stroke it automatically slows down in its speed of movement and is at that time cushioned in coming to a stop.

These and many other objects as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts all as will appear from the following detailed description.

Referring to the drawing—

Figure 1 is a side view of the engine of this invention partly in elevation and partly in cross-section;

Fig. 2 is a plan view of the valve looking at it from one side;

Fig. 3 is a similar view looking at the valve from the opposite side; and

Fig. 4 is an edge elevational view thereof.

The engine itself consists of two cylinders 1 and 2 each closed at one end and open at the other. These cylinders abut at their open ends and are secured together in this relation by means of an internal ring 3 and machine screws 4, as is clear from Fig. 1. Each cylinder is longitudinally slotted inwardly from its open end to provide a continuous longitudinal slot 5 which is in alignment with a slot in the ring 3. The composite cylindrical casing thus formed may be supported between brackets 6 and are cross-connected by means of rods and nuts 7 and 8.

The end walls of the cylinders are provided with central internally projecting cups 9 which are internally threaded at their outer ends to receive the plugs 10. These plugs are provided with central bores 11 which are threaded to receive fluid pressure supply pipes, not shown. The inner ends of the plugs 10 are recessed to form annular loops 12 which rest against the washers 13 resting against the end walls of the cups to form seals therewith. Within chambers thus formed are the valve discs 14. These valve discs have spaced projections 15 arranged around the peripheries thereof to form, in conjunction with the walls of the recess in the plugs, arcuate passages as will be apparent to one skilled in the art. Projecting from the opposite face of the valve disc is an annular ridge 16 which forms a valve seat positioned to contact with the washer 13 which is preferably made of a suitable resilient or packing material. Extending through the valve disc within the confines of the ridge 16 is a small restricted port 17. At 18 are pistons which are provided with large central passages therethrough as shown. Secured to the opposed faces of the pistons are metal discs formed to provide central cup shaped portions 19 and annular flange portions 20. These discs are secured to the pistons by means of rings 21 and machine screws as shown. At 22 is a coupling member having a transversely extending arm 23 which projects through the slot 5 formed in the cylinders so as to be longitudinally slidable therein. Threadedly secured to each end of the coupling member is a hollow piston rod 24 which has a reduced threaded end which passes through an opening in the center of the cup 19 and which receives a nut 30 so that the piston rods are connected to the pistons through the discs, as will be apparent. Slidably mounted in the piston rods are rods 26 which are provided with enlarged cup shaped ends 25 slidable within the piston rods. Springs 27 lie between the cups 25 and the coupling member. The cups 9 and the washers 13 are provided with central openings through which the rods 26 may pass to engage the valves 14. As will be apparent from the drawing in the above description each end of the engine is exactly the same in construction.

The operation of this structure will now be given based upon the assumption that the engine is at rest at one extreme position which, in the case of door operation, may be assumed to be door closed position. At this time cylinder 1 is connected to a vacuum source and cylinder 2 is connected to the atmosphere. The space between the pistons being open to the atmosphere through the slot 5 atmospheric pressure will be balanced on these faces. Cylinder 1 being connected to a vacuum source the parts will be in the position shown. When cylinder 2 is connected to the vacuum source and cylinder 1 is connected to the atmosphere the pressure against piston 18 will move the entire piston assembly and connected parts to the right. The first movement of these parts will be rapid because spring 27 will hold rod 26 in engagement with valve 14 to hold it in the position shown at the lefthand end of the engine. Thus air at atmospheric pressure will pass through port 11 around valve 14 through the arcuate passages and through the opening in cup 9 into the space between the end wall of the cylinder and the piston. It should be noted that

the piston is provided with an annular ridge to hold it spaced away from the end wall of the cylinder so that the air may act on the face of the piston. The air will also act upon the inner wall of cup 19. The connection of cylinder 2 of the vacuum source will immediately cause valve 14 at the righthand end to move over from the dotted position shown to a position similar to that of valve 14, as shown in the drawing, at the lefthand end of the engine. The piston and connected parts will, therefore, move rapidly to the right until piston rod 24 and cup 25 engage at which time spring 27 will have completely projected rod 26. Further movement of the pistons and their connected parts will cause rod 26 to move out of engagement with valve 14 at the lefthand end of the engine. As soon as this happens the inrushing air moving past this valve will cause it to move to the right so that the annular ridge 16 will seat on gasket 13 and cut off the supply of air at this point. Any further air which enters cylinder 1 must then pass through the restricted passage 17. The pistons will, therefore, slow down in their movement and during the remainder of their stroke move much more slowly. As soon as the rod 26 at the righthand end of the engine engages valve 14 at the righthand end spring 27 in the righthand piston rod 24 will begin to impress which will give some further cushioning action. Upon a reversal of connections so that cylinder 2 is connected to the atmosphere and cylinder 1 is connected to a vacuum source the reverse operations will occur. Of course, when the engine is at rest the vacuum source will be continuously connected to the proper cylinder with the other cylinder open to the atmosphere so that the pistons and connected parts will remain in that position.

From the above description it will be apparent that this invention resides in certain principles of construction and operation which may be embodied in apparatus of other physical forms and I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration but rather to the scope of the appended claims.

What I seek to secure by United States Letters Patent is:

1. A pneumatic engine comprising a cylinder having closed ends shaped to form inwardly projecting cups and opening outwardly of the cylinder, ported plugs in said cups to form valve chambers, slidable valves in said chambers each having an annular ridge on its inner face, a restricted port therethrough opening within the area of the ridge and constructed to permit free passage of air thereby, a seat in each chamber to be engaged by the ridge of the valve therein, a pair of connected pistons in said cylinder and spring pressed rods slidably mounted on the pistons and arranged to engage said valves to alternately hold them unseated during a portion of the stroke of the piston.

2. A pneumatic engine comprising a cylinder having closed ends shaped to form inwardly projecting cups and opening outwardly of the cylinder, ported plugs in said cups to form valve chambers, slidable valves in said chambers each having an annular ridge on its inner face, a restricted port therethrough opening within the area of the ridge and constructed to permit free passage of air thereby, a seat in each chamber to be engaged by the ridge of the valve therein, a pair of pistons in said cylinder, hollow piston rods connecting said pistons, rods slidably mounted in the hollow piston rods and springs therein for urging the rods to project the pistons, said rods being arranged to alternately engage said valves to hold them unseated.

3. A pneumatic engine comprising a cylinder having closed ends shaped to form inwardly projecting cups and opening outwardly of the cylinder, ported plugs in said cups to form valve chambers, slidable valves in said chambers each having an annular ridge on its inner face, a restricted port therethrough opening within the area of the ridge and constructed to permit free passage of air thereby, a seat in each chamber to be engaged by the ridge of the valve therein, a pair of pistons in said cylinder, hollow piston rods connecting said pistons, rods slidably mounted in the hollow piston rods and springs therein for urging the rods to project the pistons, said rods being arranged to alternately engage said valves to hold them unseated, and means connected to the piston rods and projecting through the wall of the cylinder for attachment to parts to be operated.

4. A pneumatic engine comprising a cylinder having end walls formed with cups projecting inwardly of the cylinder, ported plugs mounted in said cups to form valve chambers, a slidable valve in each chamber having an annular ridge on its inner face, a restricted port through the wall thereof opening within the area of the ridge and peripheral recesses to provide unrestricted air passages, a pair of pistons having central openings so that they can telescope with said cups, hollow piston rods, means for connecting said rods together as a unit, means for connecting the outer ends of the rods to the pistons, rods slidably mounted in the hollow piston rods and springs in the piston rods for causing said rods to project from the piston rods, said rods being arranged to alternately engage said valves to hold them unseated for a portion of the stroke of the pistons.

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