Aug. 11, 1964 S. ALTSCHULER ETAL 3,143,922

VANE TYPE ROTARY MOTOR FOR GUN

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Fig. 1.

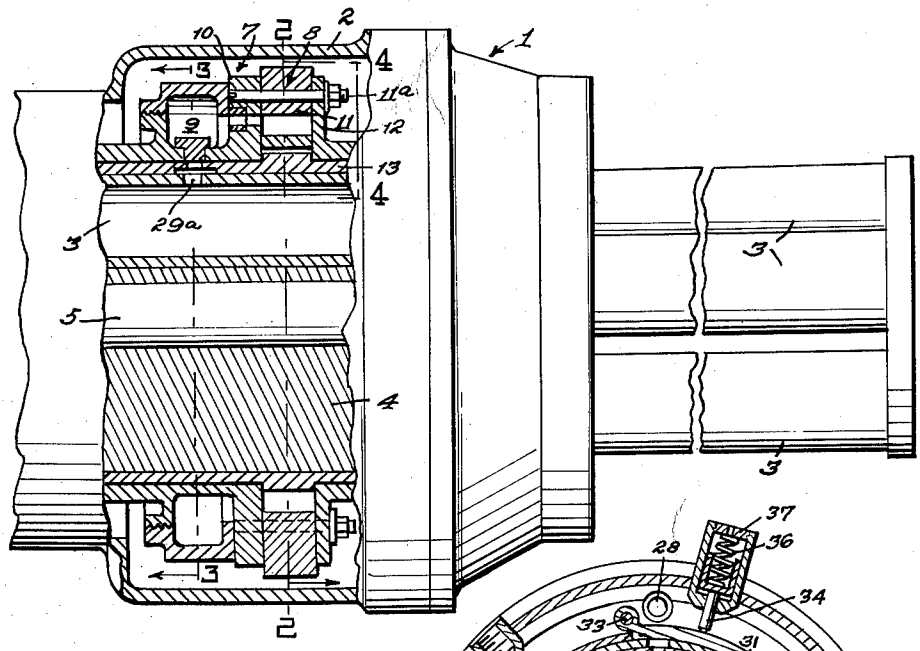


Fig. 3.

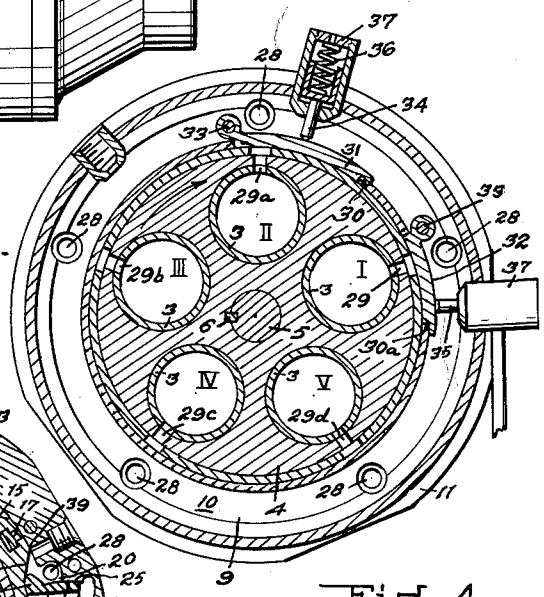


Fig. 2.

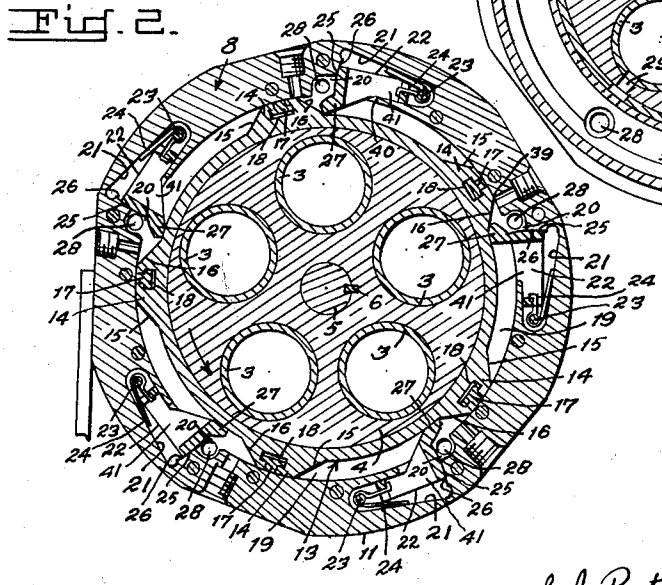
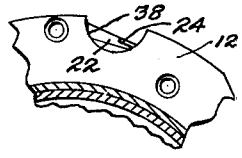


Fig. 4.



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Fig. 5.

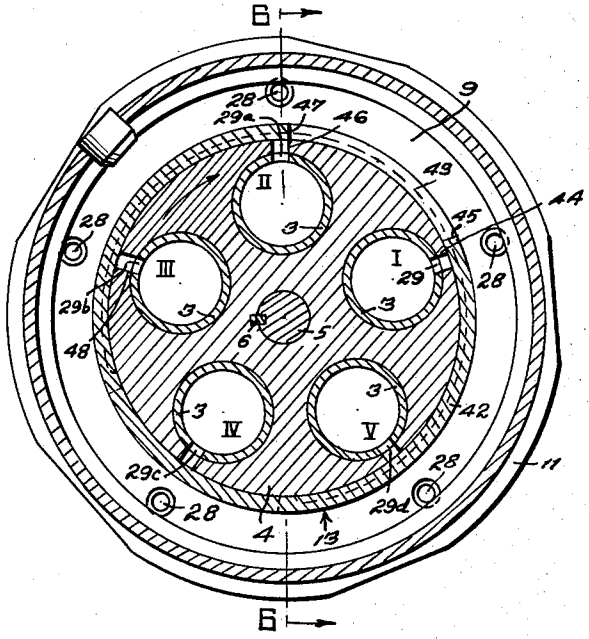
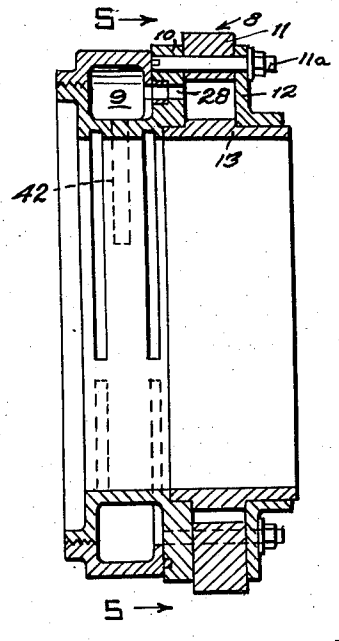


Fig. 6.



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3,143,922

VANE TYPE ROTARY MOTOR FOR GUN

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4 Claims. (Cl. 89—12)

This invention relates to a vane type internal powder gas motor for an automatic gun firing rocket type ammunition and more particularly to a motor for accelerating and maintaining velocity in an automatic gun of the type having a cluster of concentrically arranged barrels which rotate continuously during firing, the barrels being rotated only by the internal powder gases generated within the said barrels.

The present invention is designed to accomplish this rotation more efficiently than heretofore and consists of a stationary housing in which a rotor carrying the barrels is operated by the action of the powder gases in passing into multiple chambers and blocked by multiple vanes attached to the housing and cooperating with the rotor. A pair of slipper valves control the flow of the powder gases which are distributed by a manifold into multiple ports leading into the multiple chambers.

It is a primary object of this invention to provide a gas motor for accelerating and maintaining velocity in an automatic gun entirely by the combustion gases generated in the barrels thereof.

It is another object to provide a gas operated motor which is simple of construction yet highly efficient in operation.

It is still another object to provide a motor for rotating the barrel cluster of an automatic gun that is compact and has relatively few moving parts.

With these and other objects in view which will become apparent as the specification develops, reference is made to the drawings in which:

FIG. 1 is a fragmentary elevational view of the forward portion of an automatic gun, the gas motor of the invention being illustrated in axial section;

FIG. 2 is a cross section taken along line 2—2 of FIG. 1;

FIG. 3 is a cross section taken along line 3—3 of FIG. 1;

FIG. 4 is a detail section taken along line 4—4 of FIG. 1;

FIG. 5 is a cross section, similar to FIG. 3 and showing a modified form of valve arrangement; and FIG. 6 is an axial section taken along line 6—6 of FIG. 5, the barrel cluster being omitted.

Referring to the drawings, 1 indicates generally a portion of an automatic gun having an outer housing 2, a cluster of gun barrels 3 of which 5 are shown mounted for rotation within housing 2. Means are provided for supporting barrels 3 and consists at this portion of the launcher, of a retaining block 4 which is mounted for rotation on a central shaft 5 and is fixed for rotation therewith by suitable means such as a key 6. Other supports for the cluster (not shown) are distributed along the gun as required.

The gas motor of the invention is indicated generally at 7 and consists of a stationary housing indicated generally at 8. Stationary housing 8 consists of an annular manifold 9, intermediate flange 10, a fixed housing 11 and an end flange 12. Fixed housing 11 is secured between flanges 10 and 12 by bolts 11*a*. A rotor, generally indicated by 13 encircles block 4 and is provided with a series of integral bosses 14 of which fiive are shown and they are arranged on the outer peripheral surface of rotor

13 in symmetrically spaced relation. Each boss 14 is provided with beveled edges 15 and 16.

Sealing means are provided between the outer surfaces of each boss 14 and the inner peripheral surface of housing 11 and consists of a wiper 17 contained in a recess 18 in each boss.

Between the outer peripheral surface of the rotor 13 and the inner peripheral surface of housing 11, there is formed an annular chamber 19 which is inclosed by the walls of flanges 10 and 12.

Chamber 19 is divided into a series of five smaller symmetrically spaced chambers 20 and a series of five symmetrically spaced large recesses 21 in housing 11 as best seen in FIG. 2.

Chamber 19, smaller chambers 20 and large recesses 21 form a gas chamber system which is normally partitioned off by a series of five vanes 22 which are pivotally mounted one each as at 23 to seat in a respective recess 21 and are biased inwardly by a spring 24. Each vane 22 has a frontal curved wall 25 which slides on a mating curved surface 26 in the frontal wall of recess 21. Each vane 22 is provided with a slider 27 integral with the bottom of its frontal wall 25 and adapted to slide on the outer peripheral surface of rotor 13 and over bosses 14 with beveled edges 15 and 16, being held in close contact therewith by springs 24.

Manifold 9 is in communication with small chambers 20 by fire ports 28 and each of the fire gun barrels 3 is in communication with manifold 9 by ports 29, 29*a*, 29*b*, 29*c* and 29*d* respectively.

Rotor 13 is provided with a pair of large ports 30 and 30*a* (see FIG. 3). These ports are normally closed by slipper valves 31 and 32 hinged to flange 10 as at 33.

Slipper valves 31 and 32 are normally urged in their closed position by plungers 34 and 35 which are biased by springs 36 in housings 37.

Vent openings are provided in the outer portion of flange 12 as at 38. (See FIG. 4.)

As the rotor 13 rotates, slider 27 will ride up on beveled edge 16 of boss 14 to assume a position whereby it closes off a port 28 to trap the gases in its respective partition of the chamber system, and as the boss 14 continues to rotate, slider 27 will ride down the beveled edge 15 and port is opened again to admit more gas.

The operational sequence of the gas motor with the slipper valves is as follows:

When the firing circuit of the automatic gun (not shown) is closed, the round (also not shown) in tube 3, in position I (see FIG. 3) is closed, a portion of the resulting powder gases generated in tube 3 passes through port 29 to actuate the respective slipper valve 32 and admit the gasses into manifold 9 where they flow through ports 28 and into chambers 20. As soon as the gas pressure in the system is equalized, slipper vlave 32 is closed by spring biased plunger 35 and the gases are trapped between the curved wall 25 of vane 22 and boss 14 and will initiate rotation of the rotor 13 carrying the cluster of gun barrels 3.

Once in motion, the volume of the chambers 20 and 19 increases and the pressure of the trapped gases decreases.

Approximately 15 milliseconds later, the barrel 3 shown in position II will be in position IV and fired. A portion of the gases generated in this barrel will pass through port 29*a* and actuate slipper valve 31 and pass into manifold 9 to increase the gas pressure therein and also the chamber system 19 and 20.

When the gas pressure becomes equalized in the chamber system 19 and 20, slipper valve plunger 34 under bias of spring 36 closes the valve and the gases are again trapped.

These trapped gases continue to release energy until

edge 39 of boss 14 pass edge 40 on housing 11. At this stage, the gases in chambers 19 and 20 are vented through vent 41 in vane 22 and to the atmosphere through vent 38 in flange 12.

After approximately 30 milliseconds of elapsed time, the barrel 3 shown in position III will be in position II and is fired. A portion of the powder gases generated in this barrel will pass through port 29*b* and actuate slipper valve 31, then pass into the manifold 9 and into chambers 20, where they are trapped after the pressure in chambers 19 and 20 is equalized when the plunger 34 closes slipper valve 31.

The trapped gases continue to release energy in the chambers 20 until edge 39 of boss 14 passes edge 40 of housing 11, at which point they are vented through vents 41 and 38 as before.

A large amount of energy is required during the acceleration period at the start of the burst, and a relatively small amount is required to sustain operation. To accommodate this condition, slipper valve 32 will be positioned to allow unrestricted flow of powder gases, and slipper valve 31 will be positioned to meter the amount of gases which can flow through it.

A modified form of valve arrangement for the gas motor is shown in FIGS. 5 and 6.

In this form the construction of the motor is the same as in FIGS. 1 to 4 with the exception that a valve ring 42 is employed instead of slipper valves and a single valve port 43 is provided in rotor 13. (See FIG. 5.)

The valve ring 42 in this embodiment is the equivalent of the rotor shown in FIGS. 1 to 4.

As illustrated in FIG. 5, the motor is shown in the position for firing after it has been accelerated to operational speed. At the start of the burst, the barrel 3 shown in position I will be in position IV, and the operational sequence is as follows:

When the firing circuit (not shown) of the launcher is closed, the round (not shown) in position IV (FIG. 5) is fired. A portion of the powder gas generated in the launcher tube 3 passes through port 44, ring port 43 and into the manifold 9, then through ports 28 and into chambers 20. The gases in chambers 20 acting on the vanes 22 and rotor 13 initiate rotation and acceleration for the rotor 13. When edge 44 of port 29 passes edge 45 of valve ring port 42, the gases are trapped in manifold 9, chambers 19 and 20 until edge 46 of port 29*a* passes edge 47 in the valve ring port 43.

At this point the gases in manifold 9, chambers 19 and 20 vent to the atmosphere through the tube 3 in position II.

After approximately 15 milliseconds of elapsed time, the round in barrel 3 in position II will be at position V and will be fired. A portion of the powder gases generated in this barrel passes out of port 29*a* into manifold 9 and through the fire ports 28 into the fire chambers 20 where the gases, acting on the vanes 22 and rotor 13 continue the acceleration of the rotor 13. During this portion of the cycle, the pressure pattern in the manifold 9 and chambers 19 and 20 will tend to follow the pressure pattern in the barrel 3. The gases continue to accelerate and rotate the rotor 13 until edges 39 on boss 14 passes edges 40 on housing 11, at which point they are vented to atmosphere through opening 41 in vanes 22 and 38 in flange 12.

After approximately 30 milliseconds of elapsed time, the round (not shown) in barrel 3 in position III is at position II and is fired. A portion of the powder gases generated in this barrel passes out through port 48 and into manifold 9 and through ports 28 into chambers 20 where the action of the gases maintain rotational speed of the rotor 13.

During this portion of the cycle, the pressure pattern in the manifold 9 and chambers 19 and 20 will tend to follow the pressure pattern in tube 3 until edges 39 on boss 14 pass edges 40 in the housing 11 at which point

the gases in the chambers 20 are vented to atmosphere through opening 41 in vanes 22 and 38 in flange 12.

The starting position of the weapon for this type of motor is different from the motor with the slipper valves. This condition increases the initial acceleration required to bring the weapon up to operating speed. At this time, the increase in acceleration is feasible.

Variation and modifications may be effected without departing from the scope of the novel concept of the present invention.

What is claimed is:

1. In combination, a powder gas motor for an automatic gun comprising an outer housing, a stationary housing within said outer housing, there being an annular manifold in said stationary housing, a fixed housing in said stationary housing, a rotor mounted for rotation within said inner housing, there being an annular chamber formed between the outer peripheral surface of said rotor and the inner peripheral surface of said fixed housing, a cluster of circularly arranged gun barrels supported in said rotor for rotation therewith, there being a radially disposed port in each said gun barrel and communicating with said manifold and a series of symmetrically disposed ports communicating between said manifold and said annular chamber, means dividing said annular chamber into a series of segmented chambers comprising a series of symmetrically spaced bosses integral to the outer peripheral surface of said rotor, each said boss having inclined edges, sealing means between the outer face of each said boss and said inner peripheral surface of said fixed housing comprising a recess in each said boss and a wiper housed in each recess and normally wiping said inner peripheral surface of said fixed housing and means housed in said fixed housing for opening and closing said ports between said manifold and said annular chamber, said last named means being operated by said bosses.

2. The combination set forth in claim 1 wherein said means for opening and closing said last named ports comprise a series of symmetrically spaced recesses in said fixed housing and communicating with said last named ports and said annular chamber, a spring biased vane type valve pivotally mounted in each recess and normally adapted to be in sliding contact with the outer peripheral surfaces of said rotor and said bosses whereby when said vane is in contact with the outer peripheral surface of said rotor, said last named ports are open and when said vane is in contact with the outer face of said boss and is rotated thereby, said ports are closed.

3. In combination, a powder gas motor for an automatic gun comprising an outer housing, a stationary housing within said outer housing, there being an annular manifold in said stationary housing and spaced axially from said manifold, a rotor mounted for rotation within said inner housing, a chamber system in said fixed housing, said chamber system comprising an annular chamber formed between the outer peripheral surface of said rotor and the inner peripheral surface of said fixed housing, a series of symmetrically spaced smaller chambers and a series of symmetrically spaced recesses in said fixed housing, a cluster of gun barrels carried by said rotor, a radial port in each said gun barrel communicating with said manifold, a series of symmetrically spaced ports communicating between said manifold and said smaller chambers in said chamber system, a series of symmetrically spaced, integral bosses on the outer peripheral surface of said rotor, sealing members housed, one each, in a said boss adapted to seal between a said boss and the inner peripheral surface of said fixed housing whereby said chamber system is divided into divided areas, and spring type vane valves pivotally mounted, one each, in a said recess whereby the capacity of each said divided area is regulated upon rotation of said rotor and each said port between said manifold and said smaller

chambers is closed by action of a said boss upon a said vane type valve.

4. In combination, a powder gas motor for an automatic gun comprising, an outer housing; a stationary housing in said outer housing, there being an annular manifold in said stationary housing; a fixed housing in said stationary housing; a rotor mounted for rotation in said inner housing, there being an annular chamber formed between the outer peripheral surface of said rotor and the internal peripheral surface of said fixed housing; a cluster of gun barrels carried by said rotor for rotation therewith; a radially disposed port in each of said gun barrels and in communication with said manifold and said annular chamber; and means carried by said rotor and said fixed housing to seal off a portion of said annular chamber whereby powder gases generating from said gun barrels will expand to rotate said rotor, said means comprising a series of integral, symmetrically spaced bosses on the outer peripheral surface of the rotor and a series of vane type valves housed in the fixed housing, said valves normally being in continuous sliding contact with the peripheral surface of said rotor and said bosses.

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