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ROTARY OR SLEEVE VALVE USED IN COMBUSTION CHAMBERS

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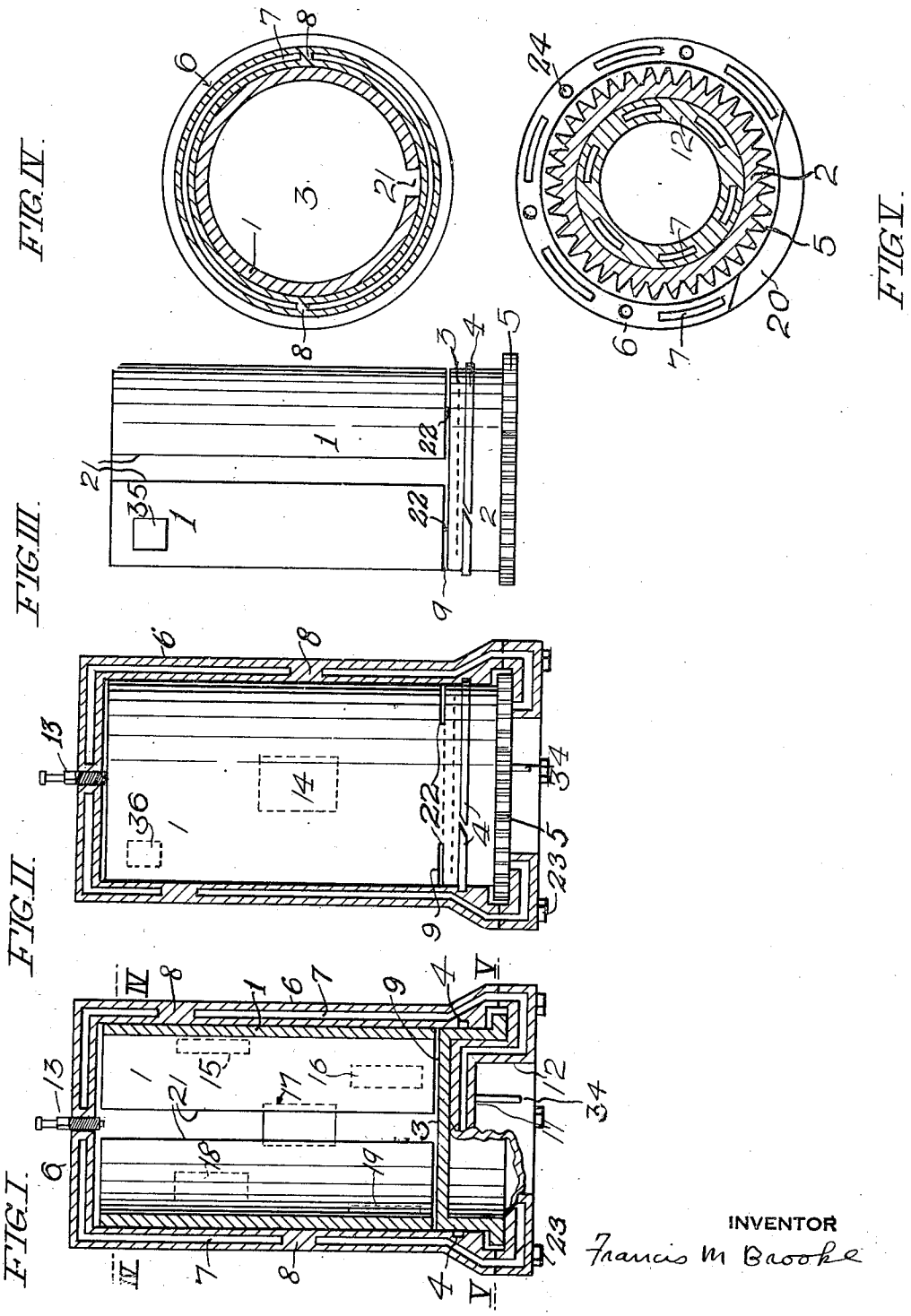

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ROTARY OR SLEEVE VALVE USED IN COMBUSTION CHAMBERS

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7 Claims. (Cl. 60—44)

The object of this invention is an automatic adjustment to take care of the expansion due to heat, particularly in large units. As the sleeve valve should at all times be in contact with its surrounding cylinder with the correct working clearance, which should be a constant distance, it is obvious that with the intense and sometimes varying heat in the combustion chamber, there is a greater range of and a more variable expansion than in the water-cooled cylinder in which it is enclosed.

Thus, if designed for a neat fit at low or moderate temperature, the valve will over-expand and bind at high temperatures. On the other hand, if designed for the latter, there will be excessive clearance at moderate temperature, permitting an over-heating and destruction of the valve, as well as leaking.

In addition the tendency for a permanent expansion from heat, called "creeping" must be considered. While the ratio of these expansions to working clearance may be neglected in automobile engines with cylinders of but a few inches bore, in large combustion chambers for turbines or large power internal combustion engines where the diameters may be in feet, the consideration of automatic adjustment is necessary in design.

The invention covering this is outlined in the following specification, illustrated by the accompanying drawing, and finally claimed.

In the drawing:—

Figure I is a left hand axial section of a combustion chamber partially broken away at the base, and including my improved rotary sleeve valve.

Figure II is a right hand axial section of the combustion chamber, but with the rotary sleeve valve in elevation and turned through an angle of 180°.

Figure III is a left hand elevation of the rotary valve.

Figure IV is a section along the line IV—IV of Fig. I.

Figure V is a section along the line V—V of Fig. I.

For a complete understanding of the above combustion chambers and rotary sleeve valves my previous Patents Number 1,938,686 issued December 12th, 1933 and Number 1,960,691 issued May 29, 1934 shall be referred to.

In Fig. I the numeral 6 designates the combustion chamber, having water spaces 7 for cooling with solid portions 8 to connect the inner and outer walls of the chamber 6, for strengthening the structure and to separate the flow of water as desired. 13 is a spark plug to ignite the charge.

Encased in the chamber 6 is the rotary sleeve valve 1, which is cut longitudinally or vertically leaving an open space or slot 21 through most of its length. 2 designates the lower part of the sleeve valve 1, which latter part is not cut but a complete cylinder. At the top of 2 there is a solid top, or base for 1, said top being numbered 3. As shown in Fig. II, the valve 1 is an integral part of 2 for about 20% of the circumference, the connection being designated as 22. It may be noted that at each side of the part 22 there is a narrow slot 9, Fig. III, extending around the valve 1 to the vertical slot 21.

4 is a piston ring. 5 is the gear fitted to the lower part 2 of the valve 1 for driving.

It may be noted that when there are explosions inside the valve 1, and it is heated and expanded, there is no wedge action as there is room for expansion in all directions. Not only is there a clearance at the top of the combustion chamber as in the previous patented structures before referred to, but in addition the longitudinal opening or slot 21 in the valve itself, which now, instead of being a complete cylinder is in effect similar to a split sleeve.

As the cylinder walls become larger due to expansion, and as the circumference is prevented from expanding by the encasing combustion chamber 6, the slot 21 becomes narrower or varies in width with the expansion of the valve 1 from heat. Until the slot 21 becomes completely closed, there can be no wedging of the cylinder upon the valve 1.

The tendency for the walls of the valve 1 to form larger arcs is easily resisted by the walls of the combustion chamber, and the elasticity and spring of said valve keeps contact at all temperatures with the walls of 6 as desired. The slots 9 permit practically even expansion throughout the length of the valve 1.

Base 3 of the valve 1 rests upon the water-cooled bottom 11 of the combustion chamber 6.

The lower part 2 of the valve 1, containing no fire and being below the water-cooled base, has a limited temperature comparable to that of the combustion chamber 6 so it can be designed for a neat fit without special allowance for expansion. As there is no fire inside of the part 2, cooling by contact with combustion chamber 6 is not required. Hot gas is prevented from leaking down 2 by means of a piston ring 4.

For assembling the valve 1 in the chamber 6, the latter is cut along the plane V—V, and the part 2 is placed on top of 11 enclosing the side wall

12. The upper part of the chamber 6 is then placed over 1 and bolted on. The bolts are designated by numeral 23 in Figs. I and II and in Fig. V the corresponding bolt holes 24.

As explained in detail in the prior patents referred to above, the valve 1 is rotated by a worm drive which meshes with teeth 5 around the lower part 2 thereof.

It may be noted in Patent No. 1,960,691 that there are three ports vertically in alignment above each other. In the present arrangement the slot 21, replaces these three ports. Thus when the slot 21 registers with the inlet port 14 (Fig. II) the combustion chamber is charged with gas which enters under compression. When ignited by spark plug 13 the pressure from explosion is successively discharged at falling pressure stages through the exhaust ports 15, 16, 17, 18 and 19. Additional exhaust ports may be added if desired or additional inlet ports in combustion chamber 6. Thus when the slot 21 registers with the port 14 for charging, an additional port 35 in the valve 1 can scavenge through an auxiliary or extra exhaust port 36 in the chamber 6 as in prior Patent Number 1,938,686 issued December 12, 1933.

In Fig. II the auxiliary port 36 is shown dotted in the combustion chamber 1.

In Fig. III port 35 in valve 1 is shown in full lines, and 35 registers with the port 36 when slot 21 registers with the inlet 14 for scavenging as aforesaid.

Fig. III shows the valve 1 alone in elevation with the slot 21 in front. It is also shown in Fig. II incased in a section of the combustion chamber 6, but turned through a half revolution.

Fig. IV is a section along the line IV—IV in Fig. I. The base 3 and slot 21 may be clearly noted.

Fig. V is a view in section along the line V—V. This is below the bottom 11 in Fig. I. It shows the internal sidewalls 12 of the combustion chamber 6 as well as its exterior sidewalls. Gear teeth 5 at the base of 2 are evident, also the space 20 where 6 is cut away near its base for the inserting of the worm drive hereinbefore referred to.

Water passes through spaces or channels 7 from the outer walls of the combustion chamber 6, through the corresponding channels 7 of the inner wall 12 of the combustion chambers. This circulation is arranged by the customary method of an inlet water pipe on one side and an exhaust on the other or at the top of the cylinder and are not shown. To prevent air binding when filling with water an air outlet pipe 34 to the water section of 11 is provided.

Having thus described my invention, I claim the following:

1. The combination with an internal combustion chamber, having an inlet port and relatively-staggered exhaust ports, of a sleeve-valve rotatable therein, said sleeve-valve having a transverse wall proximate one end and subdividing it into major and minor sections, the major section being split by a longitudinal cut-out and substantially-separated from the minor section by a segmental-circumferential narrow slot adjoining the transverse dividing wall, the minor section being cylindrical and embodying means whereby the valve is rotatable, and the narrow slot aforesaid serving to permit of the valve major section expanding under heat while its longitudinal slot consecutively-controls the staggered exhaust ports.

2. The combination of claim 1 wherein the narrow segmental-circumferential slot extends approximately four-fifths around the sleeve valve to define a connecting portion between the major and minor sections thereof, and the longitudinal cut-out is open-ended and located diametrically opposed to the median of said connecting portion.

3. The combination of claim 1 wherein the sleeve valve minor section is provided with a driving gear at its open end, and a circumferential groove for an appropriate packing ring intermediate said gear and the sleeve valve segmental slot.

4. The combination of claim 1 wherein the sleeve valve substantially fits the combustion chamber, in the axial direction, and is provided with an orifice near its open end for registration with an auxiliary exhaust port through the combustion chamber wall, said orifice being so located with respect to the longitudinal cut-out and the auxiliary exhaust port as to accommodate thorough scavenging of the combustion chamber incidental to its being charged with combustible gas under pressure.

5. The combination with a combustion chamber of a rotary sleeve valve embodying a transverse wall dividing it into aligned comparatively-independent sections; one of said sections including a segmental-circumferential separation, proximate the transverse wall, and a longitudinal cut-out therefrom to the sleeve valve open end; and the other section being wholly cylindrical, and including means whereby the valve may be rotated.

6. The combination with the explosion chamber of an internal combustion engine of a rotary sleeve valve fitting said chamber and embodying a transverse wall dividing it into major and minor axially-aligned comparatively-independent sections; the major section including a segmental-circumferential narrow slot adjoining the contiguous face of the transverse wall, and a longitudinal cut-out extending medially outwards from such cut-out to the open end of the valve; and the minor valve section being wholly cylindrical with a surrounding drive gear at its open end.

7. The combination with the explosion chambers of internal combustion engines of a rotary sleeve valve for each such chamber individually embodying a transverse wall dividing it into major and minor axially-aligned comparatively-independent sections; the major section including a segmental-circumferential narrow slot adjoining the contiguous face of the transverse wall, and a longitudinal cut-out extending medially outwards from such cut-out to the open end of the valve; the minor valve section being wholly cylindrical with an external gear surrounding its open end, and a circumferential groove in said minor section for reception of suitable packing medium.

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