April 10, 1951 R. H. GODDARD 2,548,430

SLEEVE VALVE FOR RESONANCE COMBUSTION APPARATUS

Filed Feb. 1, 1947 2 Sheets-Sheet 1

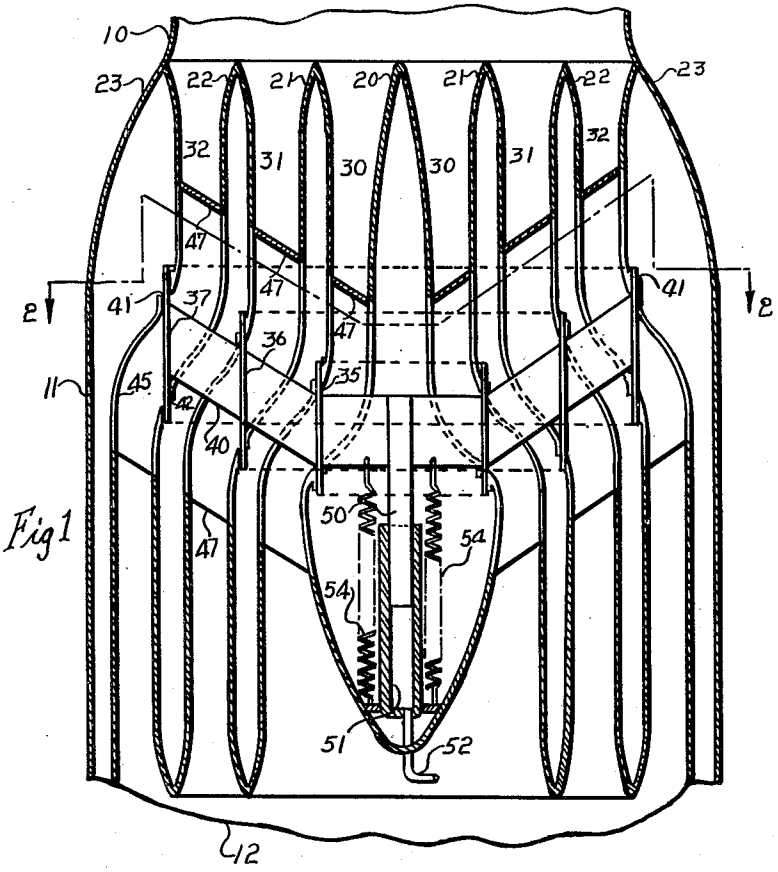

Fig 1

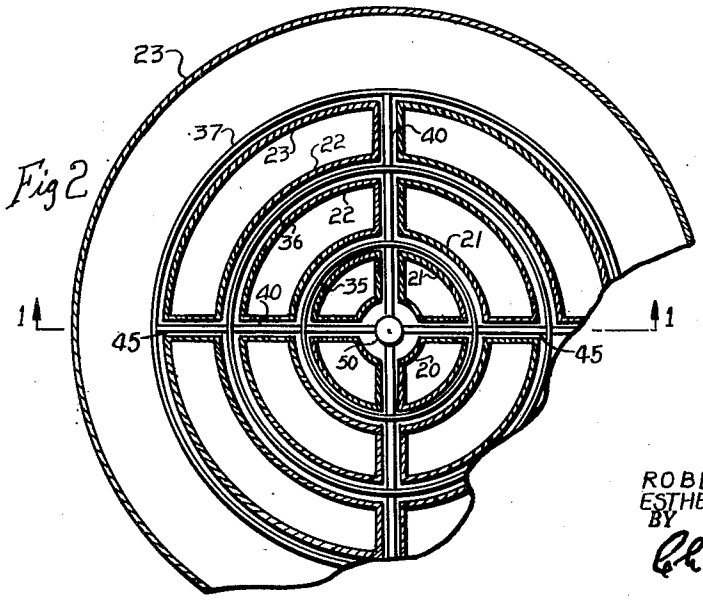

Fig 2

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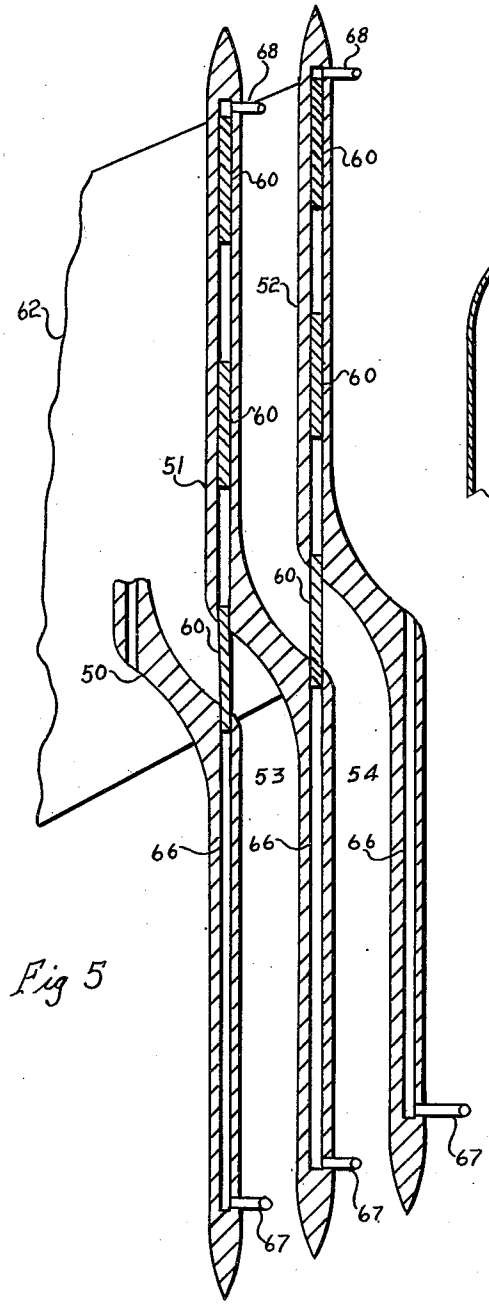

Fig 5

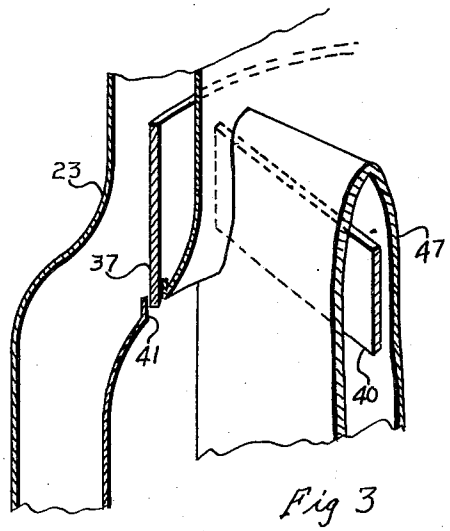

Fig 3

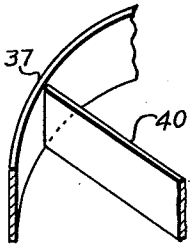

Fig 4

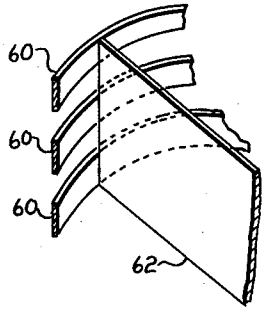

Fig 6

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UNITED STATES PATENT OFFICE

2,548,430

SLEEVE VALVE FOR RESONANCE COMBUSTION APPARATUS

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Application February 1, 1947, Serial No. 725,802

7 Claims. (Cl. 137—144)

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This invention relates to resonance combustion apparatus of the general type shown in a prior patent to Robert H. Goddard, No. 1,980,266. In such resonance combustion apparatus, air controlled by valves is intermittently admitted from a collecting tube to a combustion chamber, where the air is mixed with liquid or gaseous fuel and is then compressed by resonance and thereafter ignited.

It is the general object of the present invention to provide an improved sleeve valve construction for such resonance apparatus, by which relatively large air-admission passages may be quickly opened and closed.

In the preferred form, a plurality of concentric sleeve valve members is provided. Each valve member may comprise a single sleeve element, or a plurality of such elements may be axially disposed in spaced relation and for simultaneous reciprocation.

The invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

Preferred forms of the invention are shown in the drawings, in which

Fig. 1 is a sectional side elevation of a portion of a resonance combustion apparatus embodying this invention;

Fig. 2 is a partial sectional view, taken substantially along the line 2—2 in Fig. 1;

Figs. 3 and 4 are detail partial perspective views of certain parts shown in Fig. 1;

Fig. 5 is a partial sectional elevation showing a modified construction; and

Fig. 6 is a partial perspective view of a three-part annular valve member.

Referring to Figs. 1 to 4, parts of a resonance combustion apparatus are shown including an air-collecting tube 10 and an air-admitting portion 11 leading to a combustion chamber 12.

In said prior Goddard patent, admission of air to the combustion chamber was controlled by swinging or flap valves, which were satisfactory at a relatively low resonance period but which were not found to be well adapted to high speed resonance operation.

In the present construction, an axial hollow vane 20, annular hollow vanes 21 and 22, and a hollow outer casing 23 provide concentric annular air passages 30, 31, and 32 in the air-admitting portion 11. The adjacent surfaces of the vanes and casing are substantially uniformly spaced, as clearly shown in Fig. 1.

Annular sleeve valve members 35, 36 and 37

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are mounted on radially disposed ribs or partitions 40 and are slidable in annular upper openings 41 and annular lower openings 42 in the vanes 20, 21 and 22 and in the inner wall of the casing 23. The vanes are also slotted as indicated at 45 to allow the ribs 40 to be axially reciprocated.

U-shaped shields 47 are mounted between the vanes and casing and act to securely hold these annular parts in fixed spaced relation, as well as providing streamlined protection for the radial connecting ribs or partitions 40.

The ribs or partitions 40 (Fig. 2) are preferably quartered and are secured at their inner ends to a plunger 50 (Fig. 1) slidable in a fixed cylinder 51 which is provided at its lower end with a pipe 52 through which air under pressure may be intermittently admitted. When air is thus admitted, the ribs 40 and annular valve members 35, 36 and 37 will be moved upward, thus opening the air-admitting passages 30, 31 and 32 between adjacent vanes and between the outer vane 22 and the outer casing 23.

When the air pressure is relieved and the pipe 52 is connected to exhaust, the valve members will be moved downward by tension springs 54. As the valve members reach mid position, the annular passages 30, 31 and 32 will be momentarily closed and ignition will take place. The valve members will continue to move downward under the tension of the springs 54 and as they reach their lowered position, the air passages will be again opened.

Fuel admission and ignition may be taken care of as in said prior patent or in any other convenient manner. It is thus apparent that the air passages between the concentric vanes and casing are all simultaneously opened each time the annular valve members are moved to either extreme raised or extreme lowered positions. Thus relatively slow oscillation of the valve members will cause opening and closing of the air passages twice for each complete oscillation. By selectively regulating the air-admitting pressure and the exhaust back pressure, the rate of travel of the valve members may be readily controlled to correspond to any desired resonance period.

In Figs. 5 and 6 a quite similar construction is shown, with concentric vanes 50, 51 and 52 providing air passages 53 and 54 controlled by three-part sliding valve members. Each valve member comprises three annular valve elements or rings 60, mounted in axially spaced relation on radial partition members 62. The vanes 50, 51 and 52 are indicated as solid but as having annular re-

cesses **66** to receive the multiple valve members and they are also slotted axially to permit movement of the partitions **62** but these axial slots are not in the plane of Fig. 5.

Pipes **67** and **68** are provided for simultaneously admitting air under pressure alternately at the upper and lower ends of the recesses **66**. The multiple valve structure may be moved as a unit at any desired speed in either direction by suitable control of the air pressure and exhaust.

When the valve structure is in the raised position shown in Fig. 5, the air passages **53** and **54** are closed, but as the valve structure moves downward, the air passages will be successively opened, closed, again opened and again closed, all during a single movement of the valve structure in one direction. On the return movement, a corresponding sequence of operations will take place.

With this construction, the number of air-admitting periods is thus doubled for a given number of oscillations of the valve structure, as compared with the structure shown in Fig. 1. Otherwise the operation is substantially the same.

With both constructions, high speed operation is readily attained and a very large cross sectional area of air passages is quickly opened and closed.

Having been thus described, the invention is not to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what is claimed is:

1. In a resonance combustion apparatus, a plurality of hollow annular vanes extending in the direction of air flow and defining annular air-admitting passages between axially spaced and substantially cylindrical wall portions of different diameters and with a connecting portion having substantially conical spaced walls, a plurality of sleeve valve members mounted in annular recesses in said vanes and each slidable from a forward recess in one vane across the air passage between two adjacent vanes to a rear recess in an inwardly adjacent vane, said sleeve valve members closing said air passages when in mid position, and means connected to the sleeve valve members and operative to move each of said sleeve valve members axially between two extreme positions which are on opposite sides of one continuous air passage.

2. The combination in a resonance combustion apparatus as set forth in claim 1, in which the sleeve valve members are connected to fluid pressure responsive means for movement in one direction by fluid under pressure and in which spring means engage said valve members for moving said members in the opposite direction.

3. The combination in a resonance combustion apparatus as set forth in claim 1, in which the annular sleeve valve members are connected by radial ribs, and in which housings of U-shaped section are provided for said ribs.

4. The combination in a resonance combustion apparatus as set forth in claim 1, in which the annular sleeve valve members are connected by radial ribs, and in which said ribs are connected at their inner ends to a single valve-moving device.

5. In a resonance combustion apparatus, a plurality of annular vanes extending in the direction of air flow and defining annular air-admitting passages, a plurality of sleeve valve members mounted in annular recesses in said vanes and each slidably mounted for axial movement from a forward recess in one vane across the air passage between two adjacent vanes to a rear recess in an inwardly adjacent vane, said sleeve valve members closing said air passages when in intermediate positions, and each valve member comprising three sleeve valve elements axially spaced apart and held in fixed relation by axially extended ribs, and means connected to the sleeve valve members and operative to move said sleeve valve members to bring said valve elements successively to passage-closing position.

6. In a resonance combustion apparatus, a plurality of annular air-admitting vanes extending in the direction of air flow and defining annular air passages, a plurality of sleeve valve members mounted in annular recesses in said vanes and each slidably mounted for axial movement from a forward recess in one vane across the air passage between two adjacent vanes to a rear recess in an inwardly adjacent vane, said sleeve valve members closing said air passages when in mid position, and each valve member comprising three sleeve valve elements axially spaced apart and held in fixed relation by axially extended partition members, and fluid-pressure means connected to the sleeve valve members and operative to move said sleeve valve members to bring said sleeve valve elements successively to passage-closing position and to return said valve members to initial position.

7. In a resonance combustion apparatus, a plurality of annular air-admitting vanes extending in the direction of air flow and defining annular air-admitting passages, a plurality of sleeve valve members mounted in annular recesses in said vanes and each slidably mounted for axial movement from a forward recess in one vane across the air passage between two adjacent vanes to a rear recess in an inwardly adjacent vane, said sleeve valve members closing said air passages when in intermediate positions, and each valve member comprising three sleeve valve elements axially spaced apart and held in fixed relation by axially extended ribs, and fluid-pressure means connected to the sleeve valve members and operative to move said sleeve valve members simultaneously and alternately in both directions to bring said sleeve valve elements successively to passage-closing position.

ESTHER C. GODDARD,
Executrix of the Last Will and Testament of Robert H. Goddard, Deceased.

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