Nov. 19, 1940. H. F. WOLSTENHOLME 2,222,133

ROTARY INTERNAL COMBUSTION ENGINE

Filed April 3, 1939 3 Sheets-Sheet 1

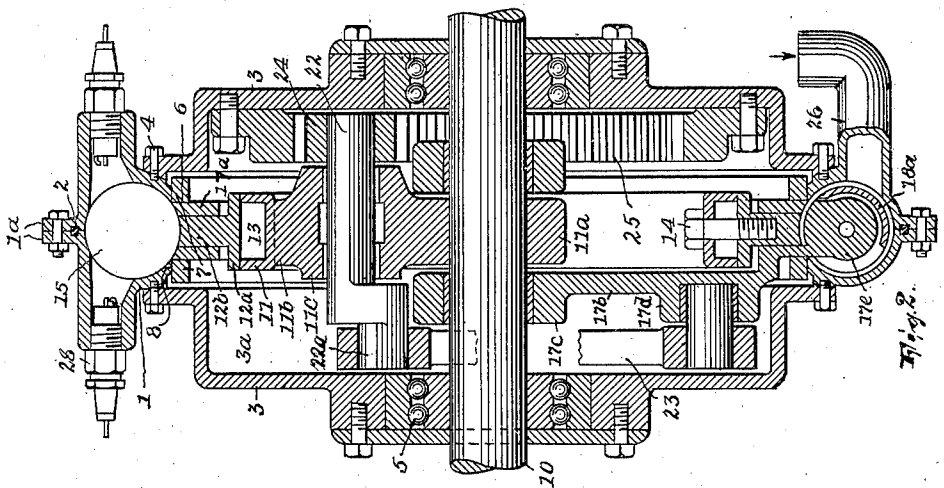

Fig. 2.

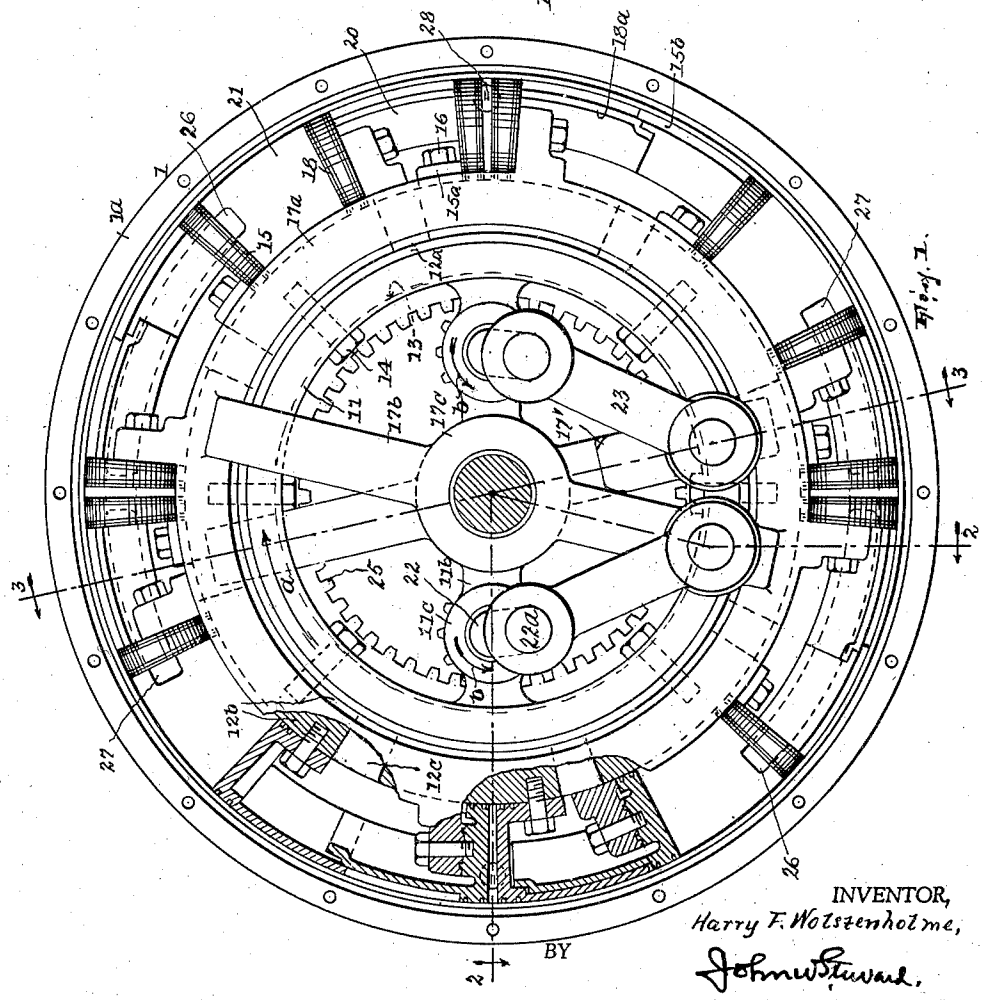

Fig. 1.

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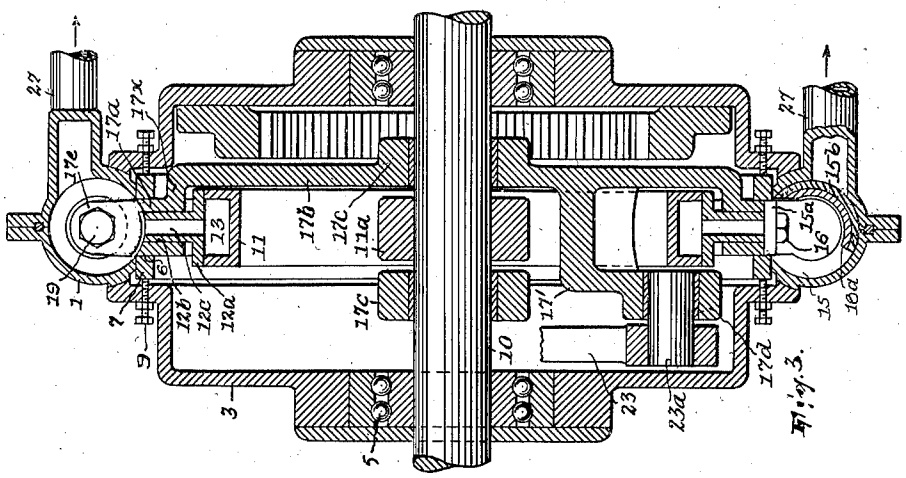

Fig. 3.

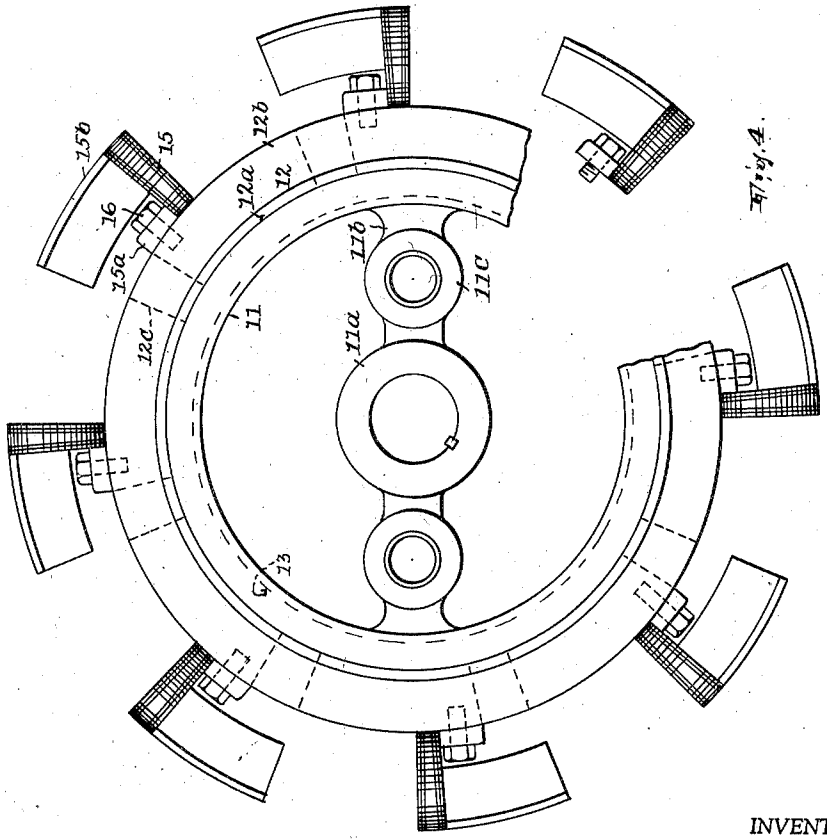

Fig. 4.

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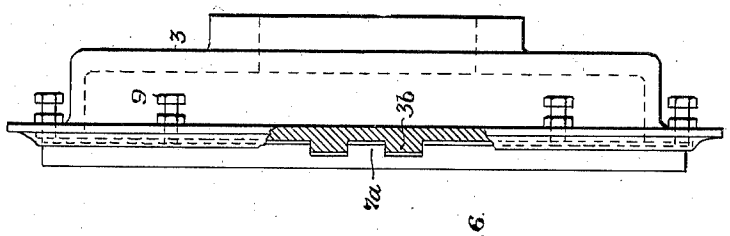

Fig. 6.

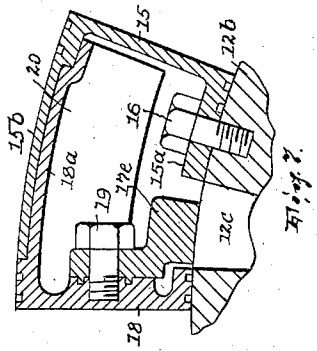

Fig. 7.

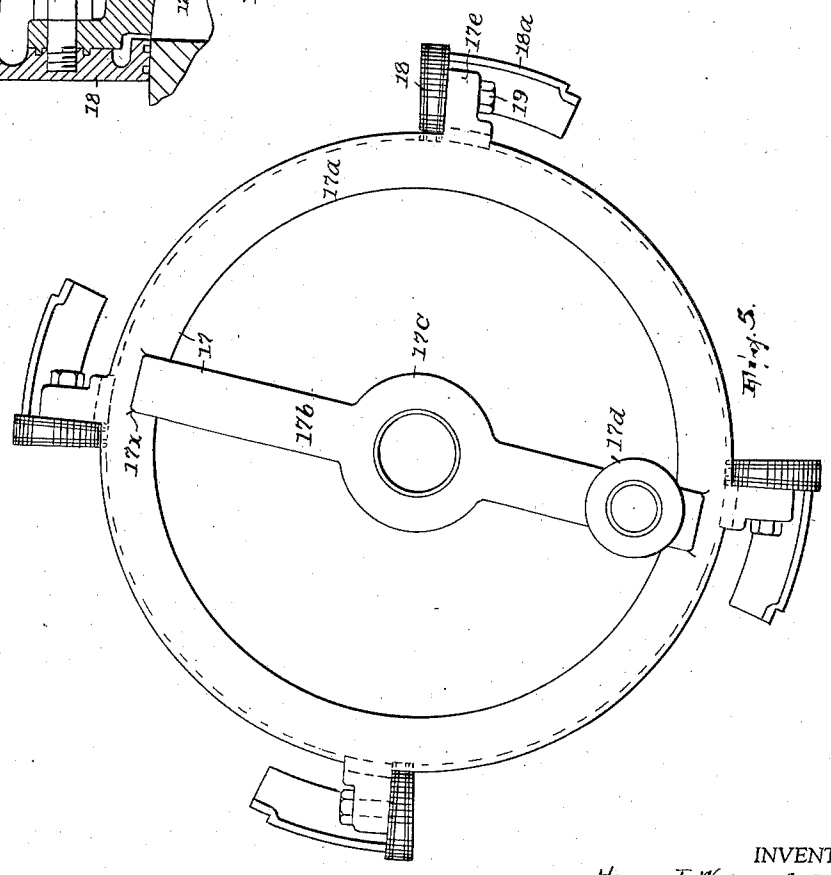

Fig. 5.

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Patented Nov. 19, 1940

2,222,133

UNITED STATES PATENT OFFICE

2,222,133

ROTARY INTERNAL COMBUSTION ENGINE

Harry F. Wolstenholme, Paterson, N. J.

Application April 3, 1939, Serial No. 265,643

3 Claims. (Cl. 123—11)

In my Patents Nos. 1,795,750 and 2,124,327 and 2,142,706, I have set forth certain improvements in rotary internal combustion engines of the type characterized by the inclusion of two elements one of which is rotary and one of which has a cylinder formed annular and with an opening extending continuously around the main axis of the engine and the other of which is coaxial with and has an abutment or abutments in the cylinder, means oscillatory coaxially with and having a piston or pistons in the cylinder, and means, operatively connecting said elements and connected to said oscillatory means, for oscillating the latter.

The present invention contemplates certain improvements in engines of this type having for their objects in general, though more particularly pointed out hereinafter and apparent to those skilled in the art, to simplify the construction and increase the sturdiness and stability of the engine as well as its efficiency.

In the drawings,

Fig. 1 is a side elevation of the engine, with the near head and one-half of the cylinder removed and parts of the fixed structure shown in section;

Figs. 2 and 3 are sections on lines 2—2 and 3—3, respectively, Fig. 1;

Fig. 4 is a fragmentary side elevation of the rotor, with screws 14 omitted;

Fig. 5 is a side elevation of the near oscillator or piston structure in Fig. 1;

Fig. 6 is an edge view, partly in section, of one of the heads of the fixed structure and the adjacent sealing ring; and

Fig. 7 is a sectional detail in the central plane of the engine transverse of the main shaft, showing a piston and a rotor abutment and a fragment of the rotor.

The stator.—This includes a cylinder 1 formed annular and, in a plane bisecting the cylinder and transverse of the axis around which it is developed as an annulus, divided into two substantially counterpart sections or halves, they having exterior flanges 1*a* bolted together, with annular sealing means 2 between them. The stator also includes a pair of heads 3 which are secured to the cylinder by screws 4, being reverse counterparts of each other and shaped to provide inner cavities 3*a*. With the inner perimeter portion of the cylinder they go to form a housing, whose interior forms what I term a "working space," as will appear. The heads support ball-bearings 5 coaxial with the cylinder. The cylinder has its inner perimetrical portion cut away in conformity with an imaginary cylinder coaxial with the bearings 5, thus leaving an inner annular opening which develops as a slot 6 in view of the presence of sealing rings 7 concentric with and in wiping contact with the cylindrical surfaces 8 of the cylinder and which have lugs 7*a* (Fig. 6) intermeshing with lugs 3*b* of the heads whereby to prevent rotation of the rings while permitting them to be inwardly adjusted, as by screws 9 (Fig. 3) tapped into the heads and bearing against the rings. Said rings are to have wiping contact with the annuli of the piston structures, as will appear, so as to seal off the interior of the cylinder from the atmosphere. The stator also includes a fixed gear, as will appear.

10 is the main shaft rotative in the bearings 5 and forming a part of the rotor, the rotor proper of which is constructed thus: It includes an annulus 11 continuously channeled at its outer perimeter, an annular element generally designated 12 in Fig. 4 and embracing the annulus, and abutments fast to said element. The annulus has a hub 11*a* to which it is integrally connected by opposed spokes 11*b* having bearings 11*c* eccentric of and on each side of the hub, which is keyed to the shaft. Element 12 is T-shaped in cross-section (Fig. 3), its horizontal portion or web 12*a* closely fitting the annulus as to form with the channel of the latter an annular chamber 13, said element being rigidly secured to the annulus by screws 14 (Fig. 1) penetrating the annulus and tapped into said element. The vertical part of the T, or flange 12*b* of said element, is to occupy slot 6; such flange has radial passages 12*c* to connect the interior of the cylinder with chamber 13. At the clockwise side (Fig. 4) of each such passage is an abutment 15 having a lug 15*a* by which it is held to the perimeter of the web 12*b* of element 12 by a screw 16 and also having an approximately half-cylindrical skirt 15*b* which projects anti-clockwise as here shown. There are in this example eight passages 12*c* and eight abutments equidistantly spaced around the axis of the engine. It will be understood that, as shown in Fig. 3, each abutment fits the cylinder.

There are two oscillators or oscillatory piston structures. The body portion of each, generally designated 17 in Fig. 5, comprises a flat annulus 17*a* of a diameter to surround, with clearance, the web portion 12*a* of element 12 of the rotor; a diametric spoke 17*b* lying generally in a plane flanking that of the annulus but having its ends 17*x* (Fig. 3) bent out of such plane ad merging into the annulus and also having a central hub

17c, said spoke of one piston structure having a bearing 17d eccentric of the hub, and the spoke of the other piston structure also having such an eccentric bearing 17d but arranged in an angular arm 17' which is offset laterally from the same side of the spoke as the lugs 17e; and lugs 17e at the perimeter of the annulus and offset laterally therefrom at the side thereof opposite the spoke. There are four pistons 18 respectively secured to the lugs by screws 19, these and the lugs being equidistantly spaced around the annulus, and the pistons have approximately half-cylindrical skirts 18a projecting clockwise. In the sense that these lugs 17e are offset laterally in opposite directions when assembled with the rotor, the piston structures are reverse counterparts, though in that state their skirts all project in the same direction.

The rotor and piston structures are arranged as follows in the housing formed by the cylinder 1 and heads 3: The rotor, with its shaft 10 journaled in the bearings 5, has the flange 12b of its element 12 reaching through slot 6 and its abutments in and fitting the cylinder. The piston structures flank the rotor, one at each side thereof, and are journaled on the shaft, their annuli 17a occupying said slot with the flange 12b of said element between them and the pistons 18 in and fitting the cylinder; the pistons of one piston structure alternate with those of the other and the eight pistons alternate with the eight abutments of the rotor, the skirts of the abutments here lapping outwardly those of the pistons. Thus what I term an open space 20, because via the corresponding passage 12c of the rotor it communicates with the chamber 13 of the latter, exists between each piston and abutment whoses skirts lap each other; and between each piston and the other abutment next adjoining exists what I term a closed or explosion space 21. The explosion spaces, as will appear, have communication with the intake and exhaust; the open spaces have communication only with each other via the chamber 13, being prevented from communication with the intake and exhaust on passing the same by the overlapping skirts. The rings 7 coact with the piston structure annuli and the flange 12b of the rotor (all these parts being held in wiping contact with each other by the screws 9) to close off the interior of the cylinder from the atmosphere via slot 6. As shown in Figs. 1 and 3, the piston structure having the arm 17' is arranged with such arm projecting into, and thus having the bearing 17d of that piston structure in, the same plane as that occupied by the other piston structure.

Journaled in the bearings 11c of the rotor are crank shafts 22 parallel with the main shaft 10 and having cranks 22a at the same side of the rotor as the bearings 17d of the piston structures. Links 23 respectively link these cranks with the piston structures, each link having one end journaled on the crank and its other end equipped with a stud 23a journaled in the corresponding bearing 17d. The cavity 3a in the adjoining head 3 houses the links and portions of the piston structures. The other end of each crank has fast thereto a planet gear 24 and this meshes with a fixed annular sun gear 25 arranged in the cavity 3a of the other head.

There are diametrically opposite exhaust and intake ports 27 and 26, respectively, and at 28 are ignition devices, as spark plugs.

The gear ratio of the planet gears to the sun gear is as 4 to 1. The rotor rotates as per the arrow *a* in Fig. 1; the planet gears as per the arrows *b*.

Operation.—Of course, since the piston structures are connected with the rotor through the crankshafts and links, they partake of the rotation of the rotor, at the same time undergoing oscillation, to wit, in opposite directions. Thus, in Fig. 1, in view of the positions of the cranks 22a the near piston structure approximates its counter-clockwise limit and the far piston structure its clockwise limit. That is to say, as to the four explosion spaces 21 corresponding to the near piston structure, they are approximately reduced to their minima, whereas as to the four spaces corresponding to the far piston structure they are approximately extended to their maxima. (In the example, the left-hand crank 22a has not quite reached and the right-hand crank has somewhat passed dead center, wherefore the far piston structure has somewhat of a lead on the near one, which is not material here.) Thus as to the right and left spaces corresponding to the near piston structure the condition is approximately that for firing and as to the upper and lower spaces, exhaust being about completed, intake is about to occur; as to the right and left spaces corresponding to the far piston, they are about to begin exhaust and the upper and lower spaces about to begin compression of the charges which they have intaken.

Otherwise stated, the operation, at least generally, is the same as in my Patent No. 2,124,327. That is, in the rotation of the rotor and, with it, the planet gears relatively to the stator, the planet gears rotate on their own axes, and the links and piston-levers (in effect here constituted by the piston structures) oscillate—with consecuent expansion and contraction of the corresponding closed spaces of the cylinder—during each revolution of the rotor, to wit, expansion when any such space coincides with the intake to draw in a fresh fuel charge, contraction to compress the charge, which is fired at 28, expansion involving application of power through the piston lever, link and planet gear to effect the propulsion, and contraction to expel the spent fuel charge at the exhaust.

In the present instance, instead of relief for the pressure and suction developed in the open spaces 21 being afforded by the main or working space of the engine (which is the space between the heads 3 and surrounded by the cylinder), such relief is afforded by a relief chamber, as 13, existing in one of the parts which reach into the cylinder (to wit, rotor and piston structure, such part being here the rotor), which chamber is closed except for access to said open space. In said working space, wherein the rotor and piston structures have their motion, lubricant may be contained.

In order to contribute to compactness, the arrangement is such that the linking of the planet gears to the piston structures is at one side and the sun gear at the other side of the rotor; however, I do not wish to be limited to both linkings being at the same side.

Each of the parts comprising the rotor and the piston structures is characterized by a rigid annular portion (annulus 12b or 17a) with respect to which the abutments or pistons are in fixed relation, whereby to eliminate practically all centrifugal and angular displacement of such pistons or abutments.

The cylinder, necessarily having a continuous opening to admit the rotor and its abutments,

has such opening closed by these annuli of the rotor and piston structures, each opening developing as a slot 6 in view of the rings 7, in effect parts (non-rotative) of the stator, though here adjustable axially so as to seal the slot in effect hermetically.

Each piston structure is here characterized by an annulus having a lug 17e which is offset out of the plane of the annulus so as to overreach the annulus of the rotor.

It is not indispensable that the spoke of each piston structure have its ends 17x bent off so that the annulus is in a plane flanking that of such spoke, though such is desirable in order to obtain a chamber 13 of adequate capacity.

I do not wish to be limited to details set forth in the preceding description which are not specifically recited in the appended claims.

Having thus fully described my invention, what I claim is:

1. A rotary internal combustion engine including two elements one of which is rotary and one of which includes a cylinder formed annular and with an opening extending continuously around the main axis of the engine and the other of which is coaxial with and has an abutment in the cylinder, means coactive with the second-named element to close said opening and including a piston structure oscillatory coaxially with the cylinder and arranged at one side of the second-named element and having an abutment in the cylinder, the first-named element having a fixed gear at said side of said second-named element and also concentric with the cylinder, a rotary device journaled in and eccentrically of and having a pinion meshing with said gear at the first-named side and a crank at the other side of the second-named element, said second-named element having an eccentric aperture and the piston structure having a part thereof projecting through said aperture to said other side of the second-named element and freely oscillatory in the aperture, and a link at said other side of the second-named element connecting the crank and said part.

2. A rotary internal combustion engine including two elements one of which is rotary and one of which includes a cylinder formed annular and with an opening extending continuously around the main axis of the engine and the other of which is coaxial with and has an abutment in the cylinder, a piston structure oscillatory coaxially with and having a piston in the cylinder, and means, operatively connecting said elements, for oscillating the piston structure, the space in the cylinder at one side of the piston and between the latter and the abutment being an explosion space and the engine having means, consisting of annular portions of said piston structure and second-named element substantially concentric with the cylinder, for closing communication between said space and the exterior of the cylinder and which provides wholly within itself a passage affording relief for pressure and suction developed in the space in the cylinder at the opposite side of the piston.

3. A rotary internal combustion engine including two elements one of which is rotary and one of which includes a cylinder formed annular and with an opening extending continuously around the main axis of the engine and the other of which is coaxial with and has abutments in the cylinder and exterior of the cylinder and developed around and concentric with said axis a relatively thickened hollow portion forming a relief chamber, oscillatory piston structures coaxial with the cylinder and arranged at opposite sides of the second-named element and respectively having annuli surrounding said portion and coactive with the second-named element to close said opening and abutments on said annuli and in the cylinder and alternating with the first-named abutments, and means, operatively connecting said elements and connected to said piston structures, for oscillating the latter, the alternate spaces between the several abutments being explosion spaces and the second-named element having ports connecting said relief chamber respectively with the remaining spaces between the several abutments.

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