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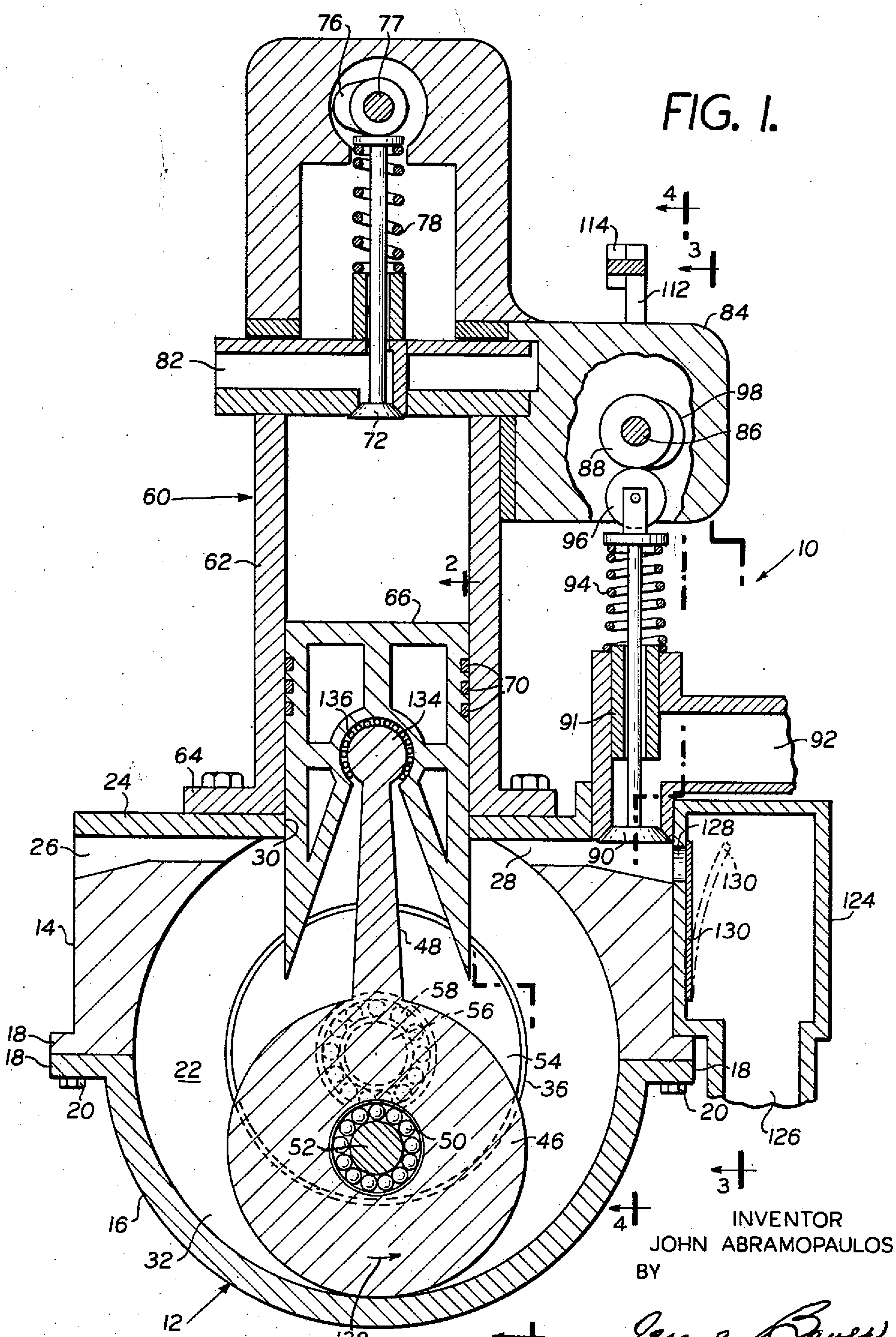
COMBINED POSITIVE DISPLACEMENT ENGINE AND POSITIVE DISPLACEMENT ROTARY COMPRESSOR APPARATUS

Filed Dec. 16, 1960 4 Sheets-Sheet 1

FIG. 1.



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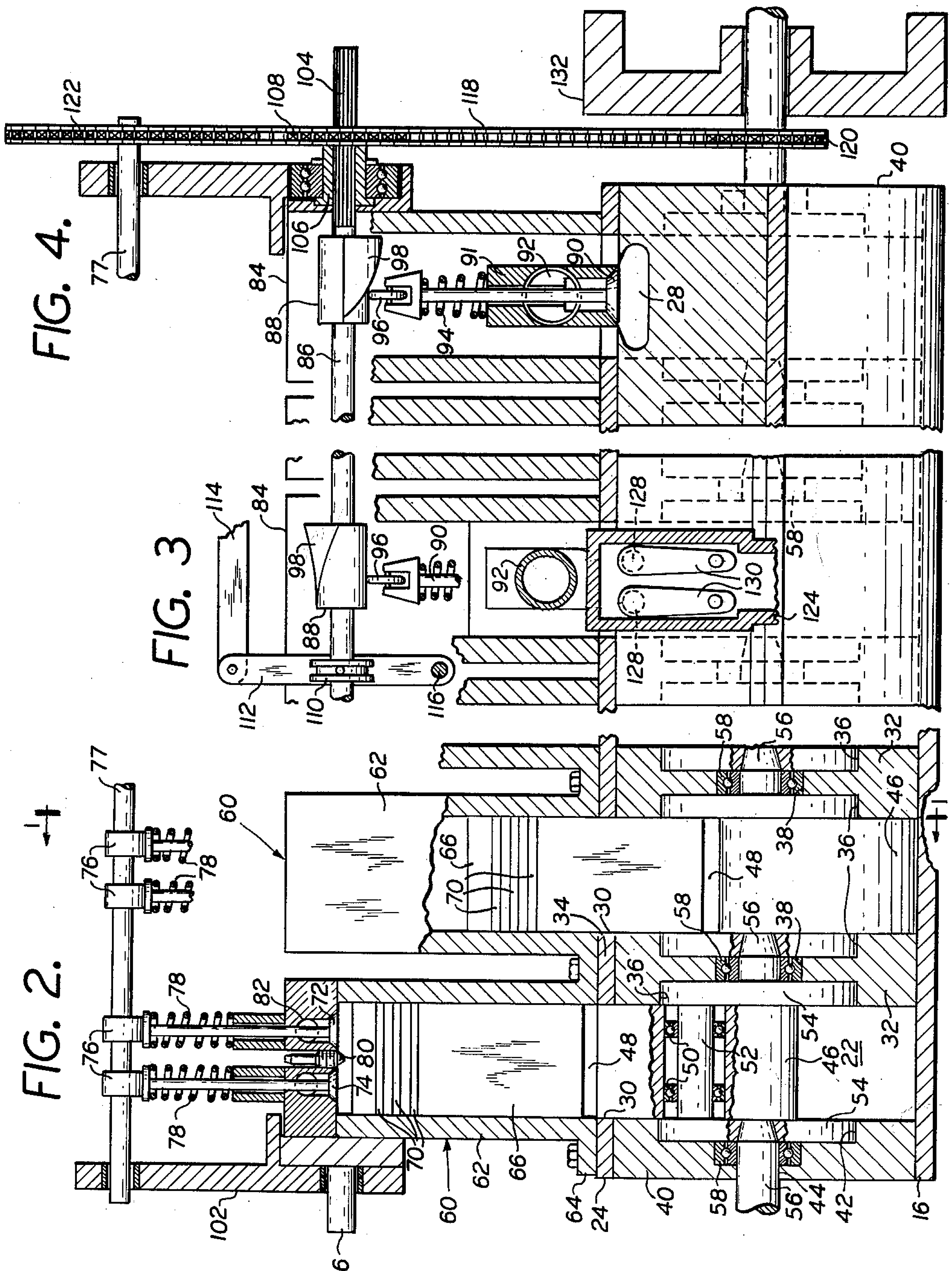

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Filed Dec. 16, 1960 4 Sheets-Sheet 3

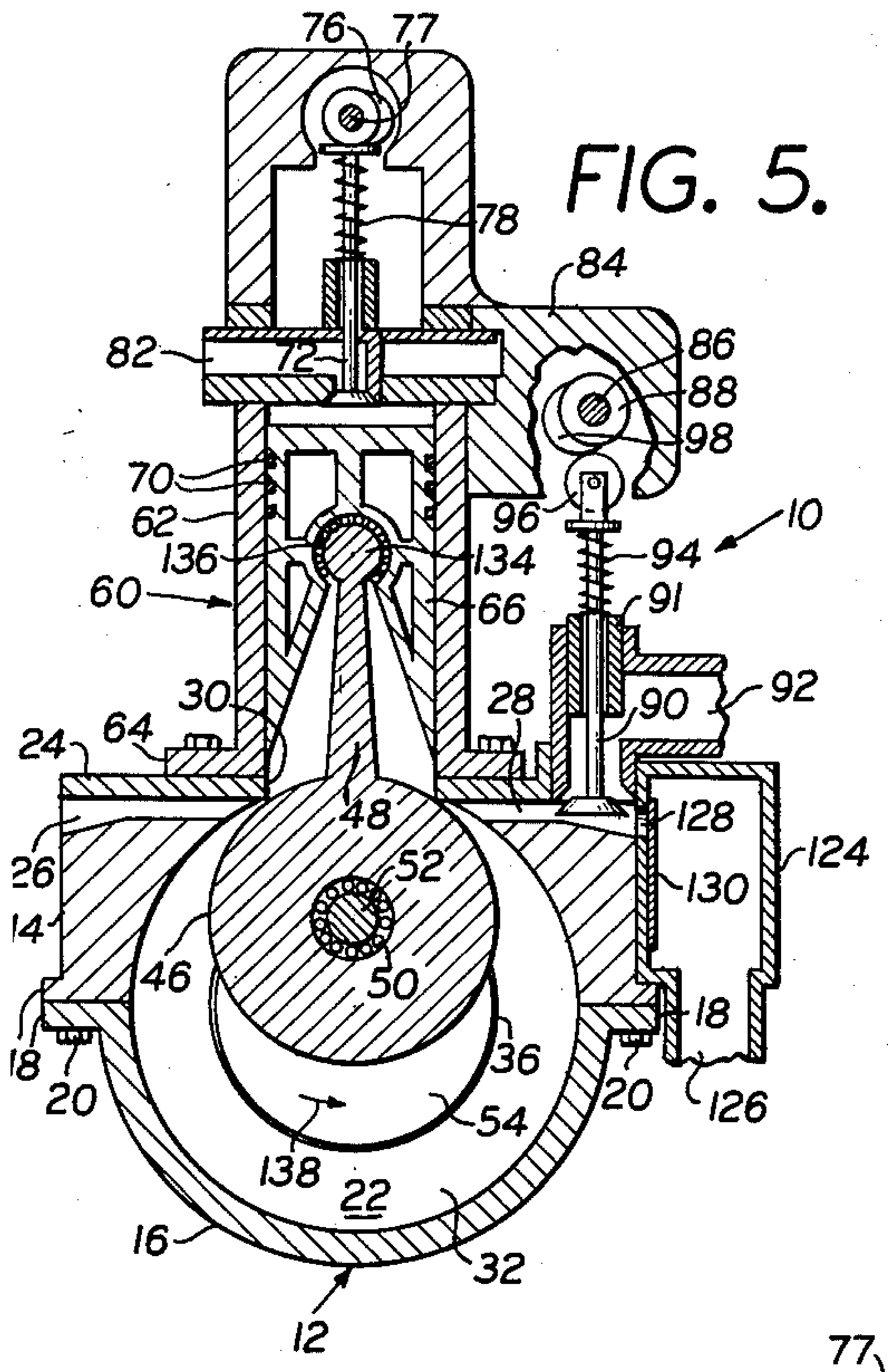

FIG. 5.

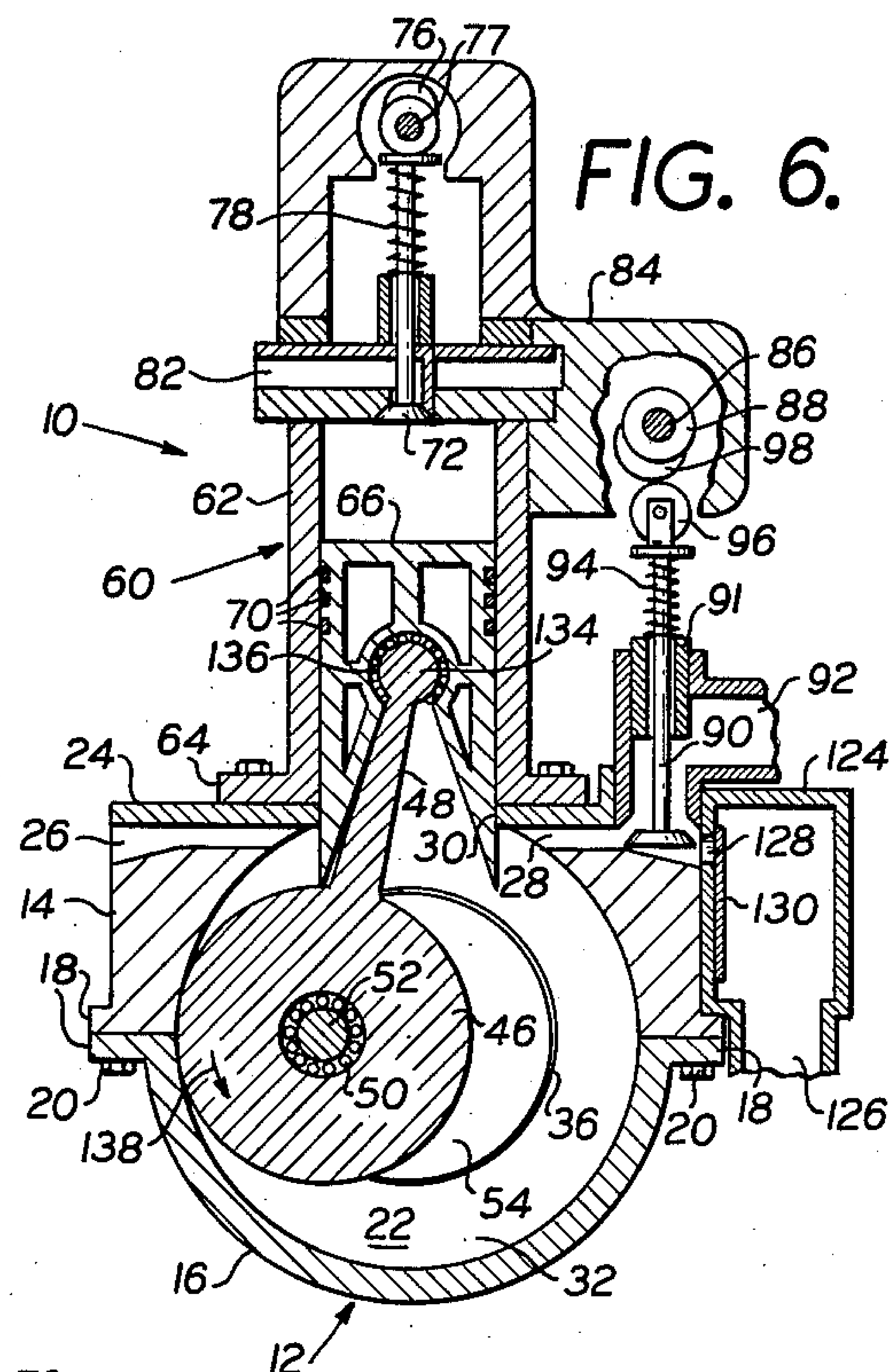

FIG. 6.

FIG. 7.

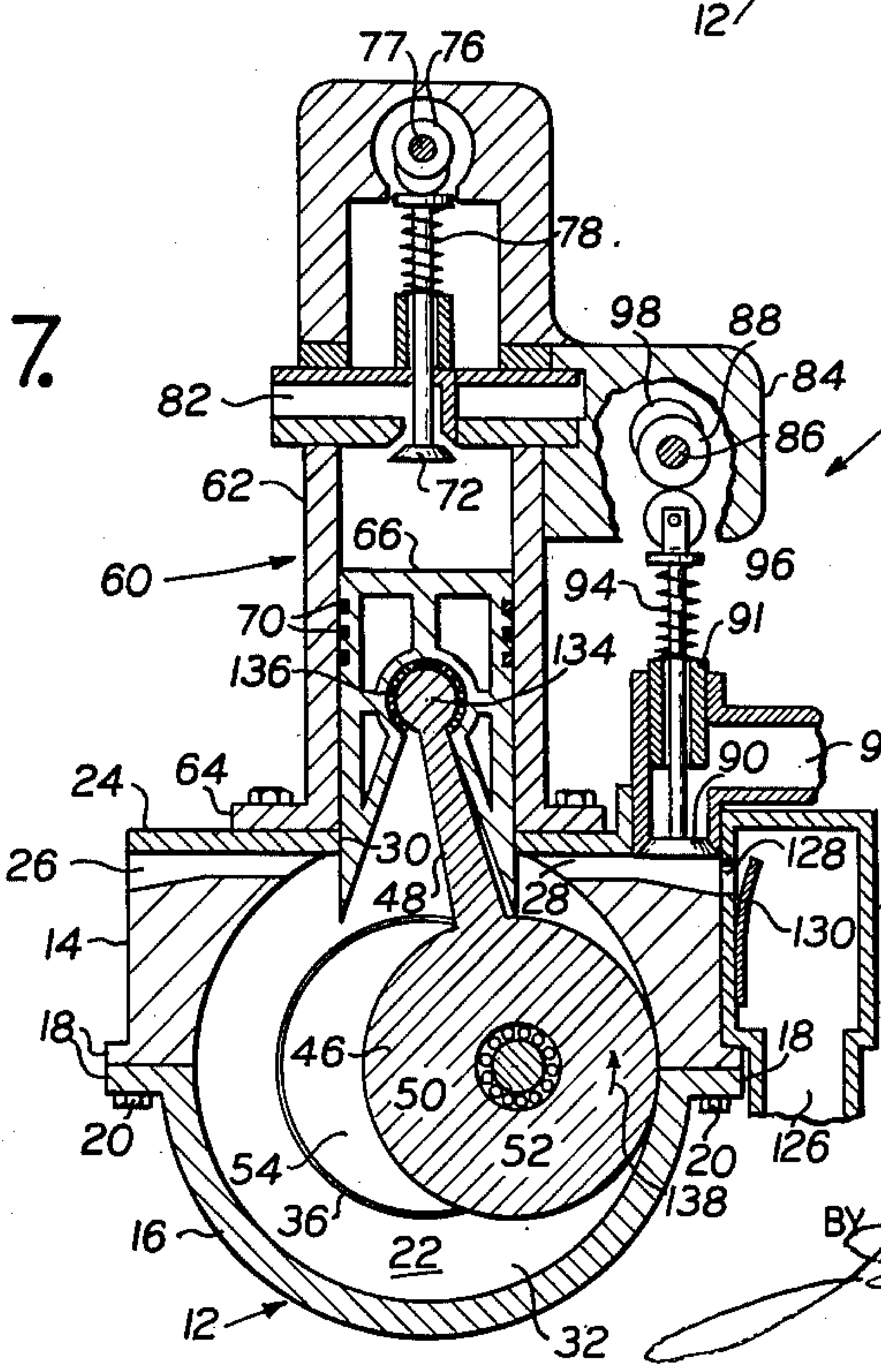

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FIG. 8.

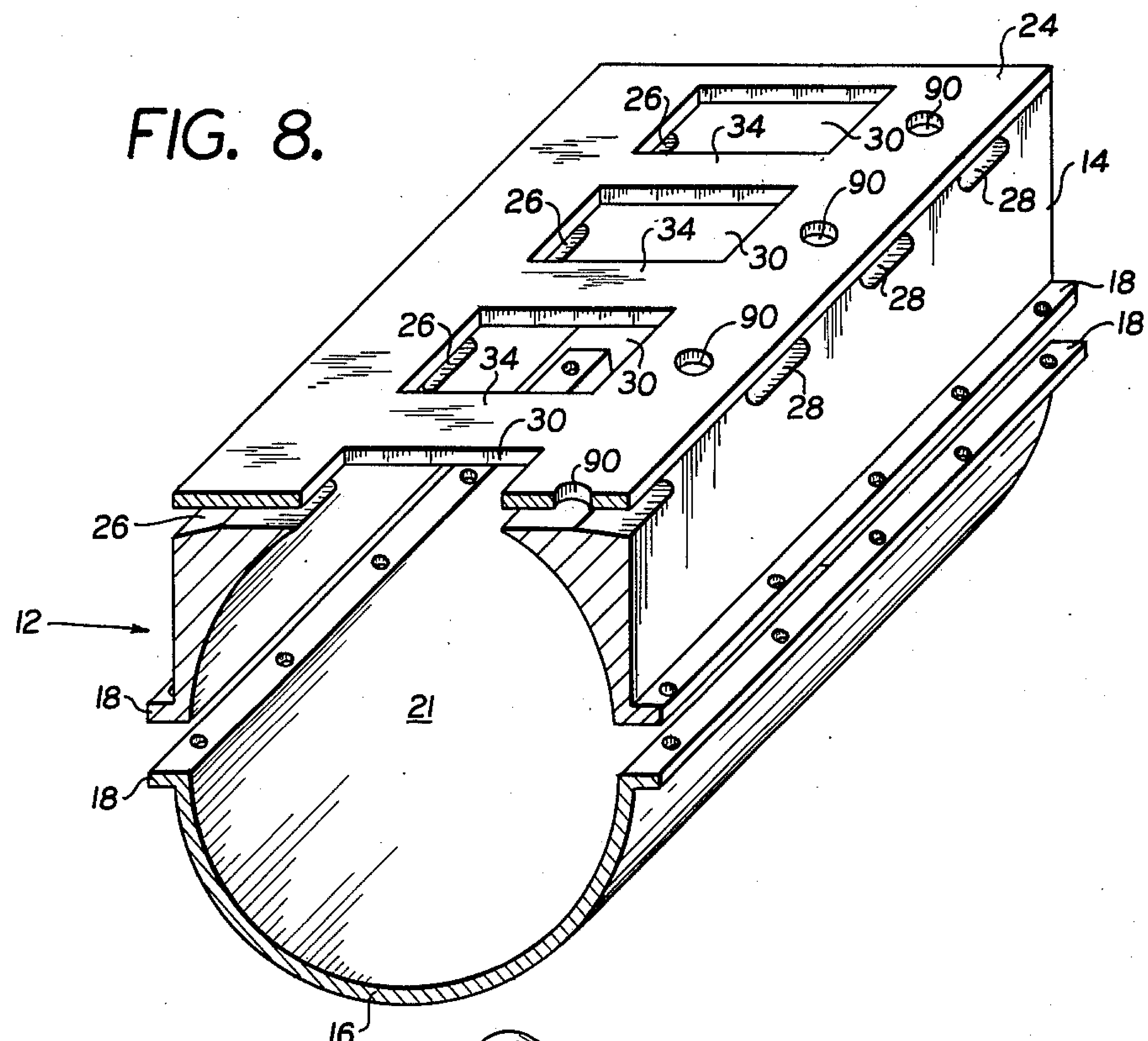


FIG. 9.

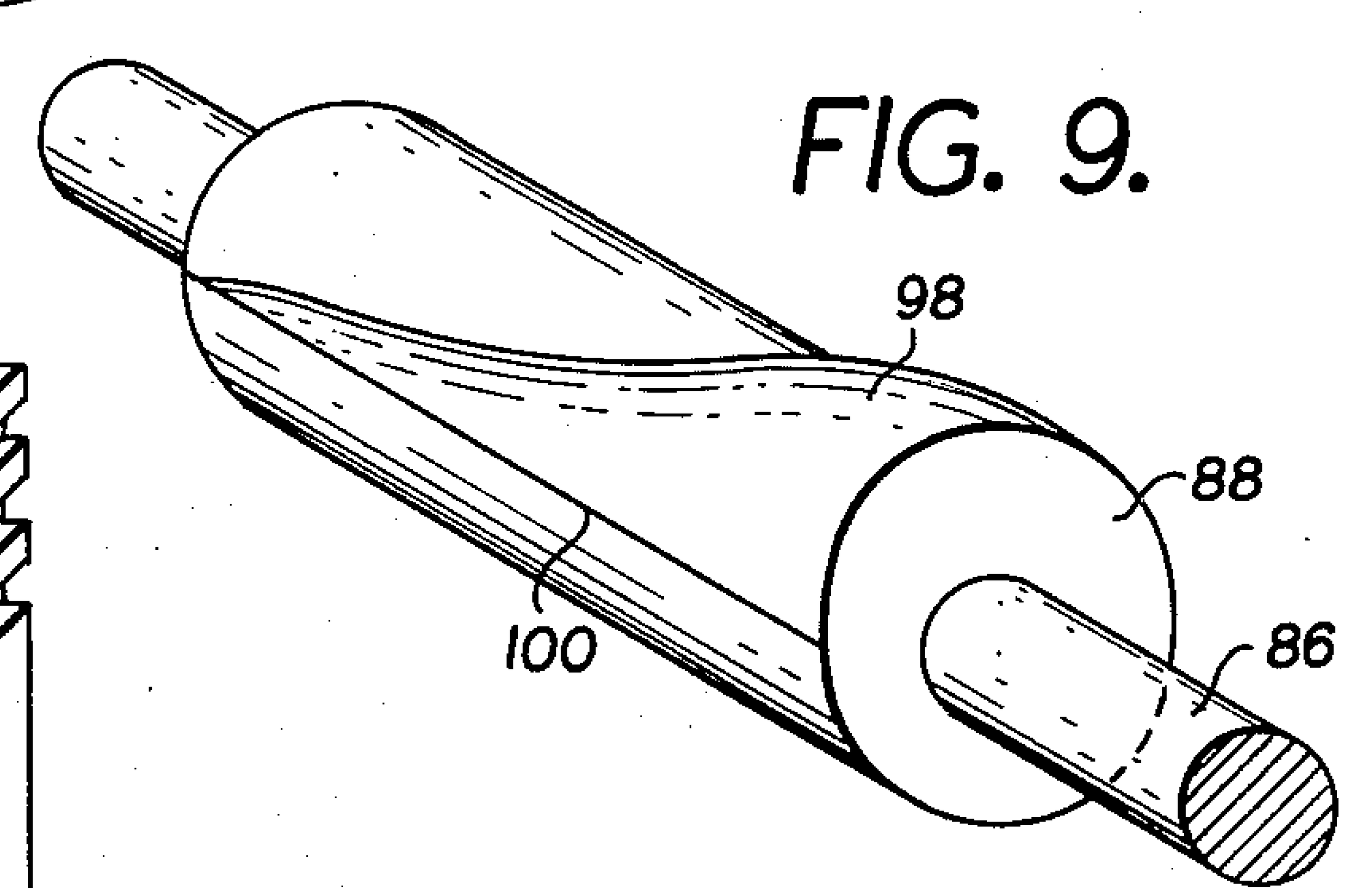
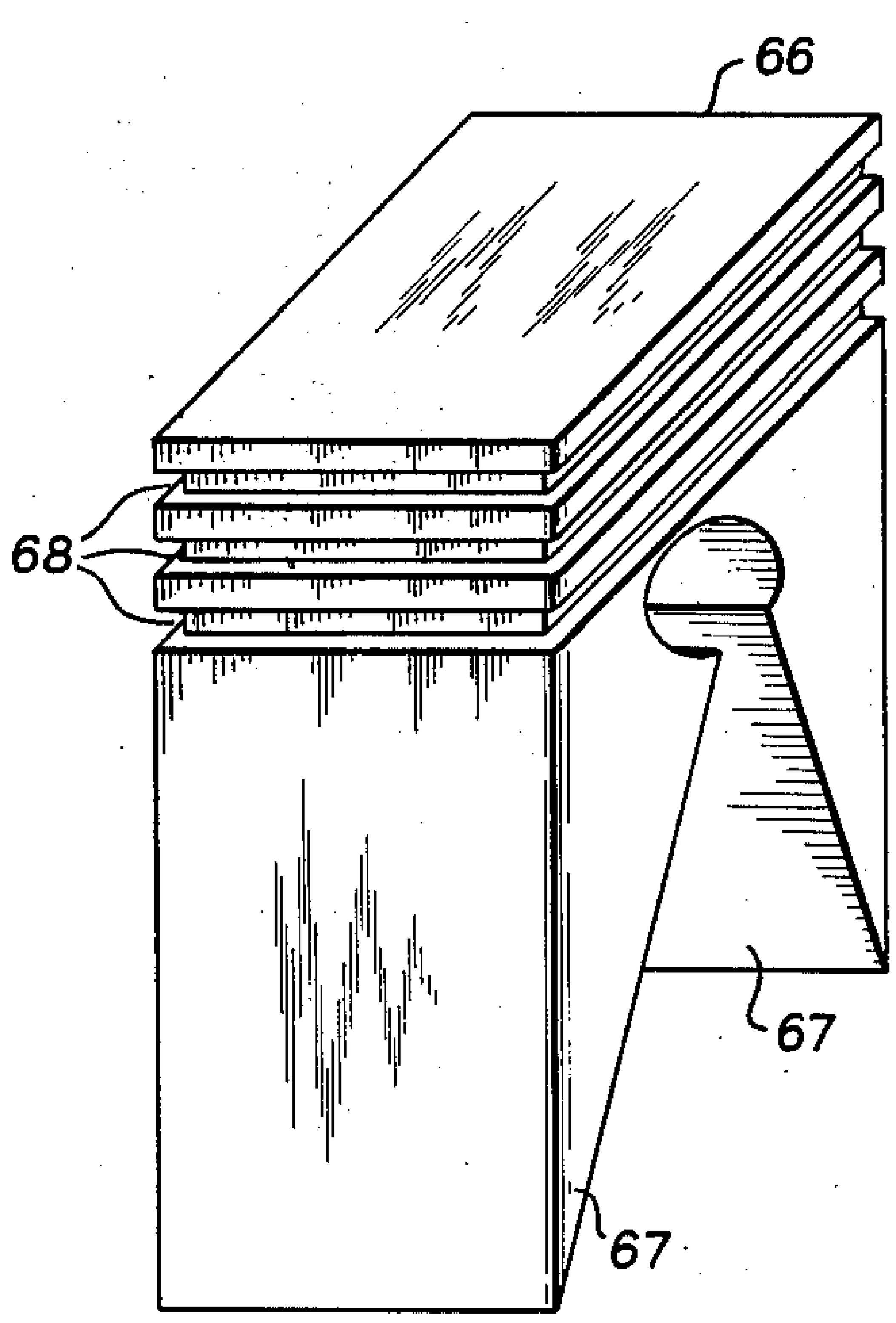


FIG. 10.



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COMBINED POSITIVE DISPLACEMENT ENGINE AND POSITIVE DISPLACEMENT ROTARY COMPRESSOR APPARATUS

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12 Claims. (Cl. 230—22)

This invention relates to the combination of a self-contained positive displacement engine and a positive displacement rotary fluid compressor apparatus.

The desideratum of this invention is to produce a controllable volume of compressed fluid for the specific purpose of utilizing such fluid for the performance of work.

Accordingly, an object of the invention is to provide an engine having a positively displaceable piston, the movement of which is transmitted to a fluid compression structure for moving a predetermined volume of fluid to be utilized for the performance of work.

Another object of the invention resides in combining a unique self-contained positive displacement engine with a positive displacement rotary fluid compressor whereby the displacement of the engine piston and the movement thereof is transmitted to the fluid compressor for operating the same. To this end novel and unique features of the invention and objects thereof reside in the use of an engine combustion structure having a combustion chamber and a piston displaceable therein both of which have corresponding straight-sided walls and a fluid compression structure including a fluid compression member connected with the piston to move fluid from a fluid supply to a fluid exhaust where the same may be directed for performing work.

Still another object and feature of the invention is to enable the control of the volume and pressure of the fluid to be employed for work performing purposes. In this connection, a unique arrangement of valves and operating structures is provided to facilitate the intricate control of the fluid.

Still a further object is to provide a single self-contained combination engine and fluid compressor that is light in weight, simple in construction and convenient in operation to produce a predetermined volume of fluid of predetermined pressure which can be utilized for the performance of work and in which the volume and pressure of the work performing fluid can be intricately controlled and varied.

Other and further objects of my invention reside in the structures and arrangements hereinafter more fully described with reference to the accompanying drawings in which:

FIG. 1 is a vertical cross-section of a single unit of the combined engine-compressor apparatus constructed in accordance with the teaching of the invention and as taken along lines 1—1 of FIG. 2,

FIG. 2 is a partial cross-section taken along lines 2—2 of FIG. 1 and illustrating a multiple cylinder construction,

FIG. 3 is a partial cross-section of FIG. 1 taken substantially along lines 3—3,

FIG. 4 is a partial cross-section of FIG. 1 taken along lines 4—4,

FIGS. 5, 6 and 7 are views of the inventive apparatus similar to FIG. 1 on a reduced scale showing the parts

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thereof in different positions during the cyclic operation,

FIG. 8 is a partial perspective view of the compressor housing on a reduced scale,

FIG. 9 is a perspective view of the adjustable cam, and

FIG. 10 is a perspective view of the displaceable piston head.

Referring now to the drawings, the inventive combined engine and compressor apparatus is generally identified by the numeral **10**. Apparatus **10** comprises the combination of interconnected combustion and compression structures, neither of which is numbered at this time and which will be more fully described as the description proceeds.

For purposes of illustration, reference is made to FIG. 8 wherein a partial view of the compressor housing, generally identified by the numeral **12**, is shown. The compressor housing **12** is materially reduced in scale and illustrates the over-all construction utilized wherein the apparatus **10** comprises a multiplicity of operating combustion chambers. As the description proceeds, those skilled in the art will readily recognize that the present invention is not limited to a multiple combustion chamber construction but is equally adaptable to a single or one combustion chamber engine type construction. The illustration of a multiple combustion chamber engine type construction is presented in the present description for purposes of explanation and solely for ease of understanding and is, therefore, not to be deemed to constitute a limitation upon the scope of the invention, it being immaterial whether the engine be in-line or opposed or operable on the two or four cycle principle.

The over-all compressor housing **12** is of two-part construction comprising an upper housing part **14** and a lower housing part **16**, both of which have laterally complementary disposed flanges **18** on the opposite sides thereof that are adapted to be secured together in any convenient manner as by the use of bolts or other suitable securing means **20**. When the upper and lower part housings **14** and **16** are secured together at their respective flanges, they define a hollow internal chamber **21** (FIG. 8) that is substantially circular in cross-section. The top of the compression chamber is closed or capped by a cover member **24** that may be formed as an integral part of the upper part of the housing **14** or separately therefrom as shown in the drawings.

Communicating with the over-all internal chamber **21** are a plurality of fluid inlet passages **26** positioned at one side thereof and a like or corresponding plurality of fluid exhaust passages or outlets **28** at the other side thereof. It is to be noted in FIG. 8 that the compressor housing **12** there shown is utilized as a single unit to house or contain a multiplicity or a plurality of compressor structures to be described, each of which is to be equally positioned along the length and at predetermined portions thereof and including a corresponding set of the fluid inlets and outlets **26** and **28** respectively. In like manner, the cover member **24** is provided with a plurality of openings or apertures **30** each of which is adapted to accommodate for reciprocation therethrough, a positively displaceable member of the combustion structure in a manner to be described. Thus, for each laterally aligned set of fluid inlet and outlet passages or openings **26** and **28** respectively, there is a piston accommodating aperture **30**. The manner of dividing the elongated chamber **21** of FIG. 8 into a plurality of compression chambers for each one of the plurality of operating units will now be described.

The length of the single chamber 21 shown in FIG. 8 is divided into a plurality of separate compression cahmbers 22 by the insertion or inclusion of intermediate partitions 32 each of which is positioned within the housing 21 in alignment with the separator bodies 34 of the cover 24. Each of the partitions 32, better seen in FIGS. 2, 3 and 4, is circular and includes large circular undercuts 36 defined in their opposite surfaces and a central through bearing opening 38. The partitions 32 are secured in their designated places along the length of and within the compression housing 21 of FIG. 8 by any convenient means, as bolts and the added securement of the flanges 18 of the upper and lower parts 14 and 16. The end-most portions of the compressor housing 12 are capped and closed by end partitions 40. Each end partition 40, having a circular undercut 42 in its one surface, and a central bearing opening 44, is secured in place to close the ends of the compression chamber 21 also by any convenient means, as bolts and the added securement of the flanges 18.

Contained within each of the separated compression chambers 22 formed by the partitions 32 is a respective compression means in the form of a substantially circular compression member 46. The member 46 is materially smaller in diameter than the circular extent or diameter of the compression chamber 22 and includes as an integral part thereof, a vane 48. Both the compression member 46 and the vane 48 are of the same length which closely approximates the longitudinal space between the respective intermediate partitions 32 and/or the end partitions 40. Thus, when each compression member 46 moves within its respective compression chamber 22 between its partition walls 40 and 32 or between adjacent sets of intermediate or inner partition walls 32, it will fully occupy the length of their respective compression chamber. To reduce and attempt to eliminate the possibility of fluid bypassing between the facing surfaces of the compression member 46 and the adjacent partition member, clearance is held to a minimum between these surfaces.

Each compression member 46 is bearingly mounted at 50 on a crank pin 52 secured at its opposite ends to a small flywheel 54. Each small flywheel 54 is mounted to rotate within the undercut 42 or 36 of the end partition 40 or 32, as the case may be, for rotation therein. The flywheels 54 are circular and closely fit for rotation in their respective undercuts while the connecting crank pin 52 is mounted eccentrically on its oppositely disposed flywheels and, therefore, when the compression member 46 moves, it rotates eccentrically within its compression housing 22. Each flywheel 54 has a projecting spindle pin 56 that is conveniently frictionally connected and keyed or suitably bolted with the next adjacent flywheel in the next compression chamber 22 and is bearingly mounted for frictionless rotation at 58 in either the end partition 40 or the intermediate partitions 32, as the case may be. The combination of flywheels 54 linked by their crank pins 52 and connected with a next adjacent set of flywheels by the spindle pins 56 define a crankshaft which may be likened in appearance to that of any well-known engine.

Mounted on the cover 24 is the combustion structure generally identified by the numeral 60. The combustion structure 60 includes a combustion housing 62, one for each of the compression structures aforedescribed. Each combustion structure 60 is mounted, at a flange 64 formed integral therewith, on the top of the cover 24 in aligned position over a respective one of the apertures 30 defined therein. Like the apertures 30, each combustion housing 62 has a plurality of straight-sided interior walls which terminate in alignment with the defining walls of their respective apertures 30.

A piston 66, shown in greater detail in FIG. 10, is mounted for positive reciprocating displacement within its respective straight-sided combustion chamber defined by the combustion housing 62. The piston 66 is also formed with a plurality of straight sides each one of which coincides with a respective straight-sided wall of the housing 62 that forms the combustion chamber within which the piston is adapted to move. Each of the straight-sided walls of the piston contains a plurality of longitudinally spaced notches 68 (FIG. 10) in which a piston sealing strip 70 is mounted. The piston sealing strips 70 are biased by springs (not shown) along the corresponding surfaces of the combustion chamber and thereby serve to adequately prevent the bypass of gases expanding in the combustion chamber from moving between the walls of the piston 66 and the combustion housing 62 downward into the compression chamber 22 therebeneath.

Thus, the piston 66 serves to separate the compression chamber from the combustion chamber and permits each to perform its intended function independently of the other and during periods of movement of the piston, the same does move partially into the area of the compression chamber 22 as may be seen in FIGS. 1, 6 and 7. The piston 66 is further provided with downwardly directed tapered fins 67 that aid in dissipating the heat of combustion therefrom during the operation of the apparatus.

Those skilled in the art will recognize that the details of construction of the combustion structure 60 may be likened to that of any positive displacement gas-operated or diesel engine having a fuel inlet valve 72 and a fuel exhaust valve 74 (FIG. 2) each of which is operated by conventional overhead cams 76 mounted on a camshaft 77 and spring returns 78. A fuel ignition means in the form of a spark plug 80 also extends into the combustion chamber for predetermined timed ignition of the fuel introduced thereinto by way of a fuel conduit 82.

Supported for rotation in a boss 84 affixed to the side of each of the combustion housings 62 is an adjustment shaft 86. Shaft 86 extends for the full length of the compressor housing 12 (FIG. 8) and has a plurality of adjustment cams 88 each of which is positioned for cooperation with a respective one of a plurality of shunt or spill valves 90. Each valve 90 has its head located to open into communication with a respective one of the fluid exhaust or outlet passages 28 of a respective one of the separated or partitioned compression chambers 22. The shunt valve 90 is guided in sleeve 91 for vertical movement to open a communicating passageway between the fluid outlet passage 28 and a shunt passageway 92 in response to the operation or adjustment of its respective adjustment cam 88. However, valve 90 is normally urged to its closed position by a spring 94 and has a substantially frictionless roller-bearing member 96 mounted at the top thereof for continuous rolling engaging cooperation with its respective adjustment cam 88.

The details of the adjustment cam 88 are more fully illustrated in FIG. 9. Each of the cams 88 is exactly alike in detail being substantially cylindrical in form and elongated in length, provided with a rising cam surface 98 that extends for substantially the full length thereof. The cam surface 98 starts at its one end (left-hand) with a rise of 0° whereby its engagement with the valve roller 96 will fail to unseat or open the valve 90 and gradually increases to a maximum rise which is sufficient to actuate the valve member 90 into its fully open position to provide complete communication between the fluid outlet 28 and the shunt passageway 92.

The arcuate extent of the cam surface 98 also varies in proportion with the height or extent of rise thereof. Thus, at the left-hand end of the cam surface 98 wherein the same begins its rise from 0°, the arcuate period of rise is measurably shorter than that of the right-hand end of the adjustment cam 88 wherein the maximum rise extends for approximately 180° of the diameter of the cam 88. The shape of the cam surface 88 is, therefore, substantially helical beginning from a reference line 100 along the length thereof. It will be understood that axial movement and adjustment of the adjustment shaft 86 will permit the predetermined positioning of a portion of the cam surface 98 for cooperation with the engaging roller member 96 of the valve 90 thereby permitting the intricate control of the extent of which the valve member will be opened and the period of time which the same will be retained open during the rotation of the shaft.

To facilitate the movement of the adjustment cams 88, the adjustment shaft 86 on which each of them is mounted, is guided at its one end (left-hand) in a standard 102 that also serves to support the cam shaft 77. The other end of the shaft 86 is splined at 104 and guided for axial movement on a similarly splined bushing 106 which includes a sprocket or gear 108. The axial movement of the adjustment shaft 86 is accomplished by actuating a grooved bearing member 110 that is secured for axial movement with the shaft 86, but permitting rotation relative thereto. Positioned about the bearing member 110 is a conventional yoke 112 having an actuator arm 114 and pivoted at its lower end 116.

Manual movement of the arm 114 will be transmitted by way of the yoke 112 to the bearing member 110 and then to the shaft 86 which slides at its opposite ends relative to its supports. However, during such axial movement, the splined end 104 cooperating with the splined bushing 106 is continously rotated by the sprocket 108 connected by chain 118 in driving relationship with a compression crankshaft sprocket 120. The chain 118 also serves to join the cam shaft sprocket 122 with the adjustment shaft sprocket 108 and the compression crankshaft sprocket 120 for simultaneous rotation. By using sprockets of different sizes, the rotation of the respective shafts may be intricately connected in a predetermined speed relationship.

Mounted on the compression housing 12 juxtaposed the fluid outlet passage 28 is an air receiver housing 124 having a chamber and conduit 126 into which fluid compressed in the chamber 22 is permitted to exhaust and to be ducted at 126 for the performance of useful work. The chamber of the air receiver 124 communicates with the fluid outlet passage 28 at communicating openings 128 which are normally closed by leaf-spring valve means 130.

The operation of the multiple combustion structures 60 of the present invention is the same as in any conventional multi-cylinder engine. Any conventional electrical distributor (not shown) may control the firing of the spark plugs 80 while the fuel intake and exhaust valves 72 and 74 operate in timed relationship with the firing or burning of the fuel in their respective combustion chambers. The compression crankshaft including the spindle pins 56, the compression mounting pins 52 joining the intermediate small flywheels 54, all being integrally connected as shown in the drawing function in the manner of a conventional engine crankshaft. In addition to the small intermediate flywheels 54, a main flywheel 132 (FIG. 4) also is connected with the compression crankshaft.

Thus, upon initial firing and combustion of the fuel in a single combustion chamber, the compression crankshaft, including the flywheels 54 and the main flywheel 132, will be rotated by virtue of the connection of the compression member 46 with the piston 66 at the enlarged end 134 bearingly mounted at 136. The positive downward displacement of the piston 66 in response to the combustion of the fuel in the combustion chamber of the housing 62 is transmitted by way of the connecting vane 48 to the compression member 46 mounted on the crank pin 52 for eccentric rotation in the chamber 22. The reciprocating movement of the positively displaceable piston member 66 is then transmitted to rotate or cause the rotation of the compression member 46.

If it is assumed that the firing or combustion of the fuel occurs substantially during a period of operation when the piston 66 and compression member 46 have just passed beyond their approximate top dead-center positions of FIG. 5, the downward displacement of the piston 66 will cause the compression member 46 to rotate eccentrically in the direction of the arrow 138. However, when the compression member 46 is in its inactive position between the fluid inlet 26 and outlet 28 as shown in FIG. 5, the chamber 22 is substantially filled with fluid because of its complete communication with a source or supply of fluid at the inlet passage 26. As the piston 66 is displaced from its top dead-center position and reciprocating downward substantially into a position as shown in FIG. 6, the compression device comprising the member 46 and vane 48 divide the compression chamber 22 into a plurality of parts. Initially, the first smaller and gradually increasing part is created behind the compression member 46 and its vane 48 in the area of communication with the inlet 26, this may be referred to as the suction compartment. The divided part of the chamber in front of the rotating compression member 46 and vane 48 becomes the fluid compression compartment.

Quite obviously, as the compression member 46 and its vane 48 continue to rotate eccentrically within the chamber 22, the suction compartment and the compression compartment vary in size. The suction compartment becomes progressively larger and thereby draws fluid into the same by way of the inlet 26 while the compression compartment becomes progressively smaller and a pressure is applied to the fluid therein to force the same out of the compartment by way of the outlet passage 28. The compression member 46 and its vane 48 continue to rotate eccentrically even after the piston 66 has reached its bottom dead-center position as shown in FIG. 1 because of the momentum of the member 48 and the rotary moment of force stored in the intermediate flywheels 54 and in the main flywheel 132. Hence, the continued rotation of the flywheels in releasing their stored rotary moments of force continue to rotate the compression member 46 and its vane 48 beyond the bottom dead-center position as shown in FIG. 1, upward again toward its position as shown in FIG. 7, and back again to and beyond that shown in FIG. 5.

During the fluid compression stroke of the member 46 and its vane 48 as illustrated in the sequence shown in FIGS. 6, 1 and 7, the fluid in chamber 22 is compressed in the rapidly decreasing compression compartment formed forward of the compression member 46 and its vane 48 and is forced outward of the compression compartment 22 by way of the communicating outlet passage 28. The fluid outlet passage 28 terminates in communication with the air receiver openings 128 which are normally closed by the one-way operating valve means 130 that prevents the reverse flow of fluid from therebeyond into the compression chamber. Although the valve means 130 are here shown in the form of leaf-springs each closing a respective one of the communicating openings 128, any other convenient communication and one-way operating valve structure could be utilized to close the exhaust of fluid from passageway 28 into the air receiver 124 under normal conditions and to permit the fluid to exhaust from the passageway into the air receiver when the pressure of the fluid in the passage 28 and in the compression chamber 22 reaches a predetermined amount.

FIG. 1 illustrates the normal position of the valve means 130 in solid lines and its open position in dot-dash lines while FIG. 7 illustrates the valve means in fully open position when the fluid pressure in the passage 28 and chamber 22 is sufficient to open the same. Interposed in the fluid outlet passage 28 prior to the location of the exhaust valve means 130 is the shunt valve 90. As previously noted, the shunt valve 90 is operated by its respective adjustment cam 88 that is connected at the adjustment shaft 86, sprocket 108, chain 118 and sprocket 120 for predetermined timed rotation with the compression member 46 and its respective vane 48 so that the same may be opened a predetermined amount and for a predetermined period during the fluid compression stroke being performed in the compression structure.

The adjustment shaft 86 may be slidingly moved longitudinally along the splined surfaces 104 and 106 by actuating the arm 114 and yoke 112 to position a higher or lower rise portion of the cam surface 98 for rotative engagement with the roller means 96 on the valve 90 to provide for a longer or shorter period of lift of the valve. In this way, the volume of compressed fluid passing from chamber 22 by way of the outlet passage 28 into the air receiver 124 can be controlled by spilling or shunting some of the same to the shunt passageway 92. If it is desired to reduce the volume of compressed fluid moving into the air receiver 124 from the compression chamber 22, the adjustment shaft 86 may be moved to the left (FIGS. 3 and 4) to position a higher rise portion of the cam surfaces 98 for a longer period of lift engagement with their respective roller members 96 to open their respective shunt valves to any desired amount and for a specific period of operation during the compression stroke being performed by the compression member 46 and its vane 48. Consequently, any desired volume of fluid may be shunted into the shunt passageway 92 and prevented from movement into the air receiver 124. The pressurized fluid permitted to enter the air receiver 124 may be conveniently conveyed by the conduit 126 to any work performing structure, as pneumatic motors or to helicopter rotor blades that are driven by the reaction of ejected fluid while the fluid shunted to the passageway 92 is discharged into the atmosphere prior to the compression of the fluid in the chamber 22 and before power is absorbed in compressing an undesired volume of fluid.

Although the illustrations in FIGS. 3 and 4 are intended to be taken of the same portion of the present apparatus 10, it will be noted that the position of the adjustment cams 88 of each of these figures is disposed 180° arcuately relative to the other. This arcuate out-of-phase relationship of the adjustment cams is for purposes of illustration only. When the apparatus 10 comprises a plurality or a multiplicity of combustion chambers, the pistons 66 in each of the combustion chambers will move through their cycles out-of-phase with respect to each other to result in a smooth running engine. In like manner, each compression member 46, actuated by its respective piston 66, will also be rotated to perform its compression stroke out-of-phase with respect to the compression member of the next adjacent compression structure and further because each compression member in the apparatus 10 is mounted on its respective crank pin 52.

However, if, under certain conditions of operation, it is desired to spill more fluid, the cam surface 98 may be designed to retain the shunt valve open even after the compression member and its vane have moved beyond the position of FIG. 1. The shunt valve controls the volume of fluid to be compressed in the chamber 22. It does this by spilling or shunting some of the fluid from the chamber during the early part of the compression stroke thereby reducing the amount of power that may be required and wasted in compressing an unnecessary volume of fluid. Consequently, the major portion of the compression stroke occurs after the shunt valve is closed and the volume of fluid remaining in the chamber 22 is substantially that required to perform the desired work thereby permitting a more efficient operating construction.

Because each of the compression structures performs its compression strokes out-of-phase with respect to the other, its respective adjustment cams 88 must similarly be positioned on the adjustment shaft 86 in the same predetermined out-of-phase relationship. FIGS. 3 and 4, showing two different adjustment cams 88 of different engine cylinders serve to adequately illustrate how the same may be arranged in out-of-phase relationship for

rotation on the same adjustment shaft 86 in order to actuate their respective shunt valves 90 during a portion of the earlier 180° period of operation of their respective compression structures.

It will be noted that the present invention does not require valve structures at the fluid inlet passageways 26 thereby permitting unrestricted flow of fluid to the compressor chamber when the same is divided into suction and compression compartments during the cylindrical operation of the compression member 46 and its vane 48. Thus, the volumetric efficiency of the compression structure is increased. If desired, the normal power of the instant apparatus can be increased by utilizing the heat of the exhaust gases of the power combustion chamber to heat the compressed fluid in the air receiver 124 and thereby increase or raise its energy level.

The engine or combustion structure 60 of the present invention may operate in the same manner as any normal or well-known engine. Its speed of operation may be maintained steady for any given volume of fluid to be moved in the compression structure by maintaining a constant carburetor throttle setting. The volume of fluid to be moved or acted upon in the compression structure is controlled by the number of revolutions which the compression member 46 and its vane 48 perform. The shunt valve mechanism 90 permits the spilling or unloading of any predetermined volume of fluid from the compression chamber during the compression stroke. Hence, opening the valve 90 at a predetermined time during the first part of the compression cycle results in lowering the volumetric capacity of the compression structure by spilling or shunting some of the fluid before it can operate the valve means 130 and thereby enables a reduction in the power required to drive the compressor structure at any given r.p.m. Accordingly, there is a resultant increase in the pressure of the compressed fluid for a given carburetor throttle setting permitting the production of higher fluid pressures in the compression compartment and eventually in the air receiver 124 to be ducted at 126 to the work performing structure than when the valve 90 is closed.

The term "fluid" here employed is not to be deemed limiting on the scope of the invention. It is within the contemplation of this invention that fluid in the form of liquids or gases or combinations thereof may be employed with equal facility.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

I claim:

1. In a combined positive displacement engine and compressor, a combustion chamber having a piston movable therein in response to combustion in said chamber, a compression chamber, fluid inlet and outlet means communicating with said compression chamber, compression means directly linearly connected with said piston and movable thereby to compress the fluid in said compression chamber, valve means operable in response to a predetermined fluid pressure to permit the exhaust thereof from said compression chamber, and shunt valve means connected with said compression means for coordinated operation therewith to exhaust fluid from said compression chamber prior to said valve means.

2. In a combined positive displacement engine and compressor, a compression chamber having a fluid inlet and a fluid outlet passage, valve means closing the flow of fluid from said fluid outlet passage and operable in response to a predetermined fluid pressure in said chamber to permit the exhaust of said fluid through said passage from said chamber, shunt means normally closed and se-

lectively operable in said outlet passage to exhaust fluid from said chamber prior to said valve means, compression means movable in said chamber to variably divide the same into a plurality of compartments and compressing the fluid in one of said compartments, said shunt means being connected with said compression means for coordinated operation therewith, and a combustion structure having positive displacement means directly linearly connected with said compression means to move the same.

3. In a combined positive displacement engine and compressor, a combustion chamber, a compression chamber separated from fluid communication with said combustion chamber, piston means movable in said combustion chamber in response to combustion therein, fluid inlet and outlet passages communicating with said compression chamber, one-way valve means normally closing said outlet passage to prevent the movement of fluid therethrough and from said compression chamber and operable to open said outlet passage to permit the movement of fluid therethrough directly from said compression chamber and from said engine in response to a predetermined fluid pressure thereon, means dividing said compression chamber and being directly connected with said piston to move fluid in said compression chamber from said inlet to said outlet under pressure, and a shunt valve connected with said compression chamber and coordinated for operation therewith to selectively exhaust fluid therefrom prior to said one-way valve means.

4. In a combined positive displacement engine and compressor as in claim 3, a fluid exhaust opening communicating with said outlet passage prior to said one-way valve means, said shunt valve normally closing said opening, means operable to open said shunt valve in predetermined timed relationship with the movement of said fluid moving means, and means to vary the opening of said shunt valve.

5. In a combined positive displacement engine and compressor, a non-circular combustion chamber having a plurality of straight-sided walls, a non-circular piston having a plurality of straight-sided walls coresponding to respective ones of said chamber walls for movement relative thereto, a compression chamber having a substantially circular cross section, fluid inlet and outlet passages communicating with said compression chamber, fluid compression means dividing said compression chamber and connected directly with said piston and movable in said compression chamber in response to the movement of said piston to move fluid from said inlet passage to said outlet passage, valve means normally closing said outlet passage and operable in response to a predetermined fluid pressure thereon to permit the exhaust of fluid therethrough from said compression chamber, and a shunt valve connected with said fluid compression means for coordinated operation therewith to exhaust fluid from said outlet passage.

6. In a combined positive displacement engine and compressor as in claim 5, a fluid shunt opening communicating with said fluid outlet passage, said shunt valve being normally closed and operable to open said opening, means connecting said shunt valve for predetermined timed operation with the movement of said fluid compression means, and means to vary the opening operation of said shunt valve.

7. In a combined positive displacement engine and compressor, a combustion structure including means positively displaceable in response to combustion, a substantially circular compression chamber, fluid inlet and outlet passages communicating with said chamber, means in and dividing said chamber and directly linearly connected with said displaceable means to move fluid in said chamber from said inlet passage to said outlet passage in response to the displacement of said displaceable means, valve means normally closing said outlet passage and operable to open the same in response to a predetermined pressure of the moving fluid, and shunt means normally closed and selectively operable in said fluid outlet passage to exhaust fluid therefrom prior to said valve means and connected with said means dividing said compression chamber for coordinated operation therewith.

8. In a compressor, a fluid compression chamber having a fluid inlet and a fluid outlet passage, movable means in said chamber to move fluid from said inlet to said outlet passage, one-way valve means normally closing said fluid outlet passage and operable to open the same in response to a predetermined pressure of fluid in said outlet passage, normally inoperative means selectively operable in said fluid outlet passage to provide an exhaust opening for fluid prior to said valve means, means connecting said selectively operable means with said movable means for coordinated operation therewith to vary the exhaust opening of said selectively operable means, and a combustion structure linearly connected directly with said movable means to move the same.

9. A combined positive displacement engine and compressor comprising a combustion structure including a chamber having a plurality of straight-sided walls, a piston movable in said chamber in response to combustion herein, said piston having a plurality of straight sides coresponding to a respective straight-sided wall of said chamber for relative movement therealong, straight-sided piston sealing means on said piston engaging said straight-sided walls, a compression structure including a circular compression chamber, a fluid inlet and a fluid outlet passage communicating with said compression chamber, a substantially circular compression member eccentrically rotatable in said chamber to move fluid therein from said inlet to said outlet passage, a vane on said compression member connecting the same with said piston for responsive movement therewith, said vane and member serving to divide said compression chamber into a plurality of compartments during the movement of said fluid from said inlet to said outlet passage, valve means normally closing said outlet passage and operable to open in response to a predetermined fluid pressure in said passage, and means in said fluid outlet passage selectively operable to predeterminately control the volume of fluid acting on said valve means and connected with said compression structure for coordinated operation therewith.

10. A combined positive displacement engine and compressor as in claim 9, said fluid volume control means being positioned in said passage prior to said valve means, means operating said fluid volume control means in predetermined timed relationship with the movement of said compressor, and means connected with said fluid volume control means to vary the control of the fluid volume.

11. A combined positive displacement engine and compressor as in claim 10, and means connected with said compression member to impart thereto a rotative force.

12. A combined positive displacement engine and compressor comprising a plurality of combustion structures each including a combustion chamber and a piston displaceable in response to combustion therein, a plurality of rotatable compression structures one for each of a corresponding one of said combustion structures, said compression structures each including a compression member directly connected with said piston of its corresponding combustion structure for rotative movement thereby in response to the piston displacement, a compression chamber having fluid inlet and outlet means and in which said member rotates to move fluids from said inlet to said outlet, valve means normally closing said fluid outlet and operable to open in response to a predetermined fluid pressure, means in said fluid outlet selectively operable to predeterminately control the fluid pressure acting on said valve means, said selectively operable means being connected with its compression structure for coordinated operation therewith, and means connecting together said compression members of each of said com-

pression structures, said connecting means applying a rotative moment of force to said compression members after the displacement of said piston.

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