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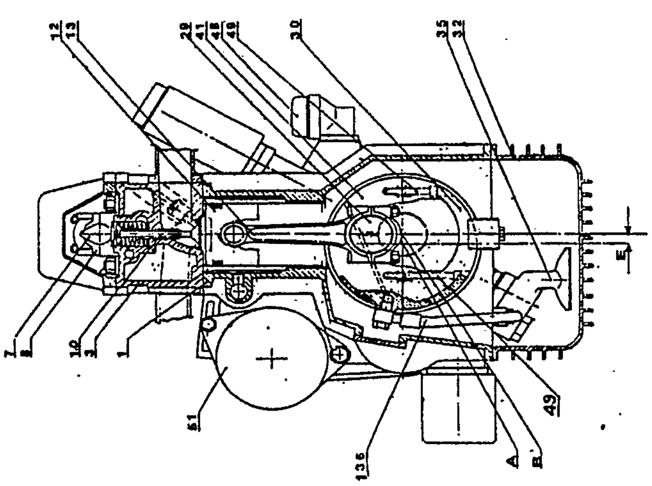
(54) **Eight cycle or diesel type internal combustion engine.**

(57) Eight cycle or diesel type internal combustion carburation engine having the capacity of automatically varying the compression ratio in order to increase engine efficiency, without varying the amount of fuel consumed, wherein the axis (B) of the crankshaft (29) is carried by supports (30, 41) rotating around an axis (A), and said axis (A) is staggered with respect to the axis (B).

The compression ratio will undergo a cyclic increase at each engine revolution so that, when the piston (12) reaches the top dead point, the resulting ratio will be higher than that achieved by a traditional engine.

Fig.1



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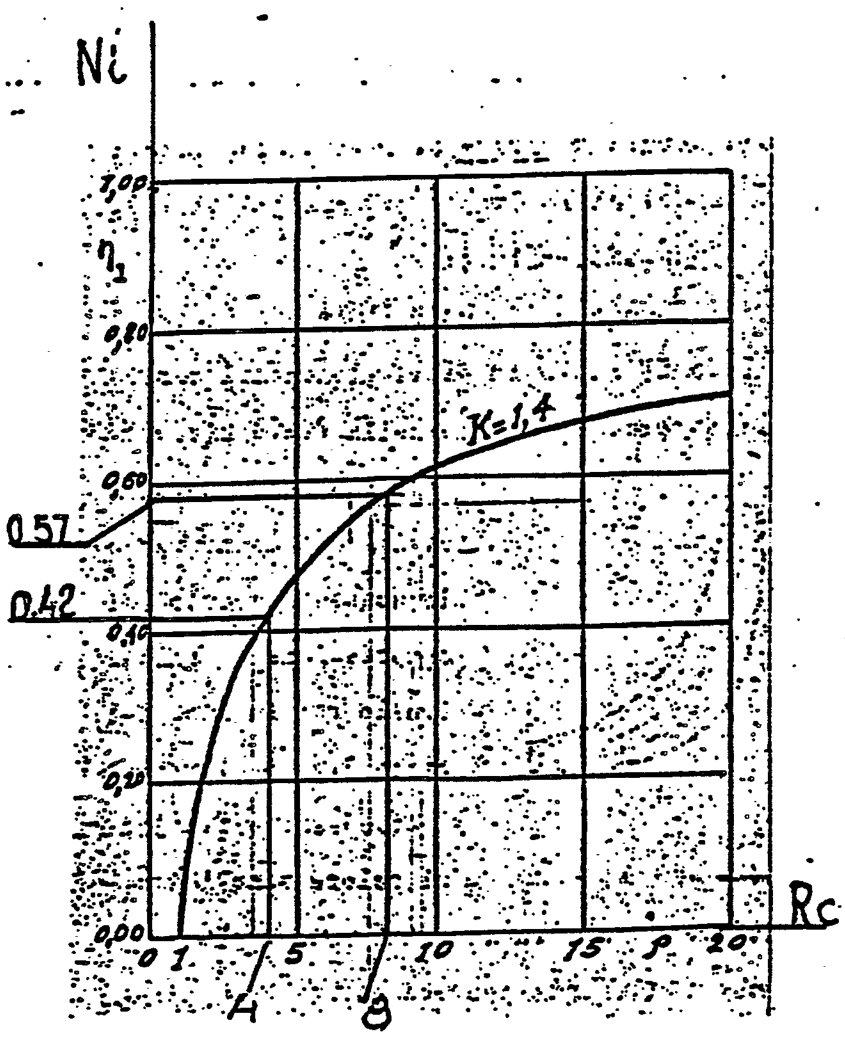
EIGHT CYCLE OR DIESEL TYPE INTERNAL COMBUSTION ENGINE

The present invention relates to an eight cycle or Diesel type internal combustion carburation engine.

More particularly, the present invention relates to an eight cycle or Diesel type internal combustion carburation engine having the important and original feature increase the compression ratio at each engine revolution, each time one of the pistons reaches top dead point or center.

Although the description which follows is related to only one of the pistons which form an integral part of an engine, the new concepts explained are easily applicable to all of the pistons.

First of all, the attention is drawn to the graph shown below which aids in understanding the engine's operating principle, as well as the innovative idea of the present invention.



This graph illustrates the relationship between the engine's compression ratio (Rc) and thermal efficiency (Ni), shown respectively on the horizontal and vertical axes.

Insofar as it illustrates the ideal situation, the graph could be considered as a mere schematic representation. It is obvious however, that a graph illustrating the actual operation of an internal combustion engine would differ only slightly from the curve as shown in the graph.

As can be seen on the graph, the compression ratio varies from 0 to 20, while the thermal efficiency varies between 0 and 7. The curve, representing the engine's thermal efficiency as a function of the compression ratio, can be compared to a hyperbolic branch. It, therefore, follows that the thermal efficiency (Ni) increases rapidly at the beginning of the curve, i.e. for relatively low compression ratios, while higher pressures, such as Rc's from 10 to 20, cause the Ni to grow in smaller increments.

Let's take the case of an engine operating at compression ratio 4 for example; looking at the graph, its corresponding thermal efficiency would be 0,42, i.e., 42‰.

If the compression ratio could be doubled from 4 to 8, the resultant thermal efficiency would be equal to 0,57, that is 57‰.

The efficiency corresponding to compression ratios (Rc) 10/1 to 20/1, is given from the following equation:
100 : 42 = X : 57
This represents a 35% change, achieved without increasing the fuel mixture let to the engine cylinders.

Keeping in mind that such figures are purely theoretical, having been taken from an ideal scheme, and ignoring the other factors which could reduce the efficiency value, the conclusion is that an engine capable of producing such variations would certainly grant enormous benefits as far as consumption and power are concerned.

Having set forth the above-mentioned premise and keeping in mind that it is based on an ideal cycle, the object of the present invention is to provide an internal combustion engine which works on the principle described above, i.e., the automatic variation of the compression ratio.

The eight cycle Diesel type internal combustion engine, as claimed allows to obtain the above object.

The advantages and benefits offered by the engine of the present invention, which operates on such principle can be clearly derived from the detailed description which follows. This description relates to the drawings which illustrate only one embodiment of the invention. Such embodiment is not to be considered restrictive or limitative of the invention but only a preferred embodiment thereof.

In the drawing:

fig. 1 is a schematic cross section view of the engine of the present invention;

fig. 2 is a longitudinal section view of the engine of fig. 1;

fig. 3 is a schematic view of a complete engine wherein the parts which make up the subject matter of the present invention are set forth;

fig. 4 is a schematic view from the distribution side of the engine;

fig. 5 shows an illustrative schematic representation of the invention at the minimum compression ratio, and

fig. 6 shows the schematic representation of fig. 5 at the maximum compression ratio.

With the reference to the figures and particularly to figure 1, note the following reference B indicates the driving axis of the crankshaft (29), the crank axis and the connecting rod axis (13). When the piston (12) is at the top dead point or center, i.e., at the end of its upward stroke, all of the above-mentioned elements are aligned between them and the distance between the piston's top surface (12) and the bottom surface of the cylinder head (3) defines and determines the compression ratio (Rc).

The intake valve (10) is shown on the cylinder head (3) above the piston (12) (see Figure 1), while the exhaust valve (11) is shown in figure 3 which is a side view of the engine.

The intake (10) and exhaust (11) valves are driven by a cam shaft (7) which is carried by known supports (8), inside of which it rotates. Reference E of figure 1 illustrates the distance between the B axis and the A axis. The upper 30 and lower 41 supports of the crankshaft (29) are fixed to and supported by the A axis.

Such supports (30) and (41) are firmly assembled and connected by clamping screws (49) as shown in figure 1; the left screw is longer than the right one.

As schematically illustrated in fig. 6, by rotating the supports (30) and (41) of the crankshaft (29) in a counterclockwise direction, said crankshaft (29) rises upward causing the top of the piston (12) to approach the bottom surface of the cylinder head (3) resulting in an increase of the compression ratio (Rc). If such rotation is performed in a clockwise direction, as illustrated in fig. 5, the crankshaft (29) lowers and the compression ratio (Rc) will decrease; in fact, the distance X between the top of the piston (12) and the bottom surface of the cylinder head in fig. 5 is higher than the corresponding distance y in fig. 6.

This particular arrangement of the above-mentioned shafts allows to achieve the object of the invention, that is, it permits the modification, i.e. the increase, of the engine's compression ratio (Rc).

The main feature of the present invention is the staggered position of the A axis of the supports (30) and (41) in relation to the B axis. The engine of the present invention is, moreover, equipped with an original mechanism which allows the automatic movement of the top of the piston (12) in order to achieve a desired variation in the compression ratio (Rc).

The mechanism is illustrated in figure 2 which shows that an appropriately shaped plate (16), part of which is toothed (16a) is connected to the supports (30) and (41) of the crankshaft (29). The clutch casing (20) is mounted on this plate (16) provided a toothed sector (16a) and rotates around the A axis, while the B axis is its own central axis.

Consequently, the clutch (20) and plate (16) rotate eccentrically. The clutch casing (20) rotation around the A axis is provided by a gear (55) (see figure 2) driven by a direct current motor (56), through a undirectional reducer (69).

With reference to figures 2 and 3, the engine of the present invention has a fixed casing (15) which houses the above mentioned elements as well as three proximity microswitches (17), (18) and (19). These microswitches work in conjunction with three position detectors (58), (59) and (60), mounted on the clutch casing (20) and caused to cooperate with the microswitches (17), (18) and (19). Insofar as the casing (15) is stationary and the clutch casing (20) is rotating, it is possible to vary the positioning between the three microswitches and the three detectors.

For example, when microswitch (17) is aligned with position detector (58), a minimum compression ratio value exists, being maximum the distance X between the top of the piston 12 and the bottom of the cylinder head (see fig. 5). A medium compression ratio value is achieved when microswitch (18) is aligned with position detector (59). The maximum compression ratio value is achieved by aligning microswitch (19) with position detector (60); in fact in this position the distance y between the top of the piston (12) and the bottom of the cylinder head is smallest (see fig. 6).

A suitable computer situated on the board of the motor vehicle determines the appropriate and selected compression ratio values (Rc) on the basis of the following factors: number of engine revolutions; position of the throttle which regulates fuel intake measured by a suitable device (9), and finally, the temperature of the air taken in. The quantity of microswitches and corresponding position detectors employed (3 of each element in the illustrated embodiment) could be increased if deemed advantageous by the appropriate skilled in the art.

A gear (27) mounted on the clutch shaft (25), transmits the movement to an internal gear (26) which in turn, is keyed on the main shaft of the casing (21).

Figure 4 shows the timing system of the engine of the present invention.

As compared to the conventional known engines, the engine of the present invention has an additional axis in which a gear (70) with a pulley (71) is located.

The pulley (71), through a belt (67), rotates a cooling water pump (42) and an alternator (51).

Gear (36), through a chain, provides movement to a gear (70); both of these are in the same horizontal axis whenever a medium compression ratio exists.

Whenever either a minimum or maximum compression ratio is used, a small phase shift of about 30'occurs between the crankshaft and the camshaft, which, however, does not negatively affect the engine's operation.

Figure 3 illustrates a complete 4-cylinder engine according to the present invention. In the figures the basic elements of the invention, and other known elements, which are not to be considered innovations, are illustrated.

These known elements are important factors since they contribute to the engine's proper operation.

In order to better understanding the invention, a reference list of such known elements is provided below.

Reference 1 indicates the engine block to which the front cover is fixed in the conventional manner.

Reference 3 indicates the cylinder head, and reference 4 identifies the chain stretching gear.

Reference 21 marks the engine flywheel, and the clutch is identified by reference 22.

The clutch control lever is indicated by reference 23, while reference 24 marks the clutch pressure spring bearing.

The gearbox is indicated by 28, and 35 identifies the pump which sends oil through a flexible pipe numbered 37; the oil pan is indicated by 32.

The starting motor and related gear shown in figure 2, are indicated by references 63 and 62, respectively.

The above description clearly illustrates the advantages of the engine of the present invention.

The present engine allows the programmed/programable variation of the compression ratio, without varying the amount of fuel mixture consumed, in order to achieve the optimal engine efficiency.

While the invention has herein been illustrated and described by way of a detailes embodiment, it will be appreciated that various substitutions of equivalents may be made without departing from the spirit and scope of the invention as set forth in the following claims.

Claims

1) Eight cycle or Diesel type internal combustion engine which allows the automatic and controlled variation of the compression ratio, comprising: at least a piston movable within a compression chamber fed by a fuel mixture and connected, through a connecting rod, to a crankshaft rotated by a drive shaft; at least one fuel intake valve and at least one valve for the expulsion of gases produced in the combustion and explosion chamber of the cylinder, said valves being driven by a shaft with at least one cam, characterized in that the axis (B) of the crankshaft (29) is carried by supports (30, 41) rotating around an axis (A) in order to produce a corresponding movement of the crankshaft (29), the axis (A) being staggered with respect to the axis (B), thereby the rotation causes an eccentric rotation of crankshaft (29), in relation to the connecting road (13), such eccentricity modifying the piston (12) stroke, so that the piston can reach the top dead point near the bottom surface of the cylinder head (3); the above being programmable through an electronic control system installed on board of the motor vehicle, which provides for varying the above-mentioned drive shaft or camshaft (B) movement with respect to the connecting road (13).

2) Internal combustion engine according to claim 1, wherein the supports (30) (41) are connected to a shaped plate (16) on which the clutch casing (20) is mounted; the clutch casing rotating around the axis (A) of the supports (30) and (41) and the shaped plate (16) being provided with at least one toothed part (16a) engaging with a gear (55) the rotation of which is programmed and modified by proximity switches (17), (18), (19) cooperating with corresponding position detector (58), (59), (60).

3) Internal combustion engine according to claim 1 or 2, characterized in that by rotating the supports (30, 41) of the drive shaft (B) in one direction, the drive axis (B) rises upward so that the top of the piston (12), when this latter reaches the top dead point, is near the bottom surface of the cylinder head (3), thereby causing an increase in the compression ratio (Rc); while, when the supports (30, 41) of the drive shaft (B) are rotated in the opposite direction, the top of the piston (12), when it reaches top dead point, will be further away from the bottom surface of the cylinder head (3), thereby causing the compression ratio (Rc) to decrease.

4) Internal combustion engine according to any of the preceding claims, characterized by the fact that a direct current motor (56), by an undirectional reducer (69), drives the gear (55) which induces rotation of the plate (16).

Fig.1

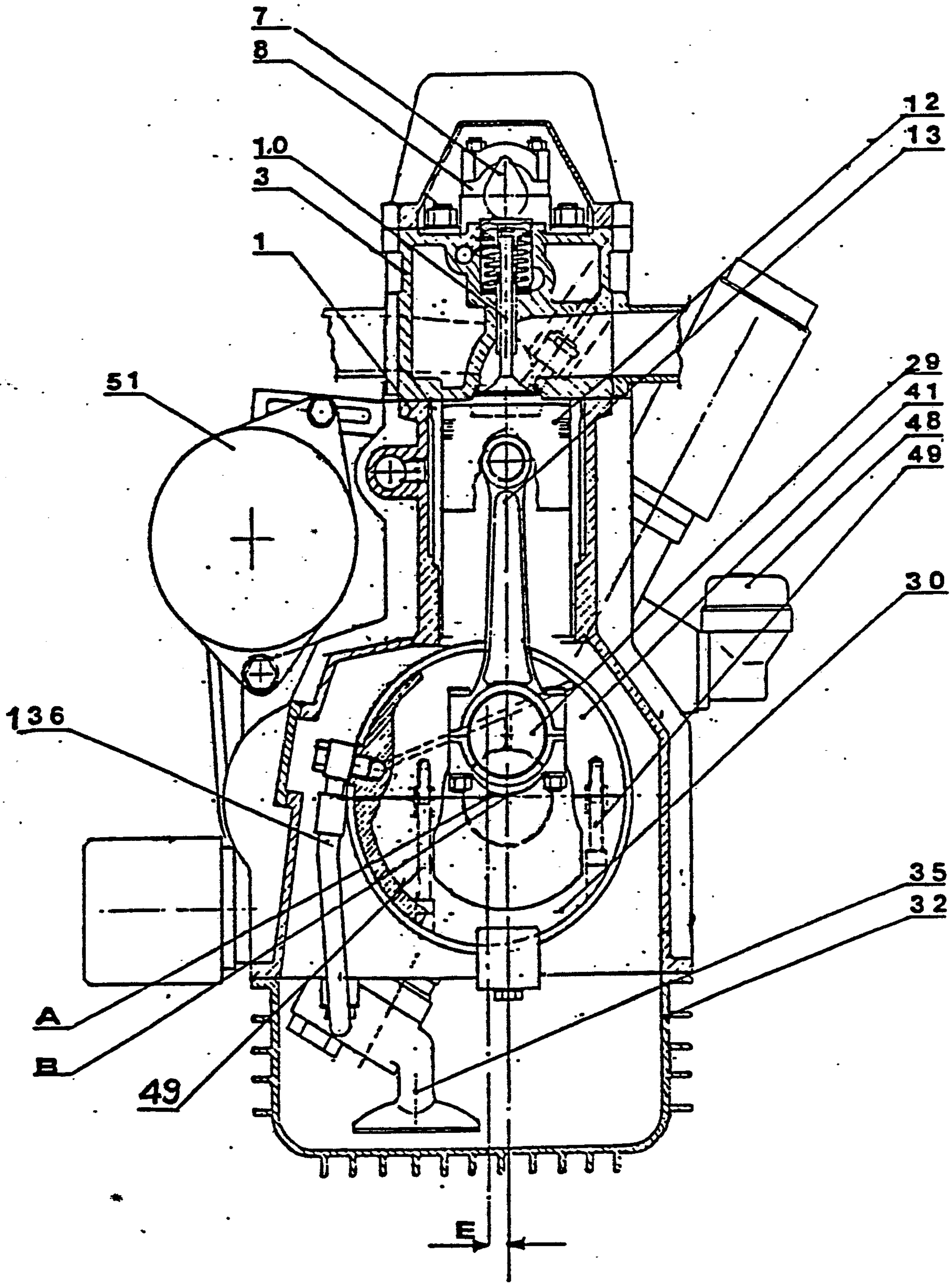
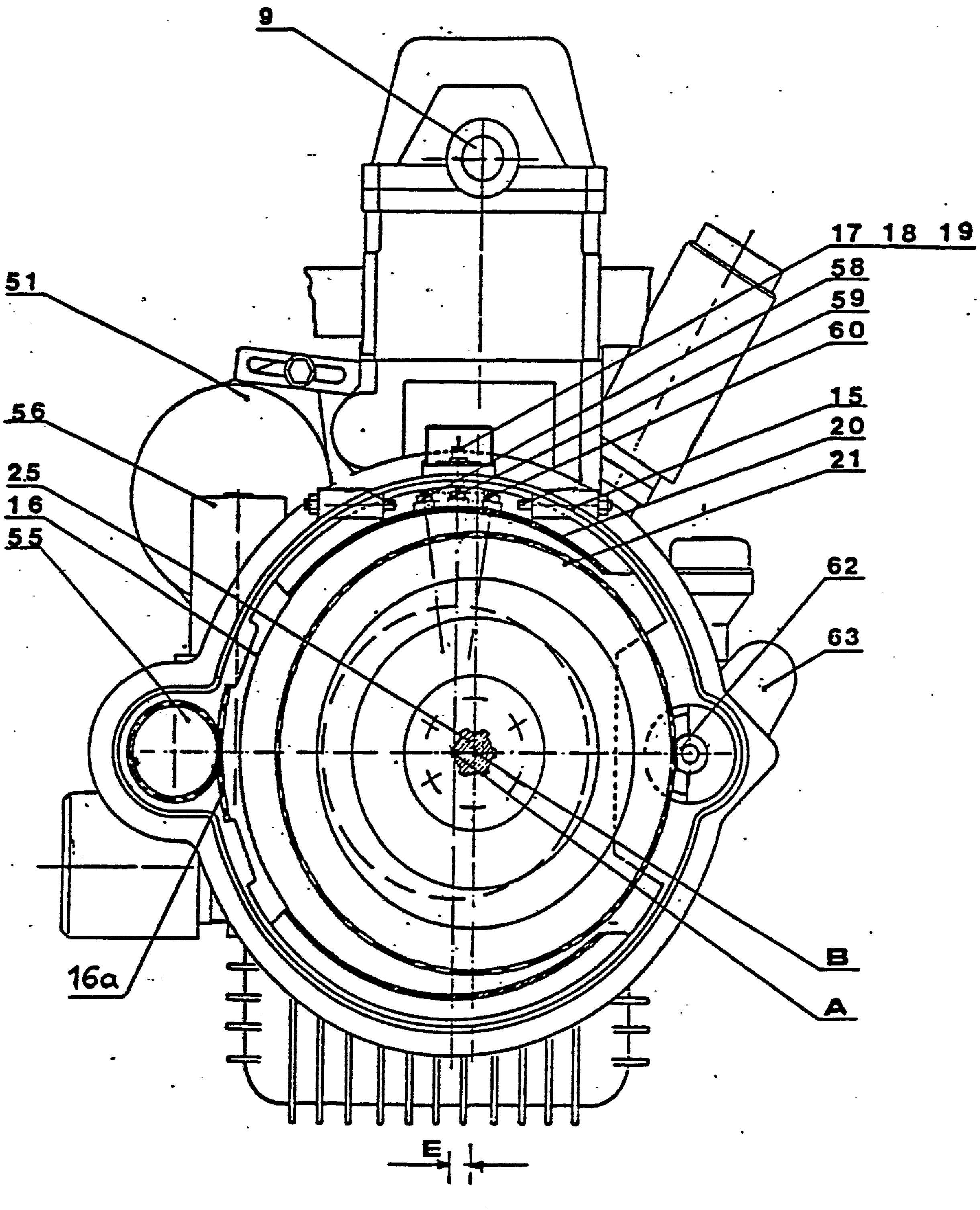


Fig.2



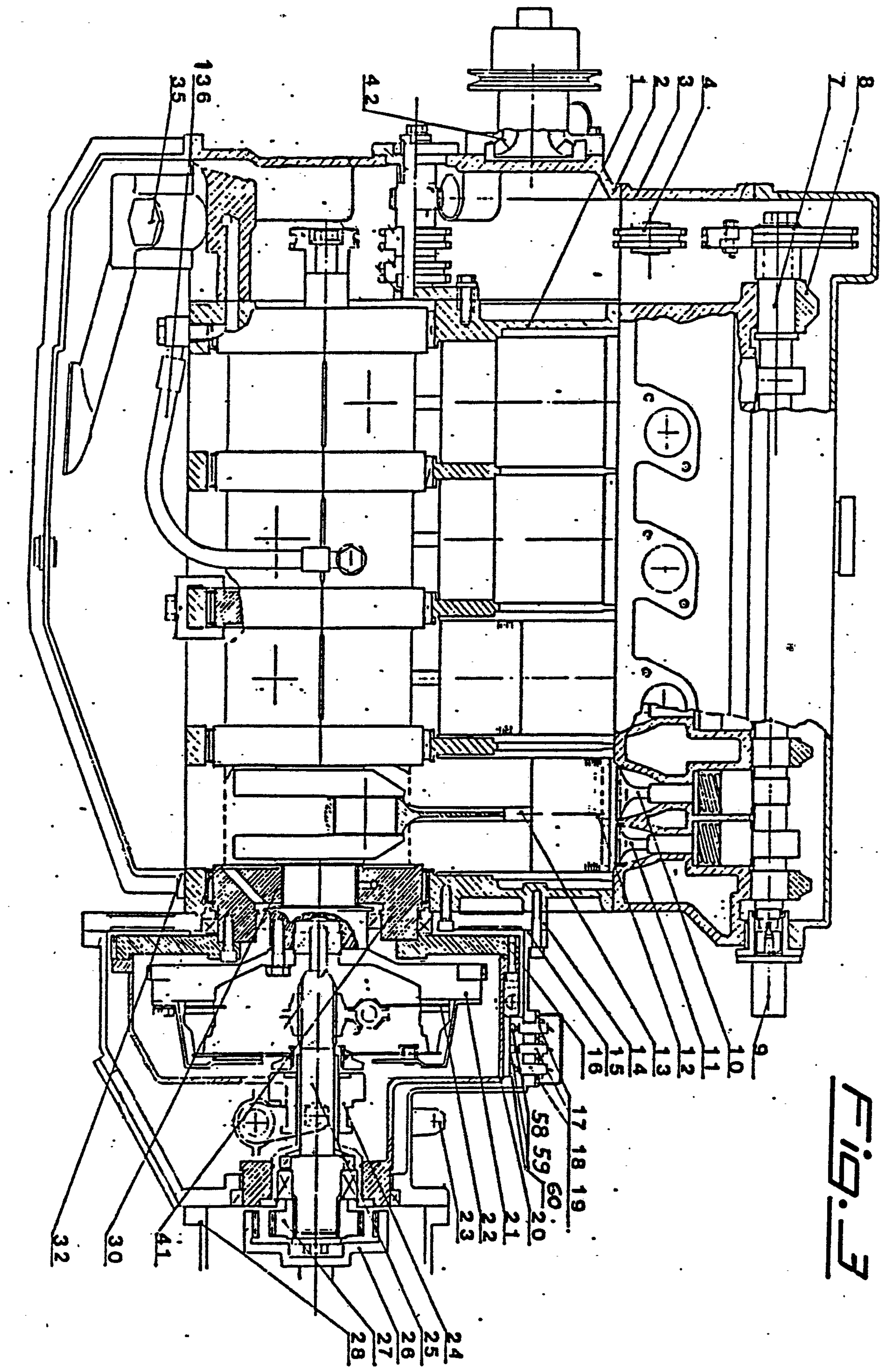

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Fig. 3

Fig. 4

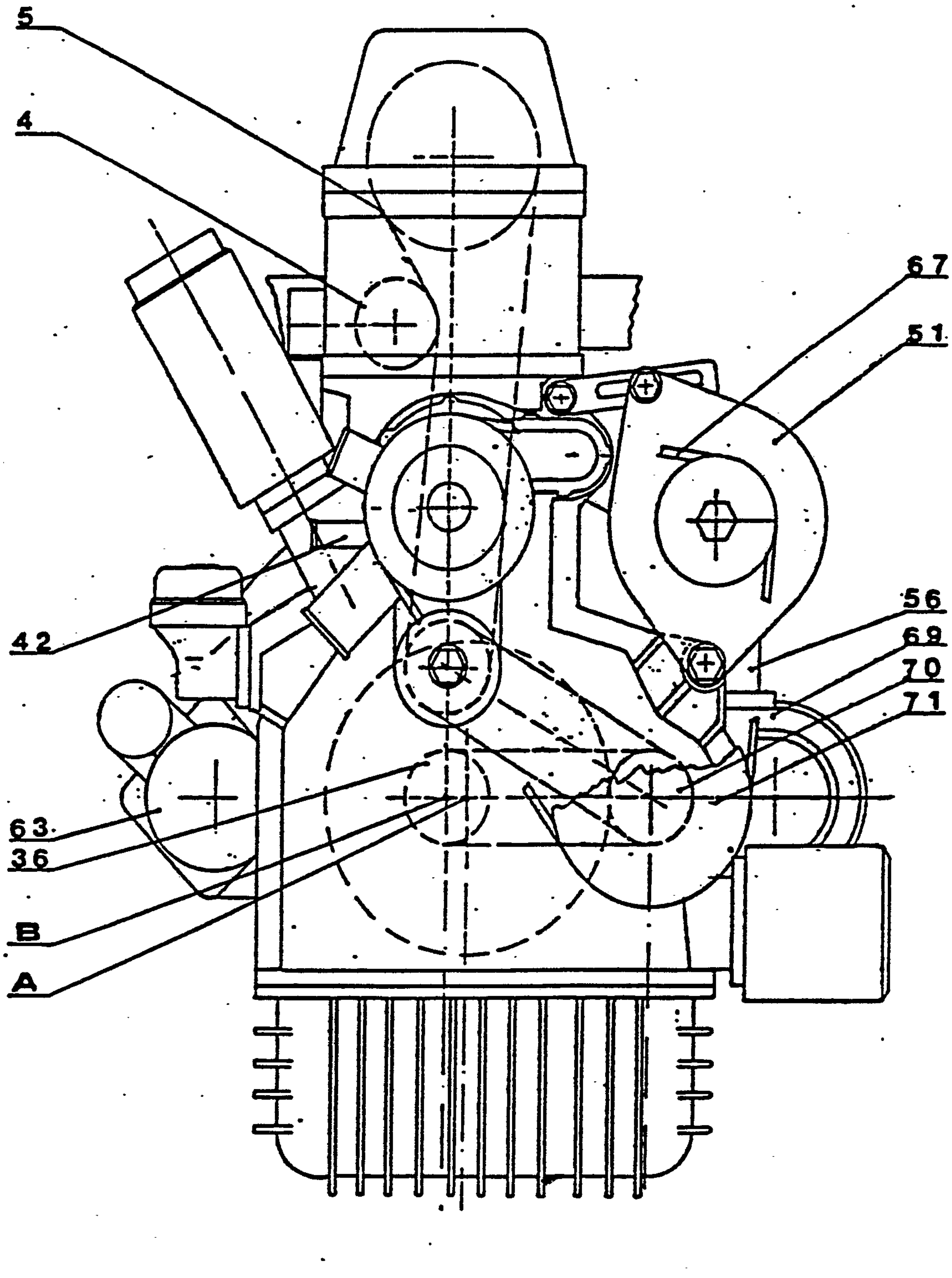


Fig.5

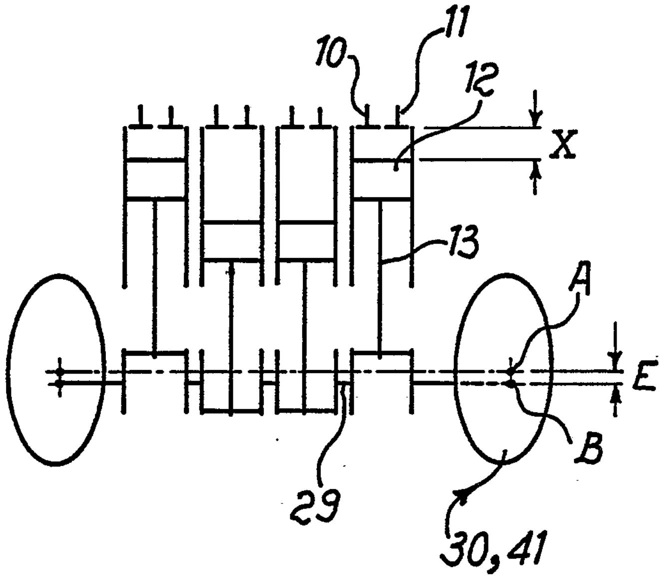
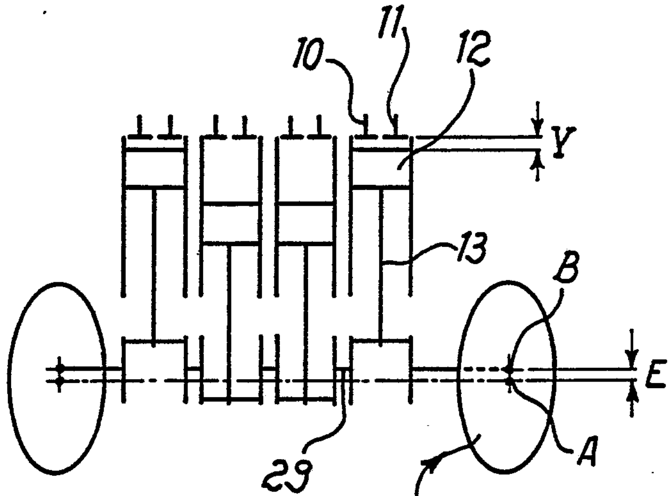


Fig.6



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EUROPEAN SEARCH REPORT

Application Number

EP 88 10 9096

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-4 738 230 (K.A. JOHNSON) * Column 1, lines 12-18,40-42; column 2, lines 4-11,27-36,44-51; column 2, line 59 - column 3, line 16; column 4, lines 39-48; column 6, lines 16-30; figure 1 *	1,3	F 02 B 75/04 F 02 D 15/04
A	FR-A- 692 084 (M.C. DURSENT) * Whole document *	1,3	
A	FR-A- 913 622 (MOTEUR ET ACCESSOIRES AVIATION MINIATURE) * Page 1, right-hand column, last paragraph; page 2, lines 4-27; figures 1-4 *	1,3	
A	DE-A-3 004 402 (DAIMLER-BENZ) * Claims 1-3; figure *	1,3	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

F 02 B
F 02 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	06-02-1989	ALCONCHEL Y UNGRIA J.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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