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(54) **A supporting system of a toothed wheel onto a casing of an internal combustion engine**

(57) A supporting system (50) of a toothed wheel (12) onto a casing (CT) of an internal combustion engine (100). The system (50) comprises:

- a first bushing (53) supported by a wall (PT);
- a second bushing (54), adapted to support the toothed wheel (12), which crosses, in use, a through hole (51) made in said casing (CT); the second bushing (54) rests

on said first bushing (53), and

- a screw (55) adapted to secure the second bushing (54) onto the first bushing (53), so as to form a seat (56) adapted to contain supporting and rolling means (57) of the toothed wheel (12).

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Description

[0001] The present invention relates to a supporting system of a toothed wheel onto a casing of an internal combustion engine.

[0002] Specifically, the toothed wheel belongs to a "rigid" type timing assembly of a single-cylinder internal combustion engine, e.g. for motorcycle applications.

[0003] Specifically, the present invention is advantageously, but not exclusively, used in a single-cylinder engine adapted to be used in specific motorcycling fields (such as motocross, enduro or supermotard), to which the following description will refer without because of this losing the generality.

[0004] As known, in motocross, enduro and supermotard application, single-cylinder engines (e.g. having a displacement of 450 cc) are preferred.

[0005] The timing assemblies of this type present the problem of how to efficiently support each toothed wheel forming the gear set.

[0006] Therefore, it is the main object of the present invention to make a supporting system for a toothed wheel belonging to a timing assembly which is easy to assemble, and which ensures a minimum hub clearance of the toothed wheel and/or of the roller bearing which supports such hub.

[0007] Therefore, according to the present invention, a toothed wheel according to the attached claims is made.

[0008] The present invention will now be described with reference to the accompanying drawings which illustrate a non-limitative example of embodiment thereof, in which:

- figure 1 depicts a (partially sectioned) exploded view of a timing assembly of a single-cylinder internal combustion engine;
- figure 2 shows a section of an internal combustion engine in which a supporting system of a toothed wheel object of the present invention is applied;
- figure 3 depicts a magnification of the supporting system in figure 2; and
- figure 4 shows a side view of the supporting system in figures 2 and 3.

[0009] In the accompanying figures, numeral 10 indicates as a whole a distribution unit related to a single-cylinder endothermic engine 100 (figure 2) particularly suitable for motorcycle applications, such as motocross, enduro or supermotard.

[0010] As known, engine 100 (figure 2) further comprises a cylinder 20, in which a combustion chamber 21 (with central axis (a) of symmetry) is defined, within which combustion chamber there is a piston 20a to which a connecting rod 20b is hinged.

[0011] A crank 22 belonging to a crankshaft 23 is associated to connecting rod 20b by means of a hinge (not shown).

[0012] In a known manner, the vertical reciprocating movement of piston 20a, according to a direction and sense shown by a double pointed arrow F is transformed into a rotational movement about an essentially longitudinal axis (b) of symmetry of crankshaft (23) according to a direction identified by an arrow R.

[0013] Engine 100 further comprises a head 30 resting on a horizontal upper surface SS of cylinder 20.

[0014] In a known manner, the seats adapted to accommodate the two fuel/air mixture suction valves, the two burnt gas exhaust valves and a central accommodation spark plug seat, are obtained in head 30.

[0015] Furthermore, a valve actuating assembly 40 provided with two camshafts 41a, 41b and corresponding tappets (not shown) is located on top of head 30 (figure 4).

[0016] As usual, timing assembly 10, indeed, mechanically connects camshaft 23 with camshafts 41a, 41b for actuating the valves of head 30 according to a predetermined cycle (figure 4).

[0017] As shown in figure 1, timing assembly 10 extends laterally to cylinder 20 and to head 30, and is of the "rigid" type, not contemplating the use of belts or pulleys, but only of toothed wheels.

[0018] Indeed, timing assembly 10 comprises three straight toothed wheels 11, 12, 13 which form a gear set adapted to transfer the motion of crankshaft 23 to camshafts 41a, 41b, starting from a toothed pinion 24 (keyed onto crankshaft 23) for reaching toothed wheels 42a, 42b keyed onto corresponding camshafts 41a, 41b (figure 4).

[0019] The innovative part resides essentially in a supporting system 50 of a generic toothed wheel 12 of a casing CT of engine 100 and external wall PT of cylinder 20 (figures 1, 2, 3).

[0020] For this purpose, a through hole 51 is made in casing CT and a blank hole 52 is made in wall PT of cylinder 20.

[0021] Holes 50 and 51 are aligned along a longitudinal axis of symmetry (c) (and of rotation of toothed wheel 12), which is perpendicular to the aforesaid axis (a) of combustion chamber 21.

[0022] Furthermore, supporting system 50 belongs to a first bushing 53, presenting a shank 53a and a head 53b. First bushing 53 is supported by wall PT.

[0023] Head 53b of first bushing 53 is located in a gap INT provided between casing CT and wall PT of cylinder 20.

[0024] Furthermore, a threaded through hole 53c and an aperture 53d are provided in first bushing 53 for the purposes which will be specified in greater detail below.

[0025] A second bushing 54, which also comprises a shank 54a and a head 54b, also belongs to system 50.

[0026] Both first bushing 53 and second bushing 54 have the same central axis of symmetry (c). Like first bushing 53, also second bushing 54 contemplates a central through hole 54d (not threaded) and an aperture 54e.

[0027] Furthermore, it must be noted that toothed wheel 12 is accommodated in gap INT in use.

[0028] As shown again in figure 1, in use, the end portion of shank 54a is inserted in aperture 53d, while the external wall of head 54b rests on the wall of through hole 51.

[0029] The tightness of head 54b is ensured by an o-ring AT.

[0030] Furthermore, head 54b ends with a flange 54c (figure 4), which, in use, rests on the external surface of casing CT.

[0031] A screw 55 is used to secure second bushing 54 on first bushing 53.

[0032] It is very important to note that through holes 53c, 54d and screw 55 present a central axis of symmetry (d) which does not coincide with the aforesaid axis (c). Indeed, as shown in figure 1, axis (d) presents an eccentricity (E) with respect to axis (c).

[0033] As shown in greater detail below, eccentricity (E) was provided to prevent undesired rotations of bushing 54 with respect to bushing 53 during the fastening of screw 55 in threaded hole 53c of bushing 53 itself.

[0034] Furthermore, a seat 56, which contains a portion of a hub MZ of toothed wheel 12 and a roller bearing 57, is created between an upper surface 53e of head 53b of first bushing 53 and a lower surface 54f of head 54b of second bushing 54. Bearing 57 is used to support hub MZ and thus toothed wheel 12.

[0035] Incidentally, hub MZ is provided in a known manner with a through hole MZ* in which bearing 57 is accommodated.

[0036] During the assembly of toothed wheel 12 and the corresponding supporting system 50, head 30 is not yet mounted on cylinder 20.

[0037] In use, the assembler firstly inserts shank 53a of first bushing 53 into blank hole 52 made on external wall PT of cylinder 20.

[0038] At this point, the assembler starts to insert shank 54a in through hole 51 so that the end of such shank 54a is inserted in aperture 53d made in head 53b of first bushing 53.

[0039] During the step of inserting shank 54a in through hole 51, such shank 54a crosses through hole MZ* of hub MZ, while roller bearing 57 which is put between supporting system 50 and hub MZ of toothed wheel 12 is placed on the surface of shank 54a itself.

[0040] At this point, screw 55 can be inserted in through hole 54d and this screw 55 is indeed fastened in the threading provided on hole 53c.

[0041] In this manner, second bushing 54 is "packed" on first bushing 53, further "sandwiching" bearing 57 and hub MZ together.

[0042] It is apparent that in order to work system 50 cannot tighten hub MZ. Therefore, appropriate tolerances along axes (c) and (d) are provided in seats 56, so that hub MZ may have minor longitudinal movements along axis (c).

[0043] Moreover, in order to further prevent the rotation of second bushing 54 with respect to first bushing 53 during the fastening of screw 55, at least one screw 58a

(or two) is provided, which is crossed through a hole 58b made on flange 54c and is fastened in a threaded hole 58c on a casing CT (figures 1, 4).

[0044] What is more, screw 58a has the further function of preventing the random loosening of screw 55 due to the vibrations which are developed during the operation of engine 100.

[0045] Evidently, the same principles shown above may be applied for fastening toothed wheels 11 and 13 to casing CT.

[0046] The main advantages of the supporting system object of the present invention are the maximum assembly simplicity and the capability of adapting to minor movements (in the order of a few hundredths of a millimeter) of the toothed wheel and/or the bearing axis along a direction identified by axis (c).

Claims

1. A supporting system (50) of a toothed wheel (12) to a casing (CT) of an internal combustion engine (100); system (50) **characterized in that** it comprises:
 - a first bushing (53) supported by a wall (PT),
 - a second bushing (54), adapted to support said toothed wheel (12), which crosses, in use, a through hole (51) made in said casing (CT), said second bushing (54) resting on said first bushing (53), and
 - a screw (55) adapted to secure said second bushing (54) onto said first bushing (53), so as to form a seat (56) adapted to contain supporting and rolling means (57) of said toothed wheel (12).
2. A system (50), as claimed in claim 1, **characterized in that** said second bushing (54) is fixed to said casing (CT) by means of means (58a, 58b, 58c).
3. A system (50), as claimed in any of the preceding claims, **characterized in that** said casing (CT) and said wall (PT) define a gap (INT) adapted to contain said toothed wheel (12) and corresponding supporting means (54a, 57).
4. A system (50), as claimed in any of the preceding claims, **characterized in that** said toothed wheel (12) is comprised in a timing assembly (10) of an internal combustion engine (100), specifically for motorcycle uses.

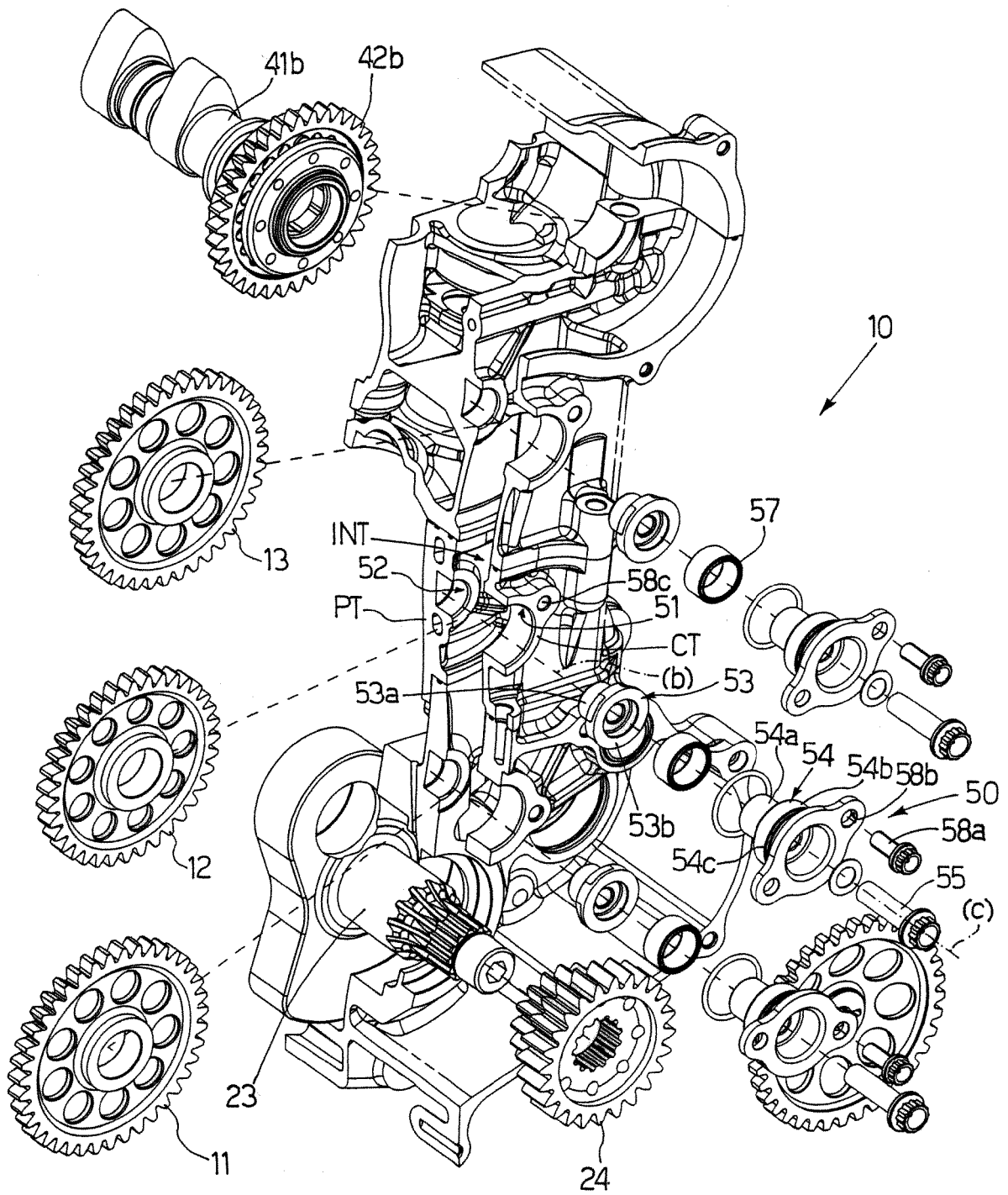


Fig.1

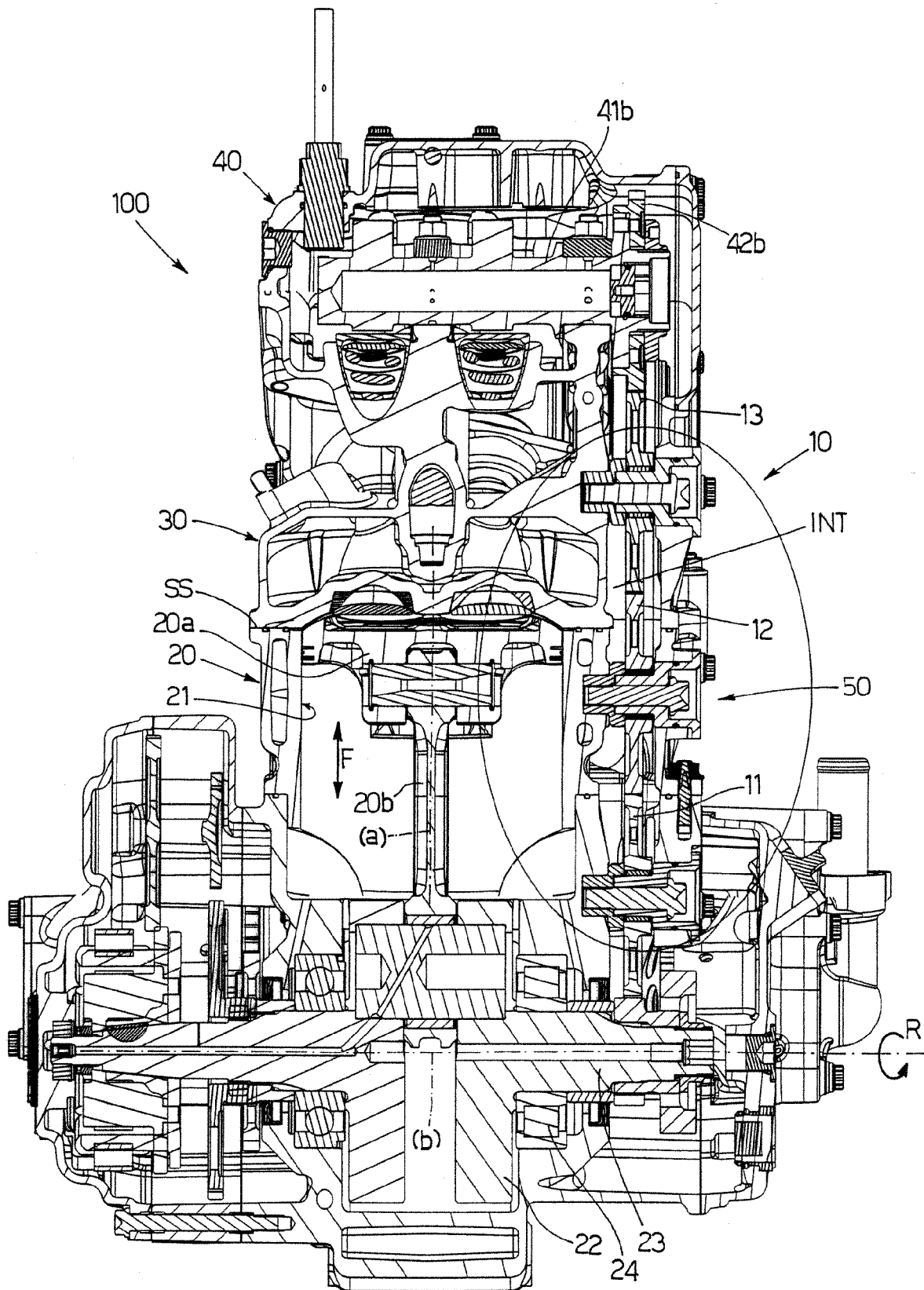


Fig.2

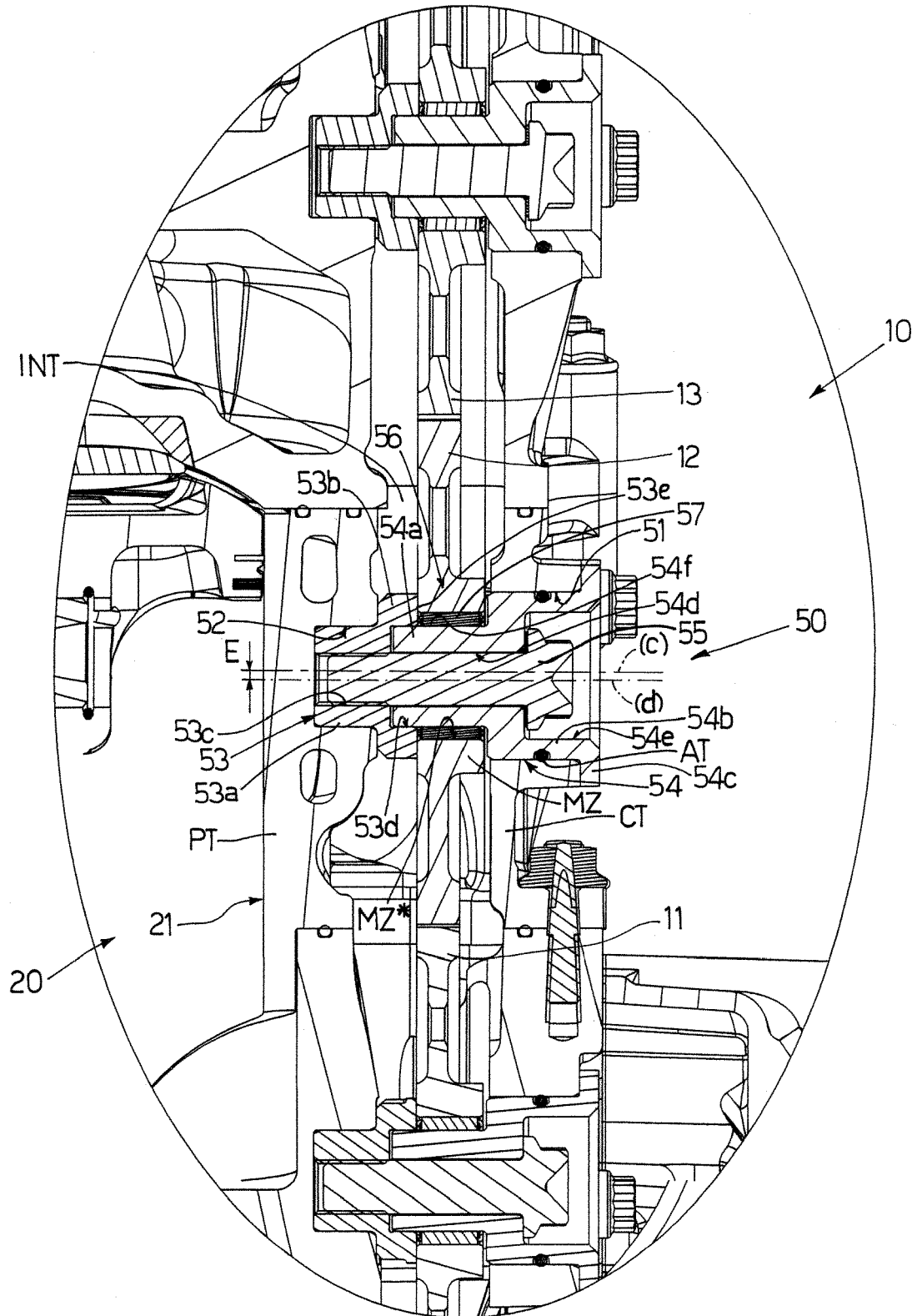


Fig.3

