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**(54) Timing Gear Housing of an
Internal Combustion Engine**

(57) The timing gear housing
comprises a case (1) accommodating
the timing gears (5 to 8) and a cover
(4), Fig. 2 (not shown), sealingly
connected to the case (1) by means of
screws or bolts (13). Additional means
are provided for clamping the case (1)

and cover (4) together so as to reduce
noise emission. Such additional
means may be provided in the clear
area (10) of the case (1) and/or may
comprise extensions of the gear
trunnions (20), Fig. 3 (not shown).
Alternatively, they may comprise rigid
(12, 17), Fig. 3 (not shown), and/or
flexible screws or bolts (21 to 25),
Figs. 3 to 5 (not shown).

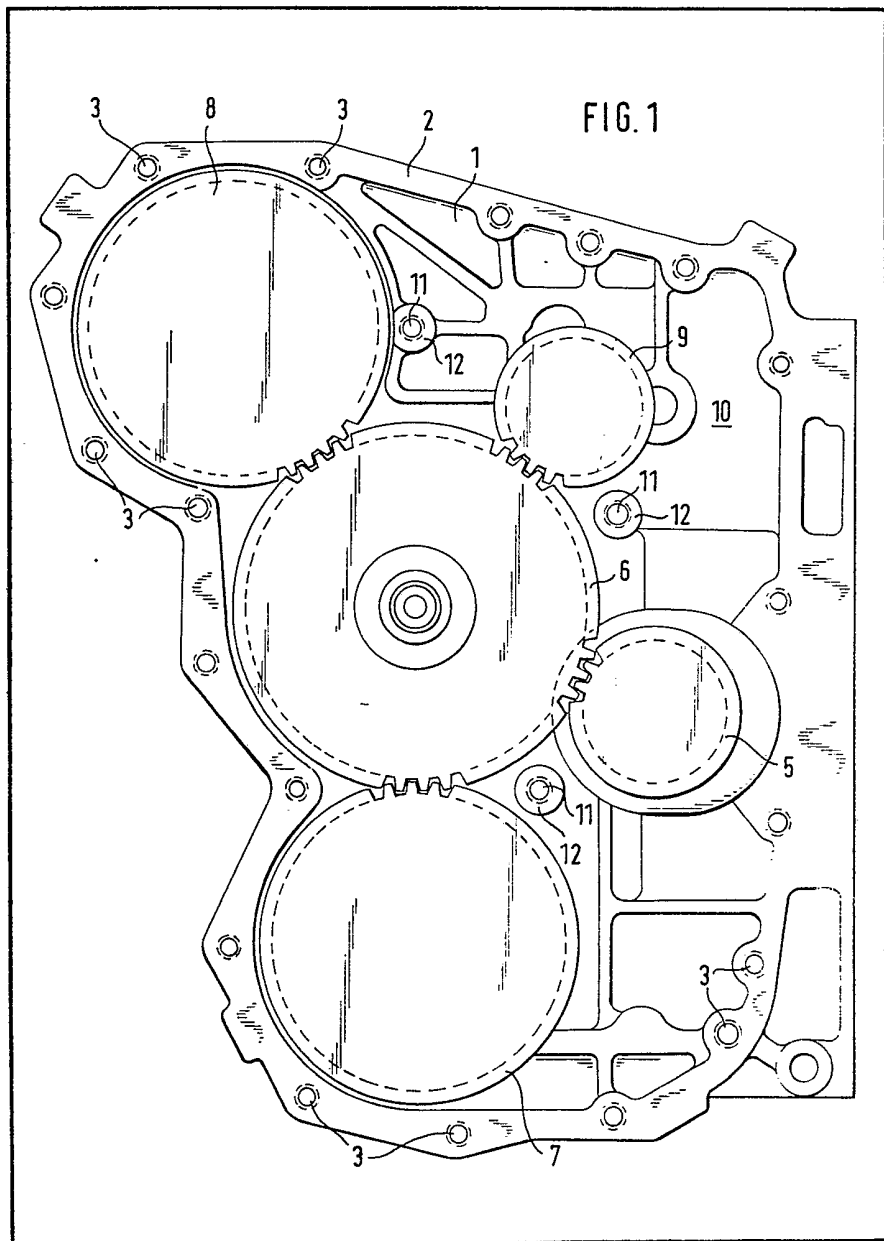


FIG. 1

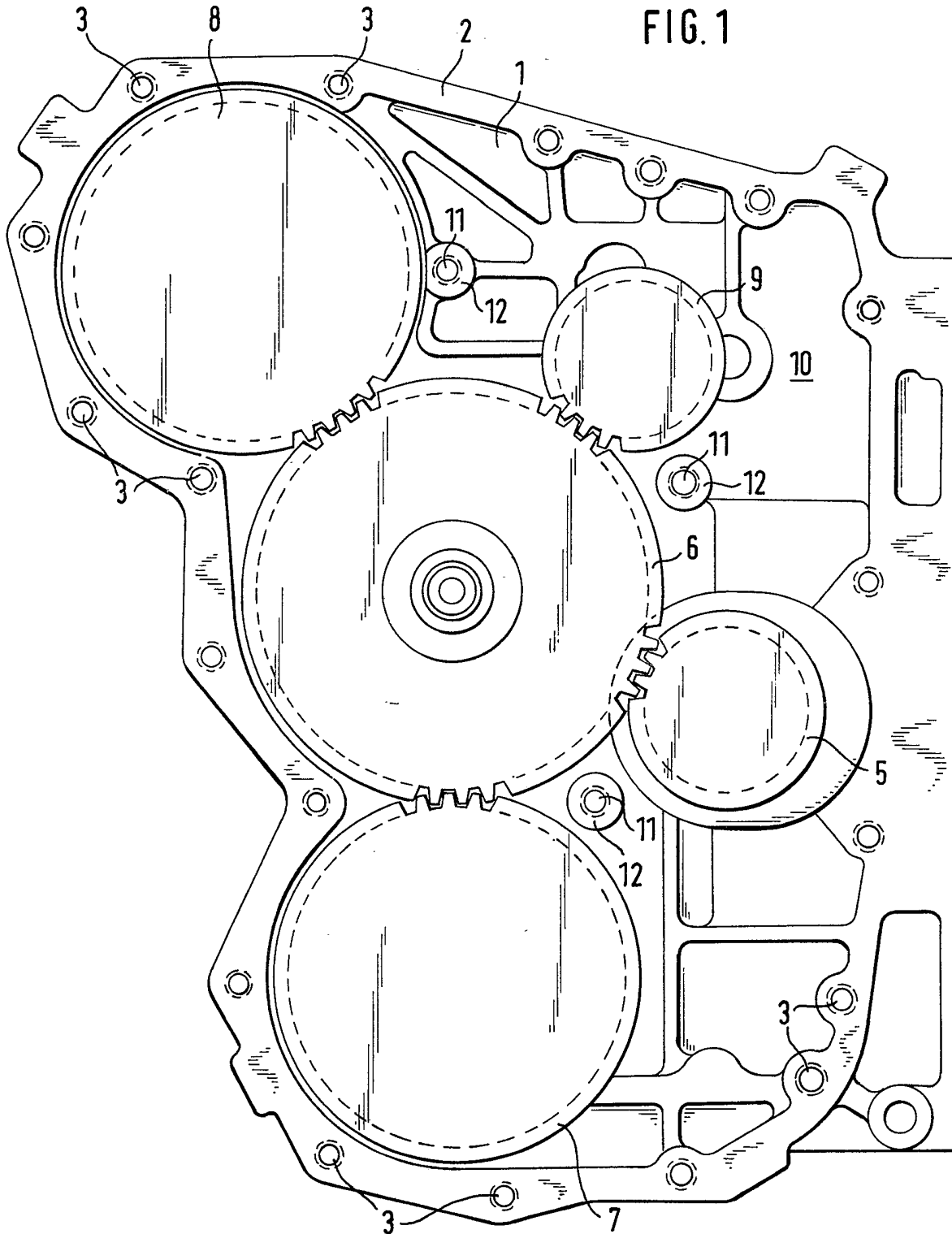


FIG. 2

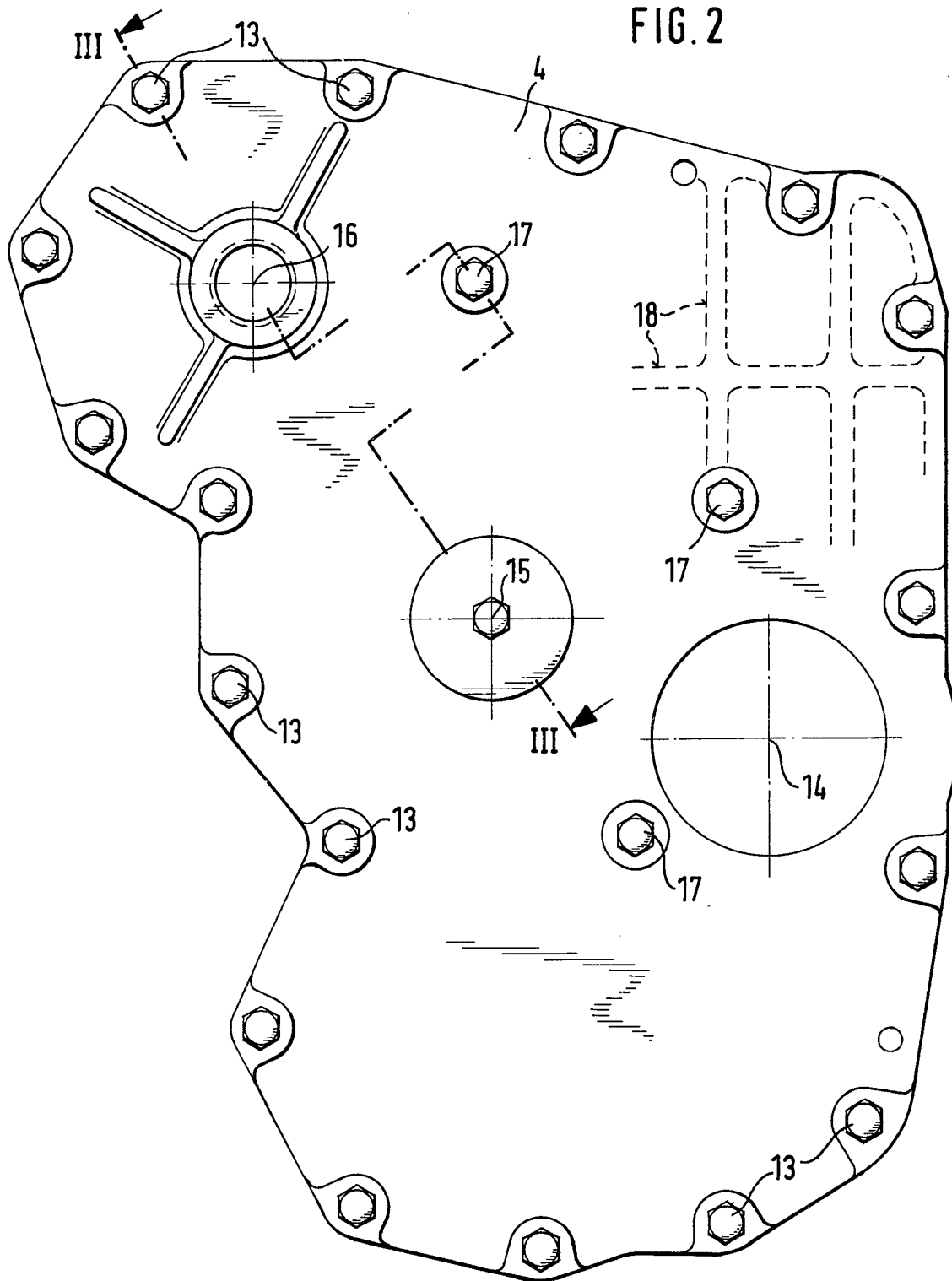


FIG. 5

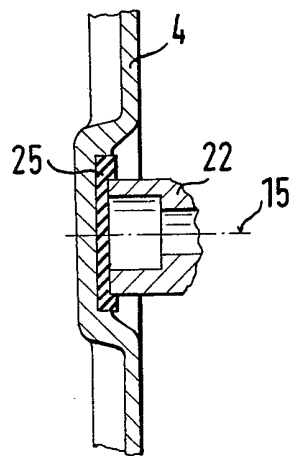


FIG. 4

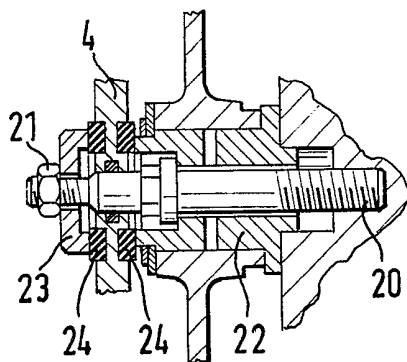
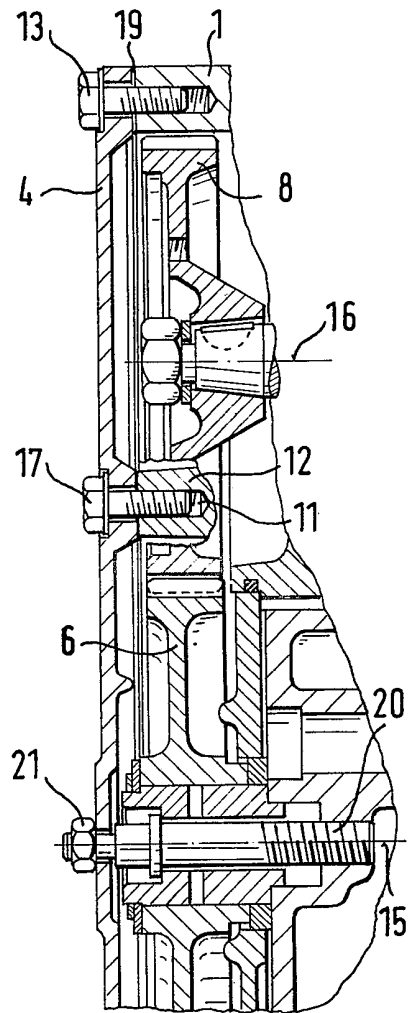


FIG. 3



SPECIFICATION

Timing Gear Housing Of An Internal Combustion Engine

This invention relates to a timing gear housing of an internal combustion engine. Such a housing comprises a case accommodating the timing gears and a cover sealingly connected to the case by means of bolts or screws, and is usually arranged at the front-end of the crank case of the internal combustion engine.

Such designs have been part of the general state of the art for a long time. In the case of modern truck engines, helical gears of bath-nitrited finish are preferably chosen as timing gears because of the specified service life and also for reasons of price. Since maintenance and repair costs are required to be as low as possible, this timing gear train is located at the fan end.

A field-proven design provides for a timing gear case of aluminium die-cast construction to be screwed or bolted to the front-end of the crank case of the internal combustion engine, the timing gear case consisting of a case and a cover screwed or bolted to the case with a gasket interposed. The number of bolts or screws used is chosen only with a view to ensuring effective sealing.

Legislation in the field of environmental protection has imposed additional tasks on engine manufacturers to maintain specified noise emission levels. Legislation mostly applies to the vehicle or prime mover in toto but it is known that the engine generally accounts for the greater proportion in the total noise level. Therefore, efforts have to be made to quieten the engine as the main source of noise.

As a secondary measure, the possibility has been proposed of completely enclosing the engine. However, such an acoustic enclosure will be effective only if it establishes tight contact and is completely isolated from vibrating parts. Furthermore, the enclosure would have to be resistant to fuels and oil and be capable of withstanding the high operating temperatures, mainly in the area of the exhaust manifold.

The second possibility of noise control is primary measures which are aimed at reducing noise directly at the source. In this connection, components such as the crank case, oil sump, valve hood and timing gear case number among the principal sources of noise.

It is proposed in the following to have a closer look at the timing gear case consisting of the case and cover.

The time-proved design described initially also has a drawback:

Due to irregularity motions and torsion angle deflections of the crankshaft, tooth chatter arises at the gears. Considering the irregularity at the crankshaft gear, this tooth chatter extends over a frequency of 20 to 60 Hz and considering torsional vibration has a frequency of about 150 to 300 Hz depending on the natural frequency of the crankshaft.

Since, on the one hand, the timing gear cover has a relatively large surface and, on the other hand, is made relatively thin, it acts as a good noise transmitter and noise radiator. Chatter of the tooth flanks (in the case of backlash) first of all produces structure-borne noise. This structure-borne noise turns into air-borne noise and is transmitted to the case cover. The case cover, in turn, is capable of readily transmitting structure-borne sound waves (flexural waves) which are excited by air-borne noise. The flexural waves tend readily to excite air-borne waves. Therefore, they play an important role in noise radiation from the case cover.

Added to this is the fact that the timing gear case also acts as a transmitter of structure-borne waves. These waves originate in the crankcase and then lead to plate-mode natural frequencies in the case cover.

An object of the present invention is to provide a timing gear housing without the use of any noise-damping layers in a manner that frequency detuning of the case cover is produced and thereby the effect of structure-borne waves and air-borne waves is reduced.

The invention provides a timing gear housing of an internal combustion engine comprising a case accommodating the timing gears and a cover sealingly connected to the case by means of screws or bolts wherein additional means are provided for clamping the case and cover together.

The additional means may be provided in the free area of the case between the timing gear or they may be formed as extensions of the gear trunnions. Both designs may be applied together in a timing gear case.

Since it is necessary to provide accurate tuning of the clamping, preferably the means for clamping are designed as rigid and/or flexible screwed or bolted joints. However, it is also possible to use compression members provided on the case and/or the case cover bearing against the case and cover and these may, in turn, be rigid or possess different flexibility by the interposition of spring means.

The case cover may be clamped with a predetermined deflection with the case and/or additional masses may be provided on the case cover to change the frequency, for instance, in the form of ribs or similar configurations.

Embodiments of the invention will now be described with reference to the accompanying drawings, wherein:

Fig. 1 is a plan view of an open timing gear case according to the invention with the timing gears arranged therein,

Fig. 2 is a front view of the timing gear case of Fig. 1,

Fig. 3 is a section substantially along the line III—III of Fig. 2, and

Figs. 4 and 5 show in section alternative methods of clamping according to the invention.

In Fig. 1, a case 1 of a timing gear housing is attached to the crankcase seen from the front

end, the case being formed with a plane end surface 2 to receive a gasket (not shown). The end surface 2 is provided on the perimeter of the case 1 with tapped holes 3, preferably equally

5 spaced, so that a case cover 4 (Fig. 2) can be tightly screwed or bolted on. Inside the case 1, a drive gear 5 is solidly connected to the crankshaft and meshes with an idler gear 6, which positively meshes with a camshaft gear 7, an injection
10 pump gear 8 and an oil-pump drive gear 9 to drive various auxiliaries. In the clear space 10 of the case 1 bosses 12 are provided between the timing gears 5, 6, 7, 8, 9, and these are flush or substantially flush with the plane end surface 2
15 and are provided with tapped holes 11 for clamping the case parts 1, 4.

The case cover 4 of the timing gear case of Fig. 1 can be seen in Fig. 2. Screws 13, arranged around the perimeter of the cover 4, are inserted
20 in the tapped holes 3 (Fig. 1) whereby a tight closure is achieved. Centres 14, 15, 16 of the drive gear 5, the idler gear 6 and the injection pump gear 8 respectively are indicated in Fig. 2. Furthermore, the cover 4 is provided with
25 clamping screws 17 inserted in tapped holes 11 (Fig. 16 for clamping the cover 4 and the case 1. Finally, the cover 4 may be provided with additional masses 18 changing its frequency and which are only shown by dashed lines.

30 Fig. 3 shows the upper part of the case 1 which is closed by the case cover 4 by means of the screws 13 with a gasket 19 interposed. The idler gear 6 and the injection pump gear 8 are shown inside the case 1. Furthermore, one of the bosses
35 12 can be seen into which a clamping screw 17 is inserted. A bearing trunnion 20 of the idler gear 6 extends through the case cover 4 and a nut 21 also provides rigid clamping.

Fig. 4 also shows the bearing trunnion 20 of
40 the idler gear 6 which again extends through the cover 4. Between a bearing bush 22 and the cover 4 and between the latter and a stirrup 23 guided on the bearing trunnion, there are flexible rings 24 whereby more or less flexible clamping is
45 obtained between the case 1 and the cover 4, depending on the type of material used.

Fig. 5 shows a further method of clamping. In this case, the cover 4 is clamped via the bearing bush 22 of the idler gear 6 with a flexible plate 25
50 interposed.

Claims

1. A timing gear housing of an internal combustion engine comprising a case accommodating the timing gears and a cover
55 sealingly connected to the case by means of screws or bolts wherein additional means are provided for clamping the case and cover together.

2. A timing gear housing as claimed in Claim 1,
60 wherein the additional means are provided in a clear area of the case between the timing gears, and/or comprise extensions of trunnions of the gears.

3. A timing gear housing as claimed in Claim 1
65 or 2, wherein the said additional means comprise rigid and/or flexible screwed or bolted joints.

4. A timing gear housing as claimed in claim 1 or 2, wherein the said additional means comprise compression members arranged on the case
70 and/or the cover and bearing against the case and cover.

5. A timing gear housing as claimed in Claim 4, wherein the compression members are arranged rigidly and/or with different flexibility provided by
75 spring means between the case and the cover.

6. A timing gear housing as claimed in any one of the preceding claims, wherein the cover is clamped with the case with pre-determined
80 deflection.

7. A timing gear housing as claimed in any one of the preceding claims, wherein additional masses are provided on the cover to change the frequency thereof.

8. A timing gear housing substantially as
85 herein described with reference to any one of the embodiments shown in the accompanying drawings.

9. An internal combustion engine having a timing gear housing as claimed in any one of the
90 preceding claims.