Aug. 30, 1966 R. KLEEBERGER 3,269,193
FLYWEIGHT GOVERNOR, PARTICULARLY FOR FUEL INJECTION TYPE INTERNAL COMBUSTION ENGINES
Filed Sept. 19, 1963 2 Sheets-Sheet 1

Fig. 1

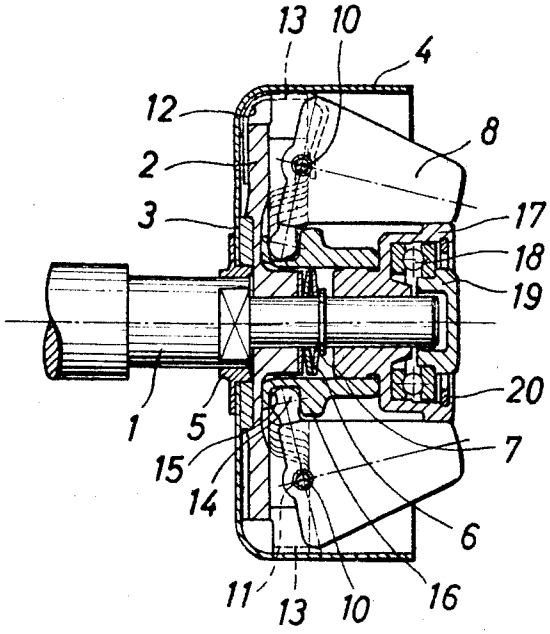
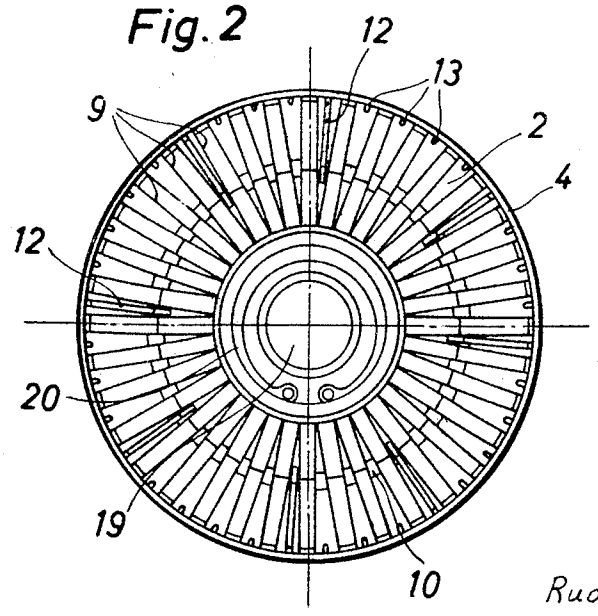


Fig. 2



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Filed Sept. 19, 1963 2 Sheets-Sheet 2

Fig. 4

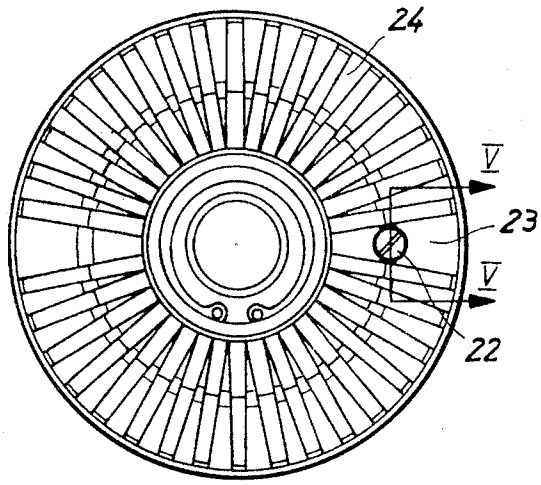


Fig. 3

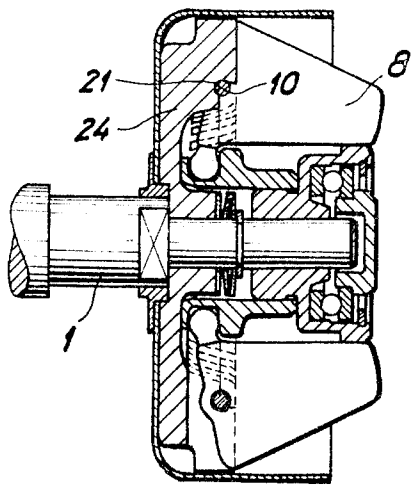
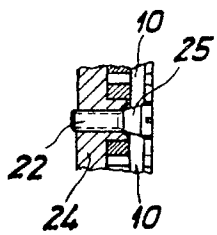


Fig. 5



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3,269,193

FLYWEIGHT GOVERNOR, PARTICULARLY FOR FUEL INJECTION TYPE INTERNAL COMBUSTION ENGINES

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5 Claims. (Cl. 73—526)

This invention relates to flyweight governors and refers more in particular to flyweight governors adapted for use in conjunction with internal combustion engines of the fuel injection type.

The most important requirement a flyweight governor has to meet is that it should have a large working capacity. Where a flyweight governor is intended to be used in conjunction with an internal combustion engine of the fuel injection type, such a governor is in addition required to occupy as little space as possible, and the governor should be of simple and rugged construction. It is of prime importance that the friction between the moving parts of a flyweight governor should be kept at a minimum so as not to impair the working capacity and the sensitivity of the governor. In the manufacture of flyweight governors intended for use in conjunction with fuel injection type internal combustion engines, i.e. in cases in which mass production procedures are applied, it is moreover important to reduce production and assembling costs to a minimum.

It is one of the important objects of the invention, as regards a flyweight governor including a plurality of flyweight mounted for pivotal motion radially of the governor shaft, which flyweights co-operate with a spring-loaded sleeve axially slidably supported by the governor shaft in such a manner as to cause any pivotal motion of the flyweights to produce an axial displacement of said sleeve, to meet the aforementioned requirements which are partly contradictory. It is another object of the invention to provide a flyweight governor of the general type mentioned whose construction permits the working capacity of the governor to be easily matched with the controlling force the governor is required to produce. It has been known that different models of engines to be controlled by a governor require different amounts of controlling force, and that the necessary controlling forces even differ among engines of the same model or type. Heretofore this situation has not only made it necessary to make available a large number of governors of different size, requiring costly inventories, but has also necessitated time-consuming adjusting operations intended to produce a perfect match between a given governor and the engine to be controlled.

In order to attain the above-stated objects of the invention, there is provided, according to the invention, in a flyweight governor of the type named, a pot-like casing carried by the governor shaft and provided, in its cylindrical portion, with radial grooves adapted to receive and laterally guide a plurality of plate-like flyweights, the said casing being further provided with an annular groove receiving an annular wire serving as a pivot for the said flyweights.

According to one feature of the invention, the said casing of the flyweight governor is mounted for free rotation and axial displacement in relation to the governor shaft, there being interposed between the casing and the governor shaft a device adapted to dampen torsional vibrations, the said device connecting the casing to the governor shaft for rotation therewith.

According to another feature of the invention, the casing of the flyweight governor is enclosed in a cup-like

member formed of sheet metal, the cylindrical wall of the cup-like member forming an abutment limiting the outward pivotal motion of the flyweights.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawing, illustrating a preferred embodiment of the invention, wherein:

FIG. 1 is an axial sectional view, partly in elevation, of one embodiment of a flyweight governor according to the invention;

FIG. 2 is an end elevational view of the flyweight governor of FIG. 1;

FIG. 3 is an axial sectional view, partly in elevation, of a modified embodiment of the invention;

FIG. 4 is an end elevational view of the flyweight governor of FIG. 3; and

FIG. 5 is a fragmentary cross-section along the line V—V of FIG. 4.

Referring now more in particular to the drawings, there will be seen in FIG. 1 the governor shaft **1** carrying a pot-like casing **2** which is freely rotatable and axially displaceable in relation to the governor shaft. A damper disc **3** which, together with a sheet-metal cup **4** surrounding the casing **2**, is secured to a sleeve **5** for rotation therewith, the said sleeve being press-fitted to governor shaft **1** and being secured by known means to shaft **1** for rotation therewith, connects the governor shaft **1** to the housing **2** so that these members rotate in unison. A cup spring **6** bearing on the hub portion of casing **2** as well as on a circular clip **7** mounted in an annular groove provided in shaft **1** urges casing **2** against damper disc **3**. Disposed within casing **2** are a plurality of flyweights **8**, the outer ends of the flyweights being engaged in radial slots **9** formed in the cylindrical portion of the pot-shaped casing **2**. A ring **10** made of spring wire forms a pivot for the flyweights **8**. The ring **10** is disposed in an annular groove **11** formed in casing **2**. A plurality of clips **12** made of spring wire retain the ring **10** in the groove **11**. The said clips **12** are bent to U-shape; they are disposed in axially extending grooves **13** formed in the periphery of casing **2**, one leg of each clip being clamped in position between casing **2** and the sheet-metal cup **4** surrounding the casing.

FIGS. 3 to 5 show a modified arrangement for locking and retaining ring **10** in position. As seen in FIG. 3, the groove **21** receiving ring **10** is undercut rather than being formed to have a semicircular cross-section as is the case with the aforedescribed annular groove **11**. Thus, the groove **21** affords axial support for the ring **10**, such axial support being afforded by the clips **12** in the embodiment shown in FIGS. 1 and 2. For the purpose of locating the ring **10** in a radial direction, there is provided a screw **22** which is engaged in a threaded hole provided in a sector-shaped web **23** of casing **24**, the construction of casing **24** in all other respects corresponding to that of the casing **2** described earlier. The screw **22** has a tapered head **25** engaging the beveled ends of ring **10** so as to spread apart the ends of the ring in a tangential direction, the result of this arrangement being that ring **10** is fully engaged with groove **21** and is securely held in position.

The provision of the flyweights **8** in the grooves **9** of casing **2** and the large number of grooves **0** available makes it possible, for example, to employ but a small number of flyweights to obtain a correspondingly small working capacity of the flyweight governor of the invention, or to dispose a flyweight in each of the grooves for the purpose of obtaining the maximum working capacity of the governor, it thus being possible to adjust the working capacity in an almost stepless manner.

The flyweights **8** each carry a projection **14**, the projections **14** of all flyweights used being engaged in an an-

nular groove 15 formed in the control sleeve 16 disposed co-axially with the governor shaft 1. The control sleeve 16 is guided by a sleeve member 17 supported for free rotation and axial displacement in relation to governor shaft 1. Upon the flyweights 8 being pivoted outwardly as a result of an increase in the speed of governor shaft 1, the control sleeve 16 will be displaced axially, producing a corresponding axial displacement of sleeve member 17. Mounted within the sleeve member 17 is one race of a ball thrust bearing 18, the other race of bearing 18 being a press fit on a cylindrical portion of a thrust member 19. Thrust member 19 is axially spring-loaded by known means (not shown). A spring ring 20 located in an annular groove formed in sleeve member 17 serves to locate thrust bearing 18 in an axial direction.

What is claimed is:

1. A flyweight governor comprising a plurality of flyweights mounted for pivotal motion radially of a governor shaft, said flyweights being in engagement with a spring loaded sleeve adapted to be axially displaced in relation to said governor shaft in such a manner that any pivotal motion of the flyweights will produce a displacement of said sleeve, a pot-shaped casing on said governor shaft, said casing including a cylindrical portion formed with radial slots adapted to receive and laterally guide a plurality of plate-like flyweights, said casing being provided with an annular groove receiving a ring formed of wire and serving as a pivot for said flyweights, said wire formed ring being held in position by a plurality of clips equidistantly spaced along the circumference of the ring, said clips being of U-shape and made of spring wire, said clips straddling the periphery of said casing to retain said ring in said annular groove formed in said casing.

2. The flyweight governor of claim 1, wherein the said casing is provided in its periphery with a plurality of grooves adapted to locate said spring wire clips.

3. The flyweight governor of claim 1, wherein said annular groove receiving the said wire ring is undercut in such a manner as to retain said wire ring in an axial direction, said ring of spring wire being cut at one point, the two opposite surfaces of said cut having opposite inclinations, and wherein a threaded hole provided in a sector-shaped web of said casing in the region of said annular groove receives a screw having a tapered head adapted to spread apart in a tangential direction the adjacent bevelled ends of said wire ring.

4. The flyweight governor of claim 1, wherein said casing is mounted on said governor shaft for free rotation and axial displacement in relation thereto, and wherein said casing is connected to the governor shaft for rotation therewith by a device adapted to dampen torsional vibrations, said device being interposed between the casing and the governor shaft.

5. The flyweight governor according to claim 1, wherein said casing is surrounded by a sheet-metal cup having a cylindrical wall adapted to act as an abutment limiting the outward pivotal motion of said flyweights.

References Cited by the Examiner

UNITED STATES PATENTS

2,392,265	1/1946	Ricardo	73—550
2,413,882	1/1947	Miller	73—530
2,660,421	11/1953	Sorensen	73—522

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