AUTOMATIC TIMING DEVICE FOR ENGINES

Filed Oct. 9, 1959

FIG. 1.

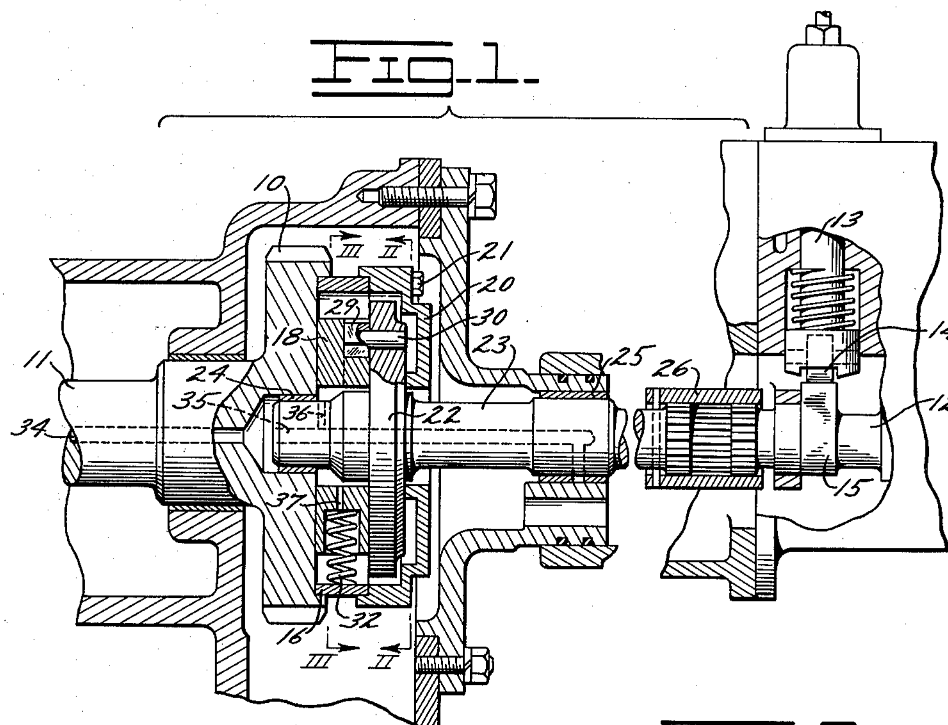


FIG. 2.

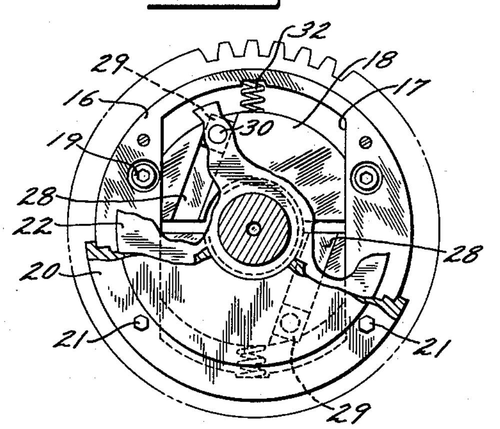
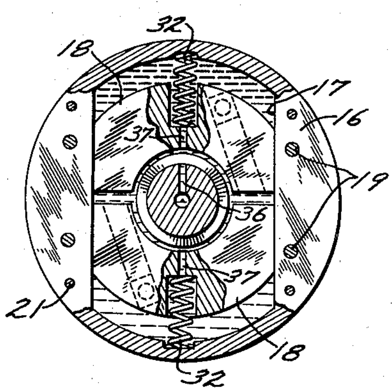


FIG. 3.



INVENTORS
ROBERT R.B. BACKLUND
JOHN M. BAILEY
ALEXANDER GOLOFF
DONALD C. DOWDALL
HARRY M. KILEY
BY
Fryer and Johnson
ATTORNEYS

United States Patent Office

2,977,778

Patented Apr. 4, 1961

1

2,977,778

AUTOMATIC TIMING DEVICE FOR ENGINES

Robert R. B. Backlund, Morton, John M. Bailey, East Peoria, Alexander Goloff, Washington, Donald C. Dowdall, Pekin, and Harry M. Kiley, Washington, Ill., assignors to Caterpillar Tractor Co., Peoria, Ill., a corporation of California

Filed Oct. 9, 1959, Ser. No. 845,444

5 Claims. (Cl. 64—25)

This invention relates to a coupling device between a driving shaft and a driven shaft including means through which the angular relationship between the two shafts varies automatically within limits as a function of the speed of rotation of the shaft.

The ensuing description is directed particularly to the automatic regulation of the advance in cyclic timing of the injection pumps of a diesel engine. However, the timing of other types of engines can be varied by the device as will be apparent upon an understanding of the invention.

It is well recognized that the efficiency and economy of an internal combustion engine depends upon the time of firing with relation to crankshaft position and that it is desirable to vary this time as the speed of operation of the engine varies. Devices for automatically varying the time of firing or the time of injection in a compression ignition type engine are known and usually comprise a system for connecting two shafts including weights adapted to move away from each other under the influence of centrifugal force and against an opposing resilient action, the angular relationship between the two shafts being modified in response to movement of the weights. In presently known devices designed for this purpose, undesirable pulsations are created by cyclic forces of the engine and reactionary forces are brought about by sudden changes in engine speed which cause an undesirable reverse action resulting in erratic engine performance. An unusual amount of fretting between the metal parts of such devices which interferes with the smooth satisfactory functioning of the devices is also experienced.

It is the object of the present invention to provide an automatic timing device for engines or the like which overcomes the aforementioned deficiencies of existing devices and which provides means for effecting hydraulic damping of flyweights as they move in two directions responsive to acceleration and deceleration of the shaft speed and also to provide novel means for reducing friction and fretting of the moving parts through their design and through adequate lubrication and a balance of hydraulic pressures within the device.

Further and more specific objects of the invention reside in the construction and particular arrangement of its several components and are made apparent in the following specification wherein reference is made to the accompanying drawings illustrating the invention in a preferred form.

In the drawings:

Fig. 1 is a central vertical section through an automatic timing device embodying the present invention and illustrating its connection with the fuel injection pump cam shaft of an internal combustion engine of the compression ignition type;

Fig. 2 is a sectional view with parts broken away taken on the line II—II of Fig. 1; and

Fig. 3 is a similar view taken on the line III—III of Fig. 1.

In Fig. 1 of the drawings, drive means for a fuel injection cam shaft is shown as comprising a gear **10** which is engine driven through a gear train not shown and in the present instance is illustrated as also connected with and imparting rotation to a power take-off shaft represented at **11**. The gear **10** drives a fuel injection cam shaft shown at **12** which drives a fuel injection pump for each of the cylinders of the engine, one of such pumps being illustrated at **13** as having a cam follower **14** engageable with a cam **15** on a shaft **12**.

It is to the drive between the gear **10** and the cam shaft **12** that the present invention is directed. The gear **10** carries, as shown in Figs. 1, 2 and 3, a flyweight housing **16** of cylindrical shape on its outer diameter and having a substantially rectangular chamber as shown at **17** for the reception of a pair of flyweights **18** disposed for radial sliding movement in the chamber **17**. The housing **16** is secured to the gear **10** as by cap screws such as shown at **19** in Figs. 2 and 3 and a recessed cover plate **20** is secured to the member **16** as by cap screws **21**. The recessed cover plate **20** contains a disc **22** formed on or non-rotatably secured to a shaft **23** which is piloted in the gear **10** as by a bearing illustrated at **24** and suitably supported in a bearing **25** adjacent its opposite end. This shaft **23** is coupled to the cam shaft **12** as by a spline connection indicated at **26**.

In order to drive the disc **22** and, therefore, the cam shaft to which it is coupled upon rotation of the gear **10**, the flyweights **18** are provided with angularly disposed cam slots **28** which slidably receive blocks **29** carried by pins **30** which project from the face of the disc **22**. The flyweights **18** are biased inwardly toward the center of the chamber **17** by springs **32** and upon acceleration of the engine to high speed operation the weights move outwardly under the influence of centrifugal force against the force of the springs **32**. As a result of this outward movement, the cam slots **28** acting on the slide blocks **29** effect adjustment of the phase position of the flyweights and disc **22** to advance the position of the cam shaft from 6° to 10° depending upon the particular design of the mechanism and speed of the engine and this advancing of the timing provides improved acceleration, more efficient fuel consumption and a higher engine output.

In order to prevent sudden movement of the flyweights in response to quick acceleration or deceleration, a supply of oil under pressure, preferably from the engine lubricating oil system, is introduced to the chamber **17** through an axial bore **34** in the power takeoff shaft and through a bore **35** and connecting radial passage **36** in the shaft **23**. The oil passes further through radial passages **37** in the flyweights **18** as best shown in Figs. 1 to 3 and then, through the pocket which receives the springs **32**, into those portions of the chamber **17** which are disposed radially outwardly of the flyweights. Consequently when the flyweights **18** move radially either inwardly or outwardly, this oil must pass through the restricted passages **37** and has a damping effect to prevent sudden or erratic motion which would be transmitted to the cam shaft **12**.

The disc **22** as best illustrated in Fig. 1 is slightly smaller in diameter than the interior of the member **20** by which it is housed and is spaced from the member **20** to permit oil in the chamber **17** to occupy the space behind it. Thus upon outward movement of the flyweights pressure on the face of the disc which is exposed in the chamber **17** is communicated also to the opposite side of the disc to relieve a tendency of the disc to bind against the housing and thus also contribute to the desired smooth operation of a device.

We claim:

1. In an automatic timing device for engines having a rotatable shaft as a part of the engine timing mechanism and a rotatable member for driving said shaft means to

vary the phase positions of said shafts in response to their rotary speed comprising a flyweight chamber carried by the driving member, a pair of flyweights in said chamber, driving pins disposed in cam slots between the flyweights and the timing mechanism shaft to advance the timing when the flyweights move outwardly in response to acceleration, resilient means to resist outward movement of the flyweights, and fluid damping means to damp their outward movement.

2. In an automatic timing device for engines having a rotatable shaft as a part of the engine timing mechanism and a rotatable member for driving said shaft means to vary the phase positions of said shafts in response to their rotary speed comprising a flyweight chamber carried by the driving member, a pair of flyweights in said chamber, driving pins disposed in cam slots between the flyweights and the timing mechanism shaft to advance the timing when the flyweights move outwardly in response to acceleration, resilient means to resist outward movement of the flyweights, and fluid damping means to damp both the outward and inward movement of the flyweights.

3. An automatic timing device for use between aligned driving and driven shafts which actuate the timing mechanism of an engine comprising a flyweight chamber carried by the driving shaft, a pair of flyweights disposed for opposite radial sliding movement in said chamber, a disc on the driven shaft, drive pins on said disc, and said flyweights having cam slots receiving said pins whereby outward movement of the flyweights in response to acceleration will advance the phase position of the driven shaft, means to supply fluid to said flyweight chamber, and means to restrict the flow of fluid past the flyweights as they move radially in the chamber.

4. An automatic timing device for use between aligned driving and driven shafts which actuate the timing mechanism of an engine comprising a flyweight chamber carried by the driving shaft, a pair of flyweights disposed for opposite radial sliding movement in said chamber, a disc on the driven shaft, drive pins on said disc, and said flyweights having cam slots receiving said pin whereby outward movement of the flyweights in response to acceleration will advance the phase position of the driven shaft, said flyweights and said disc being enclosed in a fluid tight housing, means to supply a damping fluid under pressure to said housing, and means to communicate said fluid to the surface of the disc opposite the flyweights to balance the thrust effect of the pressure.

5. A device for automatically changing the phase position of a rotary driving member and a shaft driven thereby in response to their rotary speed comprising a flyweight chamber carried by the driving member, a pair of flyweights in said chamber, driving pins disposed in cam slots between the flyweights and the timing mechanism shaft to advance the timing when the flyweights move outwardly in response to acceleration, resilient means to resist outward movement of the flyweights, and fluid damping means to damp their outward movement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,029,026	Newman	June 11, 1912
1,579,287	Duten	Apr. 16, 1926
1,957,181	Mitchel	May 1, 1934
2,722,813	Aldiner	Nov. 8, 1955