

SECTION 5, CHAPTER 5

GOVERNORS

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Introduction

1. When an internal combustion engine is driving some form of equipment, the speed of the engine will vary according to the load applied, i.e. the speed will increase with decrease in load and vice versa. Thus, constant operation of the control mechanism is required, otherwise, the engine or the equipment connected to the engine might be damaged by too high a speed, or be operating inefficiently when the load was large. Consequently a device is required which will automatically maintain the engine speed constant, and such a device is known as the governor unit.

2. There are various forms of governor in use on different types of engines. Some governors are designed to limit maximum speed only, some control both maximum and idling speeds, whilst others control the whole speed range from idling to maximum. Compression ignition engine governors are usually mechanical or pneumatically operated, although occasionally hydraulic operation is used; the mechanical and pneumatic types which are connected to the control rod of the fuel injection pump are described in Chapter 6.

3. Governors used on both air and liquid cooled spark ignition engines for operating ground equipment are mostly mechanical, although some engines that are equipped with Solex carburettors may have an air

flow operated governor unit incorporated in the carburettor. This latter type of governor unit is described in Chapter 2, consequently the following information is confined to mechanical units. The operative agent of a mechanical governor is centrifugal force, varying as the square of the speed. These mechanical governors are usually of the hinged-weight or the ball-and-cone types, wherein movement of the weights or balls, caused by the effects of centrifugal force, is transmitted to the carburettor control linkage, thus maintaining a pre-set engine speed. To prevent hunting or surging of the throttle, a damping device, often in the form of friction discs or an oil-filled dashpot, is sometimes fitted in the linkage.

HINGED WEIGHT TYPE

General

4. There are various forms of the hinged weight type of governor in use on internal combustion engines installed in ground equipment, but they all operate on the same principle. As stated previously, the operative agent of a governor of this type is centrifugal force, with the effects of which most people are familiar, i.e. the greater the speed of rotation, the greater is the tendency for a weight to be flung outwards. This movement can be used to move a simple system of links and levers and thus control

the opening of the carburettor throttle valve, thus controlling the speed of the engine.

Construction

5. A typical hinged weight type governor is illustrated at Fig. 1. It will be seen that the governor is driven by a gear on the engine camshaft, but sometimes they are driven by the timing wheels, off the end of the crankshaft, or off the magneto driving gear, etc. In this example, the weight levers pivot on pins fitted in drilled bosses of the governor pinion. The inner ends of the levers bear against the moveable governor sleeve, which bears against the crank that is clamped into the governor lever, the latter being connected to the short arm of the governor lever, and is tensioned by an adjuster and adjustment nut. Its main purpose is to provide an adjustable load acting against the action of the weights, but it also serves to keep the crank in contact with the governor sleeve.

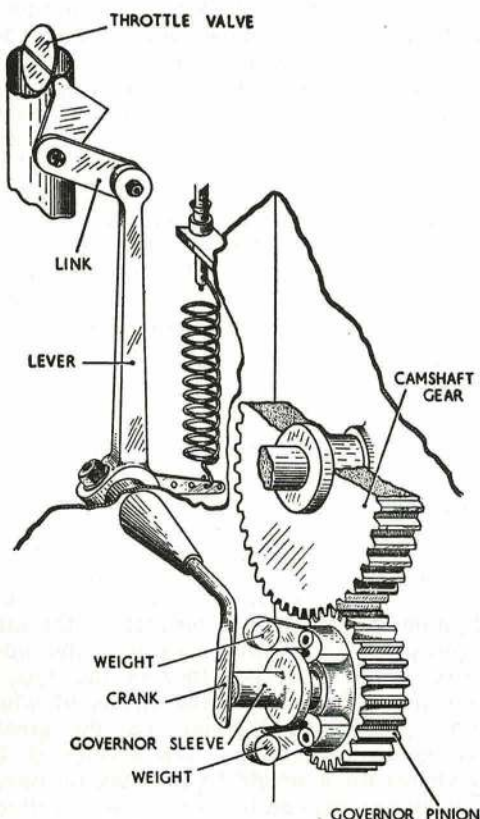


Fig. 1. HINGED WEIGHT GOVERNOR

Operation

6. The engine is started at maximum throttle opening and, as the engine speed increases, the weights move outwards, moving the governor sleeve, crank and governor lever against the tension of the governor spring. This action causes the carburettor throttle valve to move towards the closed position, thereby limiting the engine speed.

Adjustment

7. Under normal circumstances it should not be necessary to disturb the maker's setting of the governor. If, however, it becomes necessary to re-set it, increase the tension of the governor spring to increase the engine speed and decrease the tension to reduce the engine speed. On governors fitted with a remote control, this is done by altering the setting of the adjuster which is fitted on the Bowden control cable, and on others by rotating the nut attached to the screwed rod to which the top end of the spring is anchored. The adjuster must be locked in its final setting.

BALL AND CONE TYPE

General

8. This type of governor operates on the same principle as all other centrifugal type governors and, although differing in construction, has many similar features. A typical example of the ball and cone type governor is illustrated at Fig. 2, which, in this instance, is driven by the inlet camshaft timing wheel. On different engines they may be driven in various ways, just as the hinged weight type governors are.

Construction

9. The main part of the unit is the shaft which is mounted in two ball bearings, and formed with an integral solid cone. The solid cone has five part-spherical holes equally spaced around its conical face, each hole containing a steel finger ball. The balls are retained in the solid cone by a hollow cone, this component being free to slide on the governor shaft against the action of the regulating spring which bears against it. The movement of the sliding cone is limited by a collar (within the spring) which is pinned to the shaft. The other end of the spring bears against a collar which in turn bears against one of the shaft bearings, this bearing being housed in a cup-shaped sleeve that is free to slide in the governor

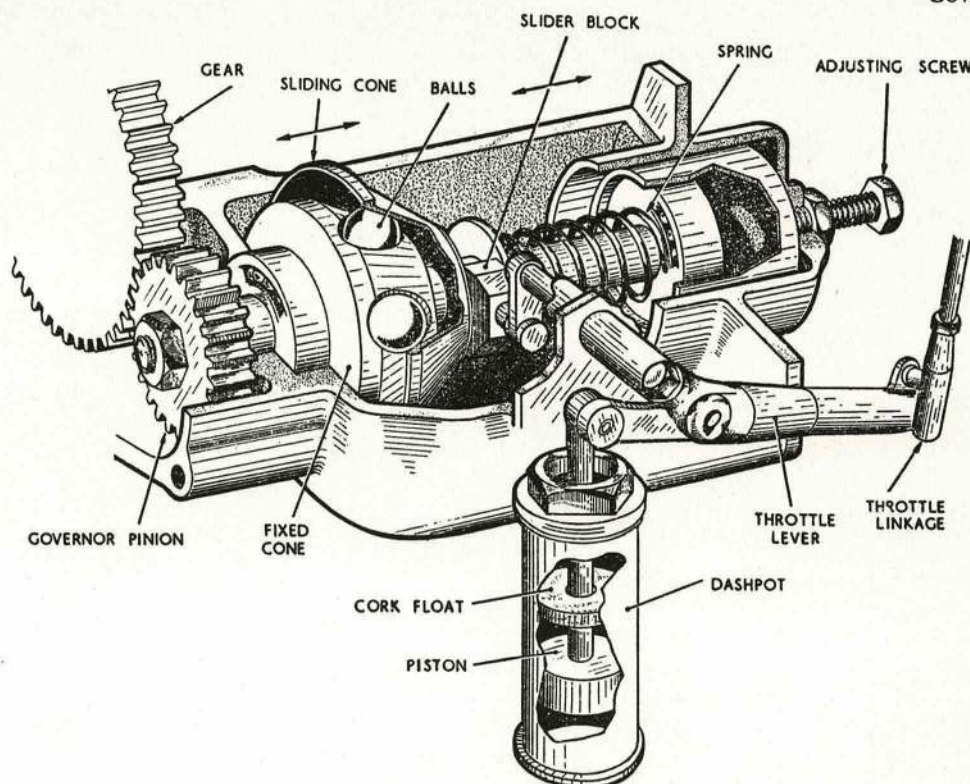


Fig. 2. BALL AND CONE GOVERNOR

end cap. Rotation of the sleeve is prevented by a peg, but it can be moved axially by means of the adjusting screw fitted centrally in the end cap.

10. The sliding cone is grooved to take a slider block which engages with a cranked operating lever, to the outer end of which is fixed the throttle lever, the movement of which is damped by a dashpot. The dashpot consists of a cylinder containing hydraulic fluid and a Tufnol piston, the piston being connected to the throttle lever by a rod. The damping action is obtained by restricting the flow of fluid from one side of the piston to the other, the flow taking place through a clearance of 0.007-in. between the piston and the cylinder. A cork float is fitted in the cylinder to eliminate surging of the fluid. The top of the dashpot is closed by a screwed cap incorporating a felt gland washer, this washer being held in place by a metal washer and circlip.

Operation

11. If the engine speed rises above the

governed speed, the flinger balls move outwards under the influence of centrifugal force and bear against the sliding cone, moving the cone along the governor shaft against the action of the regulating spring. The sliding cone carries the slider block with it, this action causing the cranked lever to turn and move the throttle lever, thus turning the carburettor throttle valve towards the closed position until the engine is again running at governed speed. If the engine speed falls below the governed speed, the flinger balls move inwards and the governor operates similarly (but with opposite movement) to open the throttle valve until the governed speed is attained.

Adjustment

12. Adjustment of the governed speed is obtained by slackening the locknut and turning the adjusting screw on the governor end cap to vary the load on the regulating spring; screw in to increase the governed speed, and out to decrease the speed.

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