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R. C. CROSS

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CENTRIFUGALLY-OPERATED ENGINE SPEED GOVERNOR

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Fig.1.

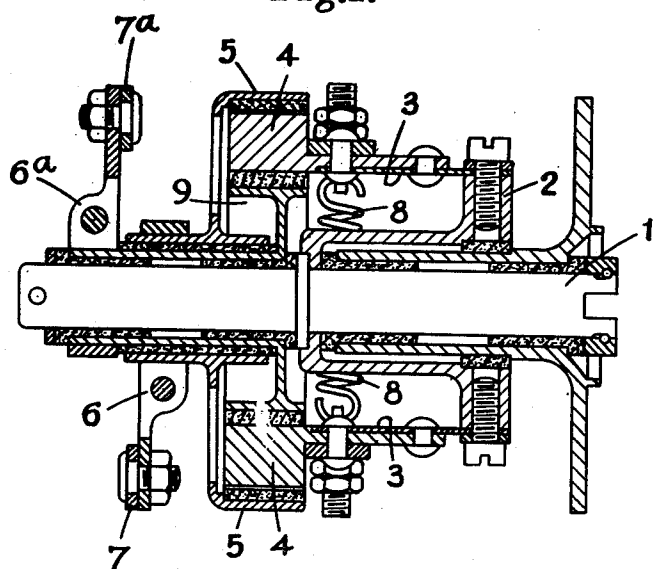
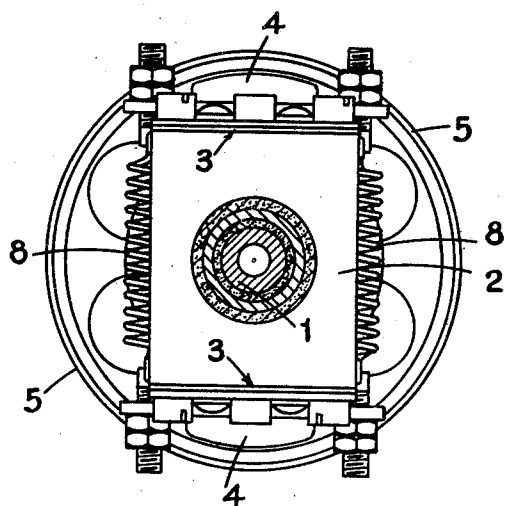


Fig.2.



INVENTOR  
ROLAND C. CROSS  
By *William H. Groff* Attys

## UNITED STATES PATENT OFFICE

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CENTRIFUGALLY OPERATED ENGINE  
SPEED GOVERNOR

Roland Claude Cross, Bath, England

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In Great Britain November 11, 1941

2 Claims. (Cl. 192-103)

This invention relates to centrifugal governors of the kind comprising one or more centrifugal weights each of which is carried at the free end of a strip of springy material (e. g. spring steel) so that movement of the weight, due to centrifugal force, flexes said strip of springy material. Governors of this kind are normally highly sensitive and efficient primarily due to the fact that the weight acted upon by centrifugal force is almost entirely free of friction, and in their application to engine control according to the invention they respond to very small changes in angular velocity around a critical revolution rate.

Heretofore, governors of the foregoing kind have been proposed for various purposes wherein weights at the ends of flexible strips of springy material are caused by centrifugal force, at a predetermined speed of the governor, to contact frictionally a member held stationary relatively to the rotatable governor to prevent the governor exceeding said speed.

According to the present invention such a governor is utilised for governing the speed of an engine, and accordingly a governor of the kind set forth driven by the engine is combined with a drum adapted to receive a turning movement according to the speed of the governor by frictional contact between the governor weights and the drum, said drum being coupled to operate the engine throttle.

The drum may surround the governor weights so as to be frictionally contacted thereby when the engine exceeds a predetermined high speed. There may be a second drum adapted to be frictionally contacted and moved by the weights as they move inwardly when the engine slows down to a predetermined low speed.

In order that the invention may be clearly understood and readily carried into effect reference will now be made to the accompanying drawing which illustrates an embodiment of the invention by way of example. In the drawing:

Figures 1 and 2 comprise a sectional side elevation and an end view of the governor.

Referring to the drawing the governor comprises a driving spindle 1 rotated by the engine the speed of which is to be controlled. To the spindle 1 is secured a rotatable body member 2 carrying one end of each of two strips 3 of spring steel. The free end of each spring steel strip 3 has secured thereto a centrifugal weight 4 adapted to be thrown outwardly by centrifugal force when the body member 2 is rotated by the driving

spindle 1 at a predetermined speed. The weights 4 are thrown outwardly when the engine exceeds a predetermined high speed to such an extent that they frictionally contact the inside surface of a drum 5 mounted to rotate freely on the driving spindle 1, this drum 5 being connected directly by an arm 6 and a link 7 or through gearing (not shown) with the engine throttle so as to close the latter. The arm 6 or the gears are only subject to partial rotation. When gears are used one of them is fitted with a pin for receiving a connection fitted to the throttle. The throttle may be spring loaded so as to open automatically when the speed of the driving shaft diminishes and the centrifugal weights 4 cease to make contact with the drum 5.

By mounting the weights 4 on strips 3 of spring steel there is, except for the very slight hysteresis brought about by the deflection of the spring steel strips (and this can be considered absolutely negligible) no friction whatever relative to the weight moving outwards against spring pressure as it is acted upon by centrifugal force.

The strips 3 of spring steel are preferably loaded by coiled tension springs 8 which are adjustable to regulate the outward movement of the weights 4.

It will be seen that this arrangement provides an extremely simple servo device, which, at the same time, is not so positive that the apparatus could become wrecked if anything jammed up outside of the governor.

Nevertheless, very considerable torque for operating the throttle could be achieved from this system by utilising (in the case of gearing) a gear reduction driven by the rotating drum 5. It will be seen that with a gear of, say, something between 80/1 and 100/1, a very slight torque would be necessary at the drum to give a strong twisting movement at the throttle. This would enable a very strong counteracting spring to be used for opening the throttle.

Further, when the friction between the drum 5 and the weights 4 ceases and the spring loading the throttle starts to work the other way, the gears would act as a dashpot, and the action would be steady and not jerky. Sudden opening and closing of a throttle is not conducive to the best results.

If necessary, where extreme sensitivity and quick action are required with light loads, the gearing mentioned in the foregoing embodiment can be omitted and the drum made to act direct through the arm 6 and lever 7 upon the throttle against spring pressure. In such an arrangement

however it may be desirable in order to avoid too vigorous an action to incorporate some form of a dashpot or the equivalent of which there are many suitable types, such for example as a piston operating in an oil container, or alternatively a rotating paddle, such as is used in various types of machinery, could be used for this purpose.

Where the control system requires very heavy loads to work it then this can be effected through the intermediation of an additional servo device making use of oil pressure on the engine or other mechanism through a cylinder and piston arrangement. The latter could be worked quite easily by means of a simple oscillating or sliding valve.

According to the illustrated form of the invention a smaller drum 9 is provided in spaced relationship inside the first mentioned drum 5 so that the centrifugal weights 4, when moving inwardly as the engine slows down to a predetermined low speed, frictionally contact this second mentioned drum 9 and the ensuing torque applied to this second drum could be used for opening the throttle in place of the spring arrangement previously referred to. For this purpose an arm 6a and lever 7a may be provided which are operatively connected with the inner drum 9.

When two drums 5 and 9 are employed as described above the inner drum 9 may if desired be used simply as a braking device adapted to hold the throttle fixed in a desired open position while the weight or weights 4 are travelling around the annular space between the drums and touching neither the inner or outer drums. This state of affairs would occur when the load remained steady for long periods.

In the case of an overriding hand control for the engine throttle this could be used to operate a disconnecting clutch between the engine and the governor so that either the automatic control or the hand control is effective.

In all constructions the actual amount of travel outwards by the revolving centrifugal weights

is very slight as will be seen from the drawing. Where extreme sensitivity is required this distance need only be a few thousandths of an inch.

From the foregoing it is evident that the device will keep the engine very steady because the weights can touch against the drum or one of the drums only very lightly if the speed is close to the desired one and the friction will be only just sufficient to counteract the spring pressure operating in the opposite direction.

I claim:

1. A governor comprising a rotatable shaft, flexible arms mounted on said shaft for rotation therewith and for inward and outward flexure relative thereto, weights carried by said arms, a drum surrounding said weights and with which said weights are engageable under the action of centrifugal force when said shaft is rotated at and above a predetermined speed, a second drum disposed inwardly of said weights, coil tension springs connecting said arms and effective to flex them inwardly to cause engagement of said weights with said second-mentioned drum when said shaft is rotated at less than said predetermined speed, and adjustable means for varying the tension of said springs.

2. A governor comprising a rotatable shaft, flexible arms mounted on said shaft for rotation therewith and for inward and outward flexure relative thereto, weights carried by said arms, a drum surrounding said weights and with which said weights are engageable under the action of centrifugal force when said shaft is rotated at and above a predetermined speed, a second drum disposed inwardly of said weights, yieldable means separate from said arms effective to flex said arms inwardly to cause engagement of said weights with said second-mentioned drum when said shaft is rotated at less than said predetermined speed, and means for adjusting said yieldable means to vary the force exerted by the same to flex said arms inwardly.

ROLAND CLAUDE CROSS.