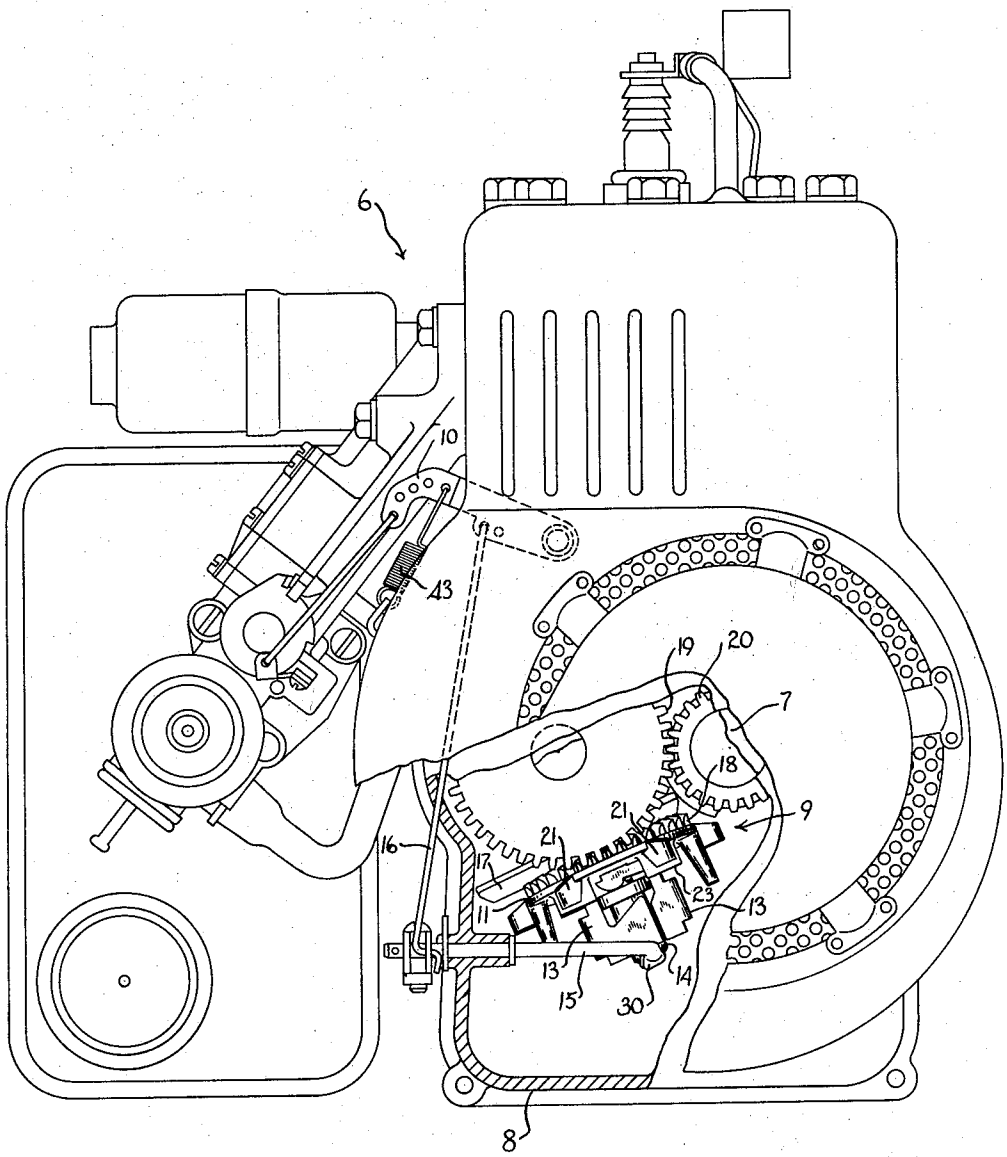
Sept. 22, 1964 R. K. CATTERSON 3,149,618

INTERNAL COMBUSTION ENGINE GOVERNOR

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Fig. 1.



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Fig. 2.

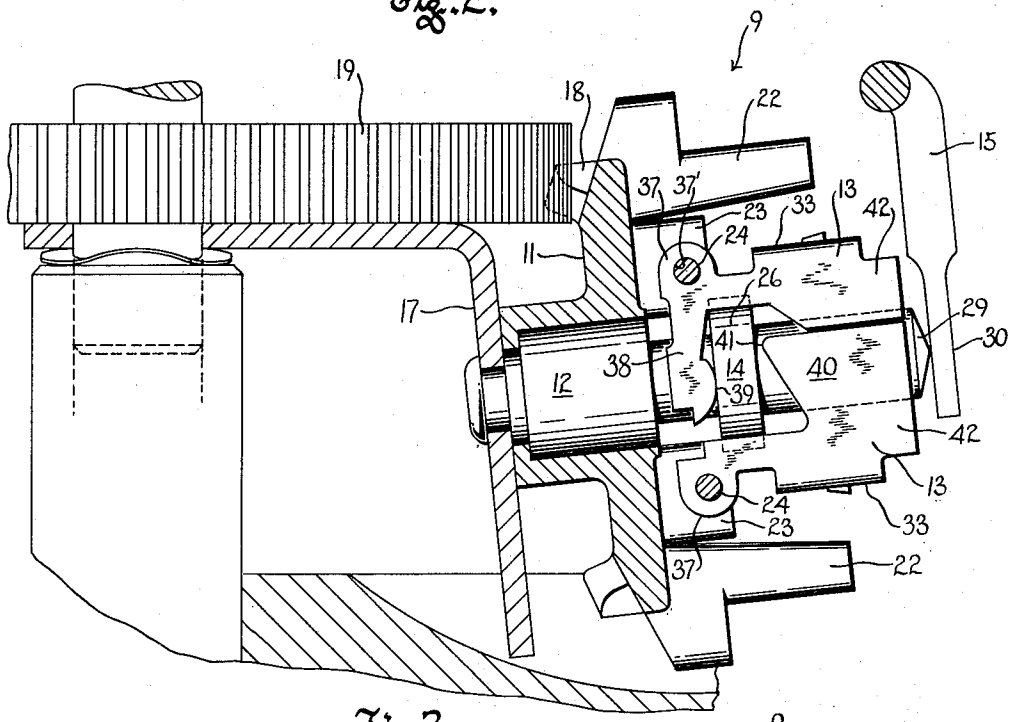
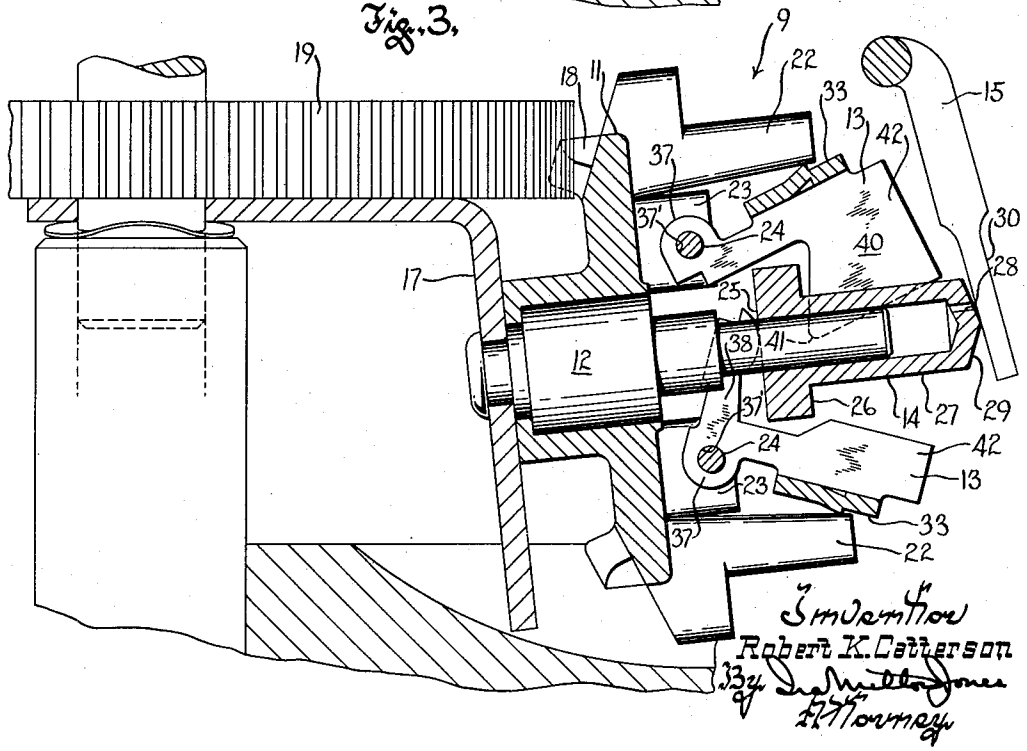


Fig. 3.



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Fig. 4.

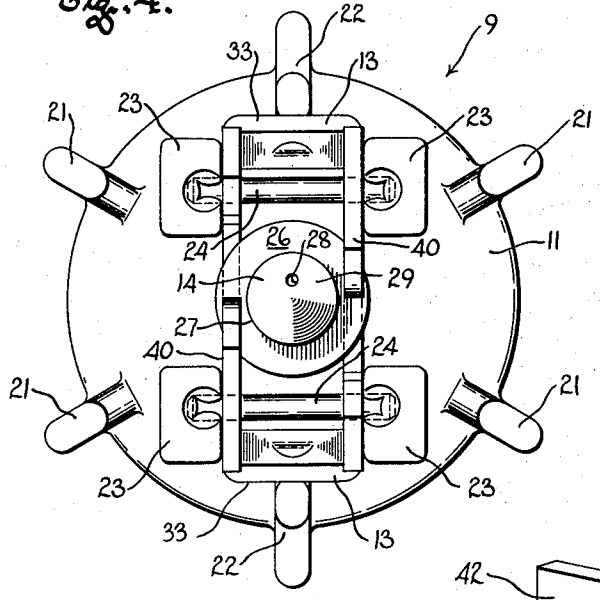


Fig. 5.

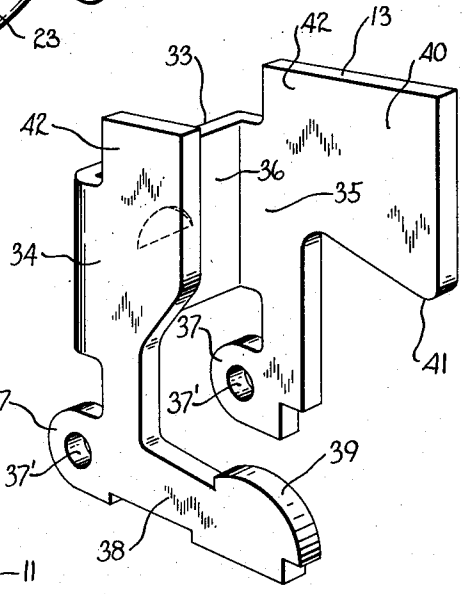
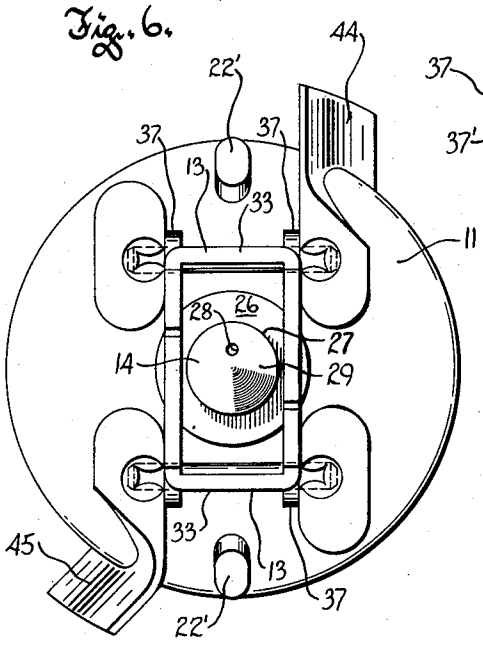


Fig. 6.



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United States Patent Office 3,149,618 Patented Sept. 22, 1964

3,149,618

INTERNAL COMBUSTION ENGINE GOVERNOR

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Filed July 19, 1962, Ser. No. 211,079
4 Claims. (Cl. 123—108)

This invention relates to governors for reciprocating internal combustion engines by which the position of the engine throttle is automatically adjusted to maintain a predetermined speed of crankshaft rotation, and the invention refers more particularly to an inexpensive centrifugally responsive governor mechanism which is particularly well adapted for use on small gasoline engines.

One internal combustion engines used on rotary power lawn mowers, it has been found desirable, in the interests of safety, to provide a governor which keeps the speed of the engine, and hence of the cutting blade, from exceeding a predetermined safe maximum limit when the blade is not encountering cutting resistance. One form of governor which has heretofore been commonly used for this purpose comprises an air pressure responsive vane linked with the throttle control of the engine and mounted in the stream of cooling air from the engine's blower to be moved by variations in the velocity of the cooling air flow. While inexpensive and relatively dependable, the air vane type of governor had certain disadvantages, including a lack of accuracy because the position of the vane could be affected by air currents from sources other than the engine blower. These deficiencies of the air vane governor were effectively overcome by the governor disclosed in Patent No. 3,028,848, to R. K. Catterson, issued April 10, 1962.

In the mechanism of that patent a rotary oil slinger, mounted on a stub shaft in the engine crankcase and driven by the crankshaft, served as a carrier for a number of centrifugally responsive balls that were confined in radially outwardly extending and forwardly inclined grooves in the oil slinger, opening to its front face. Slidable and rotatable on the stub shaft in front of the oil slinger was a follower or work performing member having a radially extending circumferential flange, the rear face of which was engaged by the balls so that the follower would be moved forwardly along the shaft by the axial component of centrifugally responsive outward movement of the balls in their slots. A feature of that governor was a cap-like enclosure portion on the follower which cooperated with the front end portion of the stub shaft to define a chamber the volume of which varied with the axial position of the follower along the shaft. The follower and the cap-like element thereon were of course immersed in the oil in the engine crankcase, and through a restricted orifice such oil was permitted to bleed into and out of the variable volume chamber to damp axial motion of the follower along the shaft. The cap-like portion on the follower also featured a coaxial substantially pointed tip portion on its end wall that engaged a lever or similar motion transmitting member in the crankcase comprising part of a linkage by which centrifugally responsive motion of the follower was imparted to the throttle of the engine, and which linkage included an element that extended through a wall of the crankcase. The pointed tip portion on the cap-like enclosure member minimized friction between the lever and the follower so that the latter could rotate freely with the oil slinger.

The present invention relates to improvements in the centrifugally responsive mechanism disclosed and claimed in Patent No. 3,028,848, and has as its general object the provision of such a mechanism which is easier and less expensive to manufacture than the particular mechanism illustrated in that patent but which sacrifices none of the advantages of that structure.

A more specific object of the present invention is to provide a centrifugally responsive mechanism for an internal combustion engine speed control, which mechanism comprises flyweights that can be readily formed as stampings and which can be easily and simply mounted on the engine oil slinger for orbital rotation therewith. In this respect, the present invention affords a solution to a problem encountered in production of the particular centrifugally responsive mechanism disclosed in Patent No. 3,028,848, namely, the difficulty of accurately forming the ball grooves in the oil slinger when the same was molded of plastic material.

Hence, it is another specific object of the present invention to eliminate the necessity for forming ball grooves in the oil slinger of a mechanism of the character described by replacing the ball type flyweights with simple and inexpensive stamped flyweights that can be readily mounted on the slinger for orbital motion therewith and for swinging motion relative thereto.

Another object of the invention is to simplify and reduce the cost of the follower damping means in an oil slinger governor of the type disclosed and claimed in Patent No. 3,028,848. In the structure illustrated in that patent the cap-like enclosure member which cooperated with the ball follower and the stub shaft to define the variable volume damping chamber was prevented from being displaced axially off of the front end of the shaft, prior and during assembly of the mechanism into an engine, by a large headed screw coaxially secured in the front end of the shaft. To permit this screw to be secured to the shaft the enclosure member was formed separately from the follower and was attached to the follower after the follower and screw were in place on the shaft.

By contrast, the present invention has as another of its specific objects the provision of a centrifugally responsive mechanism of the type disclosed and claimed in Patent No. 3,028,848, wherein cooperating means on the flyweights, on the oil slinger by which they are carried, and on the follower, prevent forward displacement of the follower off of the shaft, thus making it unnecessary to provide securement means on the shaft itself and making it possible to secure the cap-like enclosure portion to the follower before the latter is placed on the shaft, as by forming the enclosure portion integrally with the follower.

A further specific object of this invention is to provide a centrifugally responsive mechanism of the character described wherein said means on the flyweights for preventing axial displacement of the follower off of the shaft perform the additional important function of contributing centrifugally responsive mass to the flyweights, and wherein the cooperating means on the oil slinger which coact to prevent such displacement further serve to disperse oil through the interior of the engine body.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate two complete examples of the physical embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a top view of an engine on which the governor of this invention is installed, portions of the en-

gine being broken away to show the centrifugally responsive governor mechanism;

FIGURE 2 is a view of the centrifugally responsive mechanism itself, partially in side elevation and partially in longitudinal section;

FIGURE 3 is a longitudinal sectional view of the centrifugally responsive mechanism, showing the flyweights at their limiting position of outward swinging motion in response to centrifugal force;

FIGURE 4 is a front end view of the centrifugally responsive mechanism;

FIGURE 5 is a perspective view on an enlarged scale of one of the flyweights; and

FIGURE 6 is a view similar to FIGURE 4 but showing a modified embodiment of the invention incorporating a different type of oil slinger.

Referring now to the accompanying drawings, the numeral 6 designates generally a single cylinder internal combustion engine having a crankshaft 7 rotatable on a vertical axis in a crankcase 8 that provides a reservoir or sump in which is held a supply of lubricating oil for the engine. The engine is equipped with a centrifugally responsive governor mechanism 9 of this invention which is housed in the engine crankcase 8 and which automatically controls the position of the customary throttle lever 10 by which the speed of crankshaft rotation can be regulated, so as to maintain a predetermined maximum engine speed.

The governor mechanism 9 comprises, in general, a rotatable member 11 which in this case is an oil slinger, mounted on a stub shaft 12 in the engine crankcase, flyweights 13 carried by the oil slinger for orbital rotation therewith and for swinging motion relative thereto, and a follower or work performing member 14 which is axially slidable and rotatable on the stub shaft and by which swinging motion of the flyweights is translated into axial motion. Axial motion of the follower 14 is transmitted to the throttle lever 10 by means of a motion transmitting member 15 that is pivotally fulcrumed in a wall of the crankcase and connected with the throttle lever by means of a conventional linkage 16.

The stub shaft 12 on which the oil slinger 11 and follower 14 are mounted is carried by a bracket 17 which is fixed in the crankcase of the engine, and the stub shaft projects coaxially forwardly of the oil slinger to have the follower 14 slidable and rotatable on its front end portion. Further details concerning the mounting of the stub shaft can be found in the aforesaid Patent No. 3,028,848. The oil slinger is generally similar to that disclosed and claimed in the patent to Hugh S. Brown, No. 2,669,322, to which reference can be made for further details.

The driving connection between the crankshaft 7 and the oil slinger is provided by gear teeth 18 on the rear face of the slinger, which in this case are meshingly engaged with the teeth of the cam gear 19 that is driven from the timing gear 20 on the crankshaft, but obviously the gear 18 on the oil slinger could be directly engaged with the timing gear 20 or with a suitable crankshaft driven idler gear. The oil slinger has a number of circumferentially spaced apart vanes 21 near its periphery by which oil in the lower portion of the crankcase is picked up and thrown against the moving parts inside the engine, including a pair of diametrically oppositely located axially extended vanes 22 which provide post-like abutments engageable by the flyweights to define their outward limits of swinging motion as will appear hereinafter.

Projecting forwardly from the front face of the oil slinger are a number of circumferentially spaced apart bosses 23 which carry pivot means by which the flyweights 13 are mounted for swinging motion relative to the oil slinger and for orbital rotation with it. Preferably there are two pairs of such bosses, each pair cooperating to support a pin 24 that comprises the pivot means on which one of the flyweights is mounted, the pin being received in forwardly and inwardly opening grooves in the bosses

and being secured by a staking operation or the like which deforms the mouths of the slots to partially close the same. The pins 24 are of course assembled to the bosses 23 with the flyweights on them, since the bosses also serve to confine the flyweights against axial motion along their pins. It will be observed that the pins are arranged with their axes spaced radially outwardly from the stub shaft and transverse to its axis.

The work performing member or follower 14, by which outward swinging of the flyweights is translated into swinging of the motion transmitting member 15, is generally similar to that in the mechanism of Patent No. 3,028,848, having a hub portion 25 with an axially projecting circumferential flange 26 which the flyweights engage and a cup-shaped cap or damping member 27 which cooperates with the hub portion and with the front end portion of the stub shaft to provide a variable volume enclosure which serves as a dashpot that prevents hunting of the mechanism. In this case the damping member 27 can be readily formed integrally with the follower, and the stub shaft can have a uniform diameter from the oil slinger to its front end, since the damping member is held against forward displacement off of the shaft by means described hereinafter.

As in the follower member of Patent No. 3,028,848, a small orifice 28 opening through the end wall 29 of the cap-like enclosure member 27 permits oil to bleed into and out of the variable volume chamber defined by said member as the follower moves forwardly and rearwardly on the stub shaft. Also the end wall 29 is preferably conical, or is otherwise formed to a substantially small coaxial tip portion which has only point contact with a paddle-shaped end portion 30 on the motion transmitting member 15 so as to minimize rotational friction between the cap and the motion transmitting member. It will be understood that the follower member is not rotatably driven, but that it does tend to rotate with the oil slinger by reason of its connection with the slinger through the flyweights, and that any impedance to rotation of the follower would accordingly tend to retard rotation of the oil slinger.

Details of the motion transmitting member 15 and its linkage with the throttle are fully disclosed in Patent No. 3,028,848.

Each of the flyweights comprises a relatively simple stamping, the details of which are best seen in FIGURE 5. Each flyweight may be considered as having a generally U-shaped body portion 33, with a pair of parallel legs 34 and 35 extending generally rearwardly from a substantially wide bight portion 36, and terminating at their free ends in ear-like enlargements 37 in which are formed holes 37' through which the pivot pin 24 extends.

Projecting from one leg 34 of the flyweight, from near the pivot axis, and extending perpendicular to the pivot axis and the legs, is a rear arm 38 which has its free end portion disposed alongside the stub shaft. Near its outer end the front edge portion of the rear arm has a rounded protuberance or tip portion 39 which engages the rear face of the flange 26 on the follower to transmit forward swinging motion of the arm thereto, and it will be observed that because of this rounded tip portion only a small edge surface on the arm makes contact with the flange, regardless of the angle to which the arm may be swung. Since the two flyweights are identical with one another, and have their arms 38 extending in opposite directions, the rear arms on the two flyweights are disposed at opposite sides of the stub shaft and engage the flange 26 on the follower at points on diametrically opposite sides of the shaft axis, thus imposing symmetrical forces on the follower.

Projecting from the body 33 of each flyweight at the side opposite the arm 38 and near the bight portion, is another arm 40 which extends generally transversely to the axis of the pin 24 and which is disposed alongside the cap portion 27 of the follower, overlying the front face of the

flange 26. The front arm 40 has substantial width in the direction parallel too the legs 34 and 35, so as to have a relatively large centrifugally responsive mass. The rear edge of the front arm is inclined to the leg 35 in a direction to dispose its tip portion 41 rearwardly of its inner end portion, and hence only a small edge portion of the front arm makes contact with the flange in any position to which the flyweight may swing, again minimizing friction between the follower and the flyweights.

Paralleling the front arm on each flyweight, at the opposite side of the body, is a short extension 42 which contributes centrifugally responsive mass to the flyweight and which engages the front arm on the other flyweight when the two flyweights are swung fully inwardly to their retracted position of rest.

The limit of centrifugally responsive outward swinging movement of the flyweights is defined by the engagement of their bight portions 36 with the forward ends of the forwardly extended post-like vanes 22. Because of the engagement of the front arms 40 on the flyweights with the front face of the flange 26 on the follower, such engagement of the flyweights with the abutments provided by the extended vanes 22 also defines the forward limit of axial motion of the follower 14 along the stub shaft 12 and prevents forward displacement of the follower off of the shaft, prior to and during assembly of the centrifugally responsive mechanism into an engine.

Because of the different axial components of motion of the tips of the two arms on each flyweight, due to the different radii through which they swing about the axis of the pin 24, the axial spacing between the arms must of course be somewhat greater than the thickness of the flange 26, but the axial play of the follower relative to the flyweights which this arrangement permits is of no practical consequence because the bias upon the motion transmitting member, afforded by a spring 43 in the linkage 16 and which is provided to urge the throttle toward its closed position, maintains the follower engaged with the rear arm 38 on the flyweight.

In the modified embodiment of the invention illustrated in FIGURE 6, the oil slinger has vanes 44 and 45 of the type disclosed and claimed in the copending application of Paul J. Ebert, Serial No. 220,397, filed August 30, 1962, for Oil Slinger, whereby the oil slinger accommodates itself to both high and low oil levels in the crankcase. However, in this case the oil slinger is modified to include forwardly extending vanes 22' which provide stops or abutments that define the limits of radially outward swinging motion of the flyweights. In other respects the centrifugally responsive mechanism of the FIGURE 6 embodiment is identical with that hereinabove described.

From the foregoing description taken together with the accompanying drawings it will be apparent that this invention provides an improved oil slinger governor of the type disclosed and claimed in Patent No. 3,028,848, having very simple stamped flyweights which coact with vanes on the slinger to prevent forward displacement of the follower off of its stub shaft, and wherein the cap-like enclosure member that cooperates with the stub shaft to provide a dashpot effect can be formed integrally with the follower because no securement means is needed on the stub shaft to hold the follower in place.

What is claimed as my invention is:

1. In an internal combustion engine having a crankcase which provides a sump for lubricating oil and in which a crankshaft is rotatable, and having speed regulating means comprising a motion transmititng member, a portion of which is in the crankcase, means for adjusting the motion transmitting member in accordance with the rotational speed of the crankshaft, said means comprising:

(A) an oil slinger having a plurality of circumferentially spaced vanes, mounted in the crankcase of the engine and drivingly connected with the crankshaft to rotate therewith;

(B) a shaft projecting coaxially forwardly of the oil slinger;

(C) a cap-like follower member slidable and rotatable on the front end portion of the shaft and coacting therewith to define an enclosure the volume of which varies with the axial position of the follower member on the shaft and into and out of which oil can bleed through an orifice to exert a damping effect upon axial motion of the follower member, said follower member having a substantially pointed coaxial tip on its end wall which bears against said portion of the motion transmitting member;

(D) means on the follower member defining radially extending circumferential surfaces facing in opposite axial directions;

(E) a plurality of flyweights carried by the oil slinger for orbital motion therewith and each comprising

(1) a generally forwardly extending leg mounted on the oil slinger for radially in and out swinging movement about an axis which is transverse to that of the shaft and spaced radially outwardly therefrom,

(2) lateral extension means on said leg providing opposing surfaces spaced from the leg and its swinging axis and which engage said circumferential surfaces on the follower member to constrain the latter to axial back and forth movement on the shaft in unison with swinging movement of the legs, and

(3) means on each flyweight defining an abutment engageable with a vane on the oil slinger by which the outward limit of swinging motion of the flyweight is defined, to thus define the forward limit of axial movement of the follower member and prevent forward displacement of the follower off of the shaft.

2. In an internal combustion engine having a crankcase which provides a sump for lubricating oil and in which a crankshaft is rotatable, and having adjustable speed regulating means comprising a motion transmitting member, a portion of which is in the crankcase:

(A) an oil slinger rotatably mounted in the crankcase and drivingly connected with the crankshaft, said oil slinger having a plurality of circumferentially spaced apart forwardly projecting vanes;

(B) a shaft projecting coaxially forwardly from the oil slinger;

(C) a plurality of flyweights carried by the oil slinger for orbital motion therewith, each comprising

(1) a leg extending generally forwardly from a pivot on the oil slinger to be swingable radially inwardly and outwardly relative to the shaft about an axis eccentric and transverse to that of the shaft, and

(2) an arm extending laterally from said leg near the pivoted end thereof, and which swings forwardly in consequence of outward swinging of the leg;

(D) a follower slidable and rotatable on said shaft in front of the oil slinger and having radially extending forwardly and rearwardly facing circumferential surfaces, said rearwardly facing circumferential surface being engaged by the lateral arms on the flyweights so that said arms cooperate with said surface in translating outward centrifugally responsive swinging of the legs into forward motion of the follower along the shaft;

(E) cap-like enclosure means on the follower, axially movable therewith and cooperating with the follower and with the front end portion of the shaft to define a chamber the volume of which varies with the axial position of the follower on the shaft and into and out of which oil can bleed through an orifice to exert a damping effect upon axial motion of the follower, said enclosure means having a coaxial tip of

small area against which the motion transmitting member is engaged; and

(F) means for preventing axial displacement of the follower off of the front end of the shaft comprising

(1) means on the leg of each flyweight providing a radially outwardly facing abutment engageable with a vane on the oil slinger by which an outward limit of swinging motion of said leg is defined, and

(2) another arm on each flyweight extending laterally from the leg near the free end thereof, so as to provide centrifugally responsive mass on the flyweight and having a tip portion engaging the forwardly facing surface on the follower so as to block forward movement of the follower beyond a point defined by engagement of said said abutment with said vane.

3. In an engine having a crankcase which provides a sump for lubricating oil, a crankshaft rotatable in the crankcase, and an oil slinger rotatably mounted in the crankcase and drivingly connected with the crankshaft, centrifugally responsive mechanism comprising:

(A) a shaft projecting coaxially forwardly from the oil slinger;

(B) a plurality of forwardly projecting eccentric bosses on the oil slinger;

(C) pivot means carried by said bosses defining a plurality of axes which are radially spaced from and transverse to the shaft axis;

(D) a plurality of stamped flyweights carried by the oil slinger for orbital motion therewith, each comprising

(1) a pair of substantially parallel legs connected with said pivot means and extending generally forwardly therefrom but swingable about a

pivot axis radially in and out relative to the shaft,

(2) a transverse portion bridging the legs near their ends remote from the pivot means and integral with the legs, and

(3) a pair of arms, each integral with one of the legs and projecting laterally therefrom to be disposed alongside the shaft, said arms being spaced apart lengthwise of the legs; and

(E) a follower axially slidable on the shaft and having a circumferential radially extending flange confined between the two arms on each flyweight so that swinging movement of the flyweight in both directions is translated by said arms into axial motion of the follower.

4. The mechanism of claim 3, further characterized by means on the oil slinger providing abutments engageable by the flyweights to define the radially outward limit of swinging motion thereof at which that one of the two arms on each flyweight that is farther from the pivot means blocks displacement of the follower forwardly off of the shaft.

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