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2,382,952

MECHANICAL GOVERNOR FOR INTERNAL-COMBUSTION ENGINES

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3 Sheets-Sheet 1

Fig. 1.

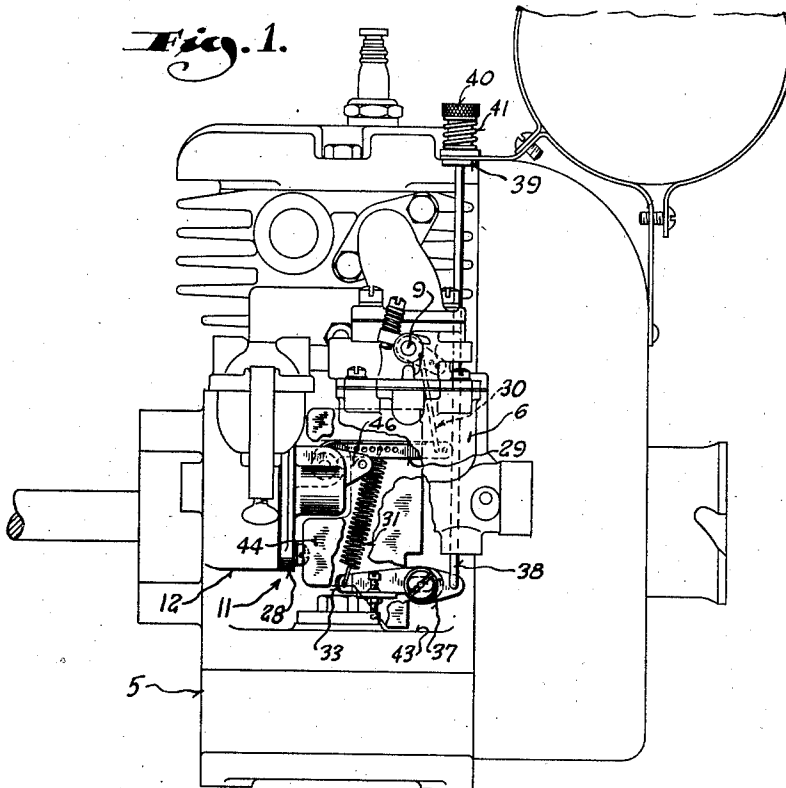
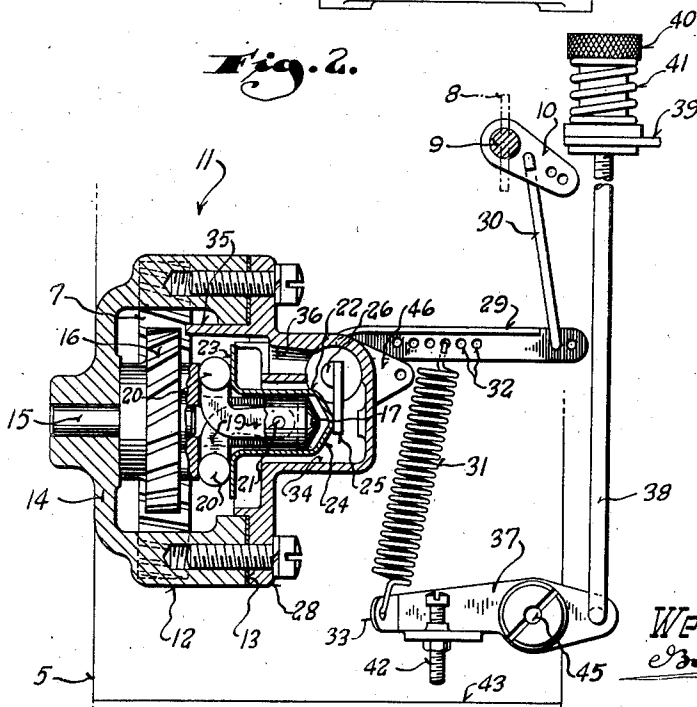


Fig. 2.



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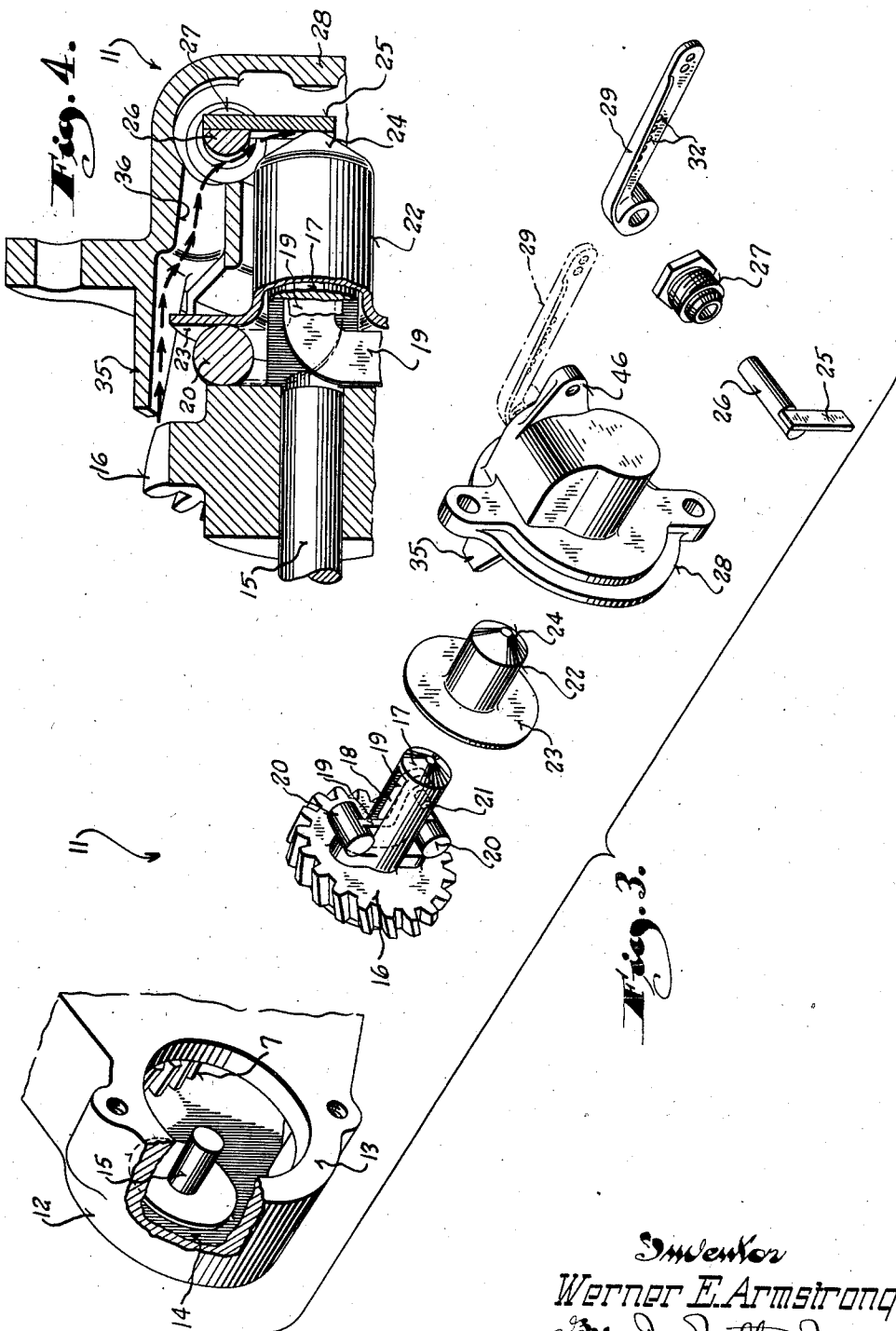
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3 Sheets-Sheet 2



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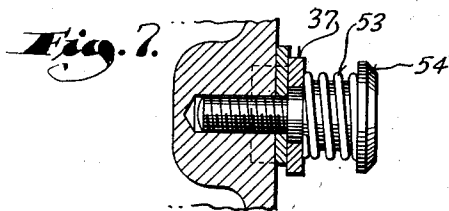
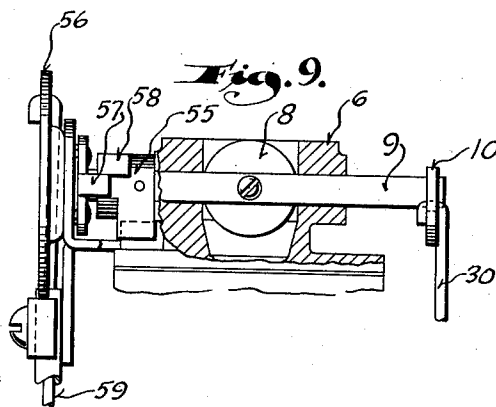
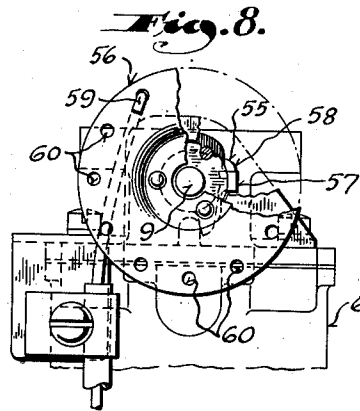
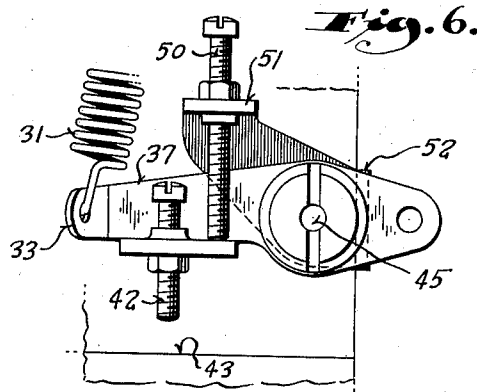
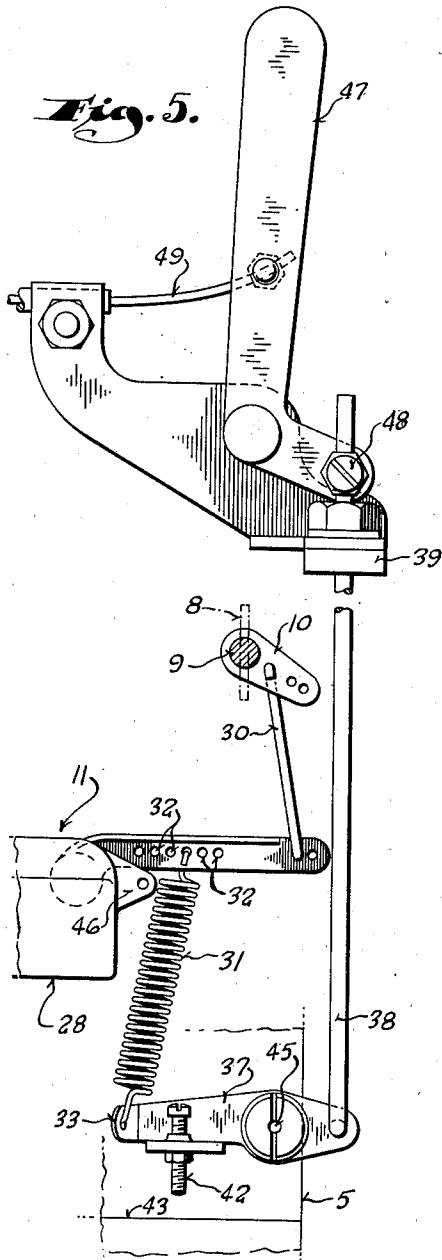
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MECHANICAL GOVERNOR FOR INTERNAL-COMBUSTION ENGINES

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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MECHANICAL GOVERNOR FOR INTERNAL-COMBUSTION ENGINES

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11 Claims. (Cl. 123—108)

This invention relates to governors and refers particularly to a governor for small portable internal combustion engines.

Heretofore it has been the custom to provide such small engines with governors actuated by the response of a vane or blade located in the path of the air blast created by the cooling fan of the engine. Patent No. 1,660,079, issued to Perry E. Mack, February 21, 1928 is an illustration of this past form of governor.

With the advent of smaller engines and consequent restriction in available space, the past forms of governors have been found unsatisfactory. This is particularly so in situations where the service for which the engine is used subjects it to external air blasts.

It is, therefore, an object of this invention to provide a governor of improved construction and design especially adapted for use on small internal combustion engines where space is at a premium.

Another object of this invention is to provide a mechanical governor for such internal combustion engines to thereby overcome the difficulties encountered in the past with the so-called wind vane type of governor.

Another object of this invention is to provide a compact and simple mechanism for utilizing centrifugal force to effect the desired governing action.

In this connection it is a further object of this invention to so mount the governor mechanism on the engine that it is driven from one of the timing gears of the engine.

Still another object of this invention is to insure adequate lubrication of all parts of the governor mechanism from the lubricant contained within the crankcase of the engine.

Small portable internal combustion engines have many uses and often it is necessary to provide means whereby the operator can quickly alter the speed of the engine, notwithstanding the presence of the governor thereon.

It is, therefore, another object of this invention to provide means whereby the throttle valve of the engine may be manually adjusted without interference from the governor and without in anywise altering the adjustment of the governor.

Still another object of this invention is to provide means whereby the maximum speed for which the governor can be set may be manually adjusted at the factory and protected against unauthorized tampering.

With the above and other objects in view, which will appear as the description proceeds, this in-

vention 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 several complete examples of the physical embodiment 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 view in side elevation with parts broken away illustrating the application of this invention to a conventional small internal combustion engine;

Figure 2 is an enlarged longitudinal sectional view through the governor mechanism, per se, illustrating the manner in which it is mounted on the engine to be driven by one of the engine timing gears;

Figure 3 is a perspective view of the various parts of the governor mechanism shown separated and in their proper order of assembly;

Figure 4 is a detail sectional view of the governor mechanism and illustrating particularly the manner in which the application of lubricant to a remote part of the mechanism is assured;

Figure 5 illustrates a means for setting the adjustment of the governor which is slightly modified from that shown in Figures 1 and 2;

Figure 6 illustrates another modification in this respect;

Figure 7 is a detail fragmentary view showing one way in which the adjustment of the governor may be held in any set position;

Figure 8 is a view illustrating part of the carburetor and showing the manner in which a manual control for the throttle valve may be applied without interfering with its control by the governor; and

Figure 9 is a side view of the mechanism shown in Figure 8.

Referring now particularly to the accompanying drawings, in which like numerals indicate like parts, the numeral 5 designates the crankcase of a small portable internal combustion engine of conventional design and construction.

As is customary, the engine is equipped with a carburetor 6 and timing gears 7, only one of which is illustrated. The carburetor has the usual throttle valve 8, the shaft 9 of which has a lever 10 secured thereto to provide means by which the valve may be adjusted.

The governor, indicated generally by the nu-

meral 11, is entirely mechanical and is mounted on the side of the crankcase between it and the carburetor so as to be closely adjacent to the throttle valve lever 10.

The crankcase has a hollow protuberance 12 projecting from the side wall thereof at a point adjacent to the timing gear 7 so that said gear is accessible from inside the hollow protuberance. This hollow protuberance has an open face 13 substantially parallel with the plane of the timing gears.

Fixed in the closed end wall 14 of the hollow protuberance is a stub shaft 15. This shaft projects toward the open face 13 and freely rotatably mounts a gear 16, the teeth of which mesh with the timing gear 7. The gear 16 is preferably a die casting and has a stem 17 integral therewith and projecting axially therefrom.

A longitudinal slot 18 extending diametrically through the stem provides for the reception of the attaching arms 19 of a pair of fly-balls 20. The arms 19 are right angular and have their end portions which are received in the slot 18 of such size that when the fly-balls are in their retracted positions, the end portions of the arms lie wholly within the confines of the stem, while the actual fly-balls, which are but enlargements on the outer ends of the arms, occupy a position adjacent to the gear 16.

A single pivot pin 21 connects the arms of the two fly-balls to the stem at a point near the outer end thereof so that the fly-balls swing outwardly away from the gear in response to centrifugal force.

This outward swinging motion of the fly-balls is transmitted to a flanged cup 22 slidable on the stem 17. The flange 23 of the cup bears against the fly-balls and its outer closed end 24 is substantially pointed to have restricted contact with a lever 25.

The lever 25 is fixed to the inner end of a short shaft 26 journaled in a bushing 27. The bushing 27 is threaded into an aperture formed in a cover 28 secured to the open face of the protuberance. The outer end of the shaft 26 has an arm 29 secured thereto which in turn is connected to the lever 10 through a link 30.

A tension spring 31 hooked into one of a series of holes 32 in the arm 29 and to an anchor 33 yieldingly urges the lever 25 against the pointed end of the cup 22 and tends to hold the parts in a position at which the throttle valve is fully open.

During operation it will be apparent that the response of the fly-balls to centrifugal force pushing on the flange 23 forces the cup 22 outwardly along the stem 17. This movement is opposed by the tension of the spring 31 which at all times acts to press the lever 25 against the pointed end of the cup. Thus, with a proper balance between the spring tension and centrifugal force, the desired regulation of the throttle valve is achieved.

The hole of the arm 29 into which the spring 31 is hooked, of course, provides a measure of the spring tension and thus through proper selection of the point of application of the spring a wide range of conditions is accommodated.

Attention is directed to the simplicity with which the assembly of the governor mechanism is effected. The stub shaft 15 upon which the die cast gear 16 is journaled is driven into position in the back wall 14 of the hollow protuberance. The die cast gear with the fly-balls and cup 22 assembled thereon slipped through the

open face of the protuberance and onto the stub shaft 15.

The cover 28, which preferably is also a die casting, has the shaft 26 with its lever 25 and arm 29 easily assembled therewith, and this subassembly is readily applied to the open face of the protuberance to complete the assembly.

Referring to Figure 2 it will be noted that the governor drive gears 7 and 16 are helical and that the helix angle of the teeth is such as to require the governor gear 16 to be driven in a clockwise direction as viewed from the open face 13 of the protuberance 12. Hence, the governor gear 16 is thrust toward the bottom of the protuberance 12 during operation of the engine and consequently maintained assembled on the stub shaft 15.

The yielding pressure of the lever arm 25 against the tip of the cup 22 in addition to holding the cup assembled with the governor is also transmitted through the flange of the cup and the fly-balls 20 to the governor gear 16 to assist in holding the parts operatively assembled.

To accommodate the cup 22 the cover 28 has a cavity 34 opening to the interior of the hollow protuberance when the cover is in position and as clearly shown in Figure 2, the free end of the lever 25 operates in the bottom of this cavity.

Inasmuch as the interior of the hollow protuberance is in direct communication with the inside of the crankcase, adequate lubrication for the governor mechanism is assured. Most of the mechanism receives lubrication directly from the oil splashed into the protuberance so that no special provision need be made for its lubrication.

However, it was found that the point of contact between the lever 25 and the end of the cup 22 was not adequately lubricated by the oil splashed into the protuberance. To insure lubrication of this vital wear point a projection 35 is formed on the cover 28 to extend to a point closely adjacent to the periphery of the gear 16 and a passageway 36 leads from the base of this projection back through the cover to a point close to the lever 25.

Hence, as clearly shown in Figure 4, lubricant splashed off the gear 16 accumulates on the projection 35 and flows back to the lever 25 to keep its contact with the cup 22 adequately lubricated.

In addition to the adjustment afforded by changing the series of holes in the arm 29 into any one of which the spring 31 may be hooked, it is also possible to adjust the setting of the governor by altering the location of the anchor 33. To this end the anchor 33 is on the outer end of a medially pivoted lever 37, the other end of which has an adjusting rod 38 connected thereto. This rod extends up to the top of the engine and passes through a supporting arm 39. Its upper extremity is threaded to receive a nut member 40 which bears on the supporting arm 39. Hence, tightening and loosening the nut member 40 raises and lowers the rod 38 to effect a corresponding adjustment of the anchor 33, a spring 41 being provided to hold the nut in any adjusted position.

To guard against adjusting the governor setting beyond the point at which the engine speed is safe, a speed limiting screw 42 is provided. This screw is threaded into a projection on the lever 37 and is engageable with a fixed abutment 43 to limit the extent to which the tension of the spring 39 can be increased. If desired, this screw may be sealed at the factory by solder or the like.

To further safeguard the adjustment, a guard 44 is fastened over the parts by which adjustment

is effected. This guard is conveniently mounted by screws threaded into a tapped hole 45 in the pivot stud which mounts the lever 37 and by a screw threaded into a tapped hole in an ear 46 integral with the cover 28. The screws by which the guard is held in place are, of course, desirably sealed against unauthorized removal.

In place of the screw adjustment afforded by the nut 40 a pivoted hand lever 47 may be provided as illustrated in Figure 5. This lever is connected to the rod 38 as at 48 so that adjustment thereof raises and lowers the arm. In addition to being directly actuated, the lever 47 may be driven from a remote point through a flexible wire 49 in the usual manner.

Still another manner of adjusting the position of the spring anchor 33 is illustrated in Figure 6. As there shown, a speed adjusting screw 50 threads into an arm 51 conveniently secured in fixed position on the engine by the same stud which pivotally mounts the lever 37. An ear 52 which reaches around the side of the crankcase is formed on the arm 51 to hold the same against swinging about its mounting screw. The speed adjusting screw 50 is accessible by means of a long handled screwdriver, and as before the speed limiting screw 42 may be provided to limit the maximum speed for which the governor can be set.

In cases where unauthorized tampering with the governor adjustment is not a factor and where the engine is not operated under circumstances resulting in extreme vibration, the simple method of holding the lever 37 in set position, shown in Figure 7, may be employed. As here shown, a friction spring 53 is merely provided between the head 54 of the screw stud about which the lever 37 pivots so that the spring bears frictionally against the face of the lever and thereby holds the same in set position.

In some cases it may be desirable to provide means for manually actuating the throttle without altering or affecting the adjustment of the governor or its ability to maintain a predetermined engine speed. For this purpose the construction illustrated in Figures 8 and 9 is provided. As here shown, the shaft 9 of the throttle valve has an arm 55 fixed thereto preferably at the end of the shaft opposite that at which the lever 10 is located.

Freely rotatably mounted on the shaft outwardly of the arm 55 is a disc 56. On the inner face of this disc an abutment 57 projects rearwardly into the path of an abutment 58 on the arm 55 so that upon rotation of the disc 56 in a counterclockwise direction, as viewed in Figure 8, the abutments 57 and 58 can be brought into engagement to thereby permit the application of turning force onto the throttle valve shaft.

This force may be applied by directly grasping the disc, or as shown in Figures 8 and 9, a flexible wire 59 may be hooked into one of a plurality of holes 60 in the disc. In view of the multiplicity of the holes 60, it is possible to have the flexible wire approach the disc from any angle. Thus, any installation can be readily accommodated.

The advantage of this attachment is that it enables the operation, for instance of a cycle, to control the throttle as desired as long as the engine speed is below that for which the governor is set.

From the foregoing description, taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an exceedingly simple

and practical governor especially adapted for small internal combustion engines where space is at a premium; and that by virtue of its particular design the application of the governor to an engine of this type is a simple matter.

What I claim as my invention is:

1. A governor for controlling the throttle valve of a combustion engine having a crankcase provided with a boss for mounting the governor, comprising: a helical gear adapted to be driven from an engine gear; a journal stud for rotatably mounting the helical gear from the mounting boss, the direction of rotation of the gear and the helix inclination being chosen so that the helical gear is thrust against the mounting boss; a cylindrical stem on the helical gear extending axially therefrom in the opposite direction from the journal stud; overlapping bell-crank levers pivoted within the stem and having weighted ends spaced radially from the stem axis and normally lying against the face of the helical gear, all other parts of the bell-crank levers being at all times enclosed within the cylindrical bounding surface of the stem; and a flanged cylindrical cup fitting on the stem with its flange engaged with the weighted ends of the levers whereby outward movement of the weights slidingly displaces the cup along the stem to provide the source of motion necessary for the control of the throttle valve.

2. A governor for controlling the throttle valve of a combustion engine, said engine having a stud provided for mounting the governor thereon, comprising: a gear journaled on said stud; a cylindrical stem on the gear extending axially therefrom in the opposite direction from the journal stud; overlapping bell-crank levers pivoted within the stem and having weighted ends spaced radially from the axis of the stem and normally lying directly adjacent to the face of the gear, all other parts of the bell-crank levers being at all times enclosed within the cylindrical bounding surface of the stem; and a flanged cylindrical cup fitting on the stem with its flange engaged with the weighted ends of the levers whereby outward movement of the weights slidingly displaces the cup along the stem to provide a source of motion necessary for the control of the throttle valve.

3. A governor for controlling the throttle valve of a combustion engine, said engine having a stud provided for mounting the governor thereon, comprising: a gear journaled on said stud; a cylindrical stem on the gear extending axially therefrom in the opposite direction from the journal stud; overlapping bell-crank levers pivoted within the stem and having weighted ends spaced radially from the stem axis and normally lying closely adjacent to the face of the gear, all other parts of the bell-crank levers being enclosed within the cylindrical bounding surface of the stem; a flanged cylindrical cup fitting on the stem with its flange engaged with the weighted ends of the levers whereby outward movement of the weights slidingly displaces the cup along the stem, the end of the cup enclosing the end of the stem; a cover for enclosing the stem and cup; and means guided in the cover for engagement by the cup for transmitting displacement of the cup to the valve to be governed.

4. A governor for controlling the throttle valve of a combustion engine, said engine having a stud provided for mounting the governor thereon, comprising: a gear journaled on said stud; a cylindrical stem on the gear extending axially therefrom in the opposite direction from the journal stud; overlapping bell-crank levers piv-

oted within the stem and having weighted ends spaced radially from the stem axis and normally lying closely adjacent to the face of the gear, all other parts of the bell-crank levers being at all times enclosed within the cylindrical bounding surface of the stem; a flanged cylindrical cup fitting on the stem with its flange engaged by the weighted ends of the levers whereby outward movement of the weights in response to centrifugal force slidably displaces the cup along the stem, the end of the cup extending around the end of the stem to enclose the same; a cover for enclosing the stem and cup; and a lever pivoted in the cover with one of its arms in the path of the end of the cup and providing for regulation of the throttle valve during operation of the governor.

5. A governor for an internal combustion engine having a throttle valve yieldingly urged to open position by a spring, said governor comprising: a rotatable member projectible into an opening in the engine crankcase to be driven by a rotating part therein; centrifugally responsive means carried by said rotatable driven member and movable outwardly thereof in response to centrifugal force; a cover for sealing the opening in the engine crankcase and for enclosing the governor parts; an arm pivotally carried by the cover at the interior thereof and adapted to have a motion transmitting connection with the throttle valve so as to effect adjustment thereof toward closed position against its spring; means inside the cover maintained engaged between said centrifugally responsive means and said arm by the action of the valve spring on said arm for translating outward movement of the centrifugally responsive means into valve closing motion of said arm; and means on the interior of the cover for collecting oil issuing from said crankcase opening and for leading such oil to the point of engagement between the arm and said translating means.

6. A governor for an internal combustion engine having a throttle valve yieldingly urged to open position by a spring, said governor comprising: a gear projectible into an opening in the engine crankcase to be driven by an engine gear therein; a stem on said gear projecting outwardly through the opening of the crankcase; weighted levers pivotally carried by said stem for outward motion away from the axis of the stem in response to centrifugal force; a flanged cup slidably on said stem and having its flange adjacent to the weights of the levers whereby outward movement of the levers in response to centrifugal force slidably displaces the cup along the stem; a cover for sealing the opening in the crankcase and for enclosing the governor parts; a lever pivotally carried by the cover and having an arm disposed at the interior thereof to lie in the path of sliding movement of said flanged cup, said lever being adapted for connection with the throttle valve to control the same whereby the lever is influenced by the throttle spring in a manner such as to cause said arm of the lever to exert an axial force on the cup opposite to that imparted to the cup by the weights during movement thereof in response to centrifugal force; and means on the interior of the cover for collecting oil issuing from said crankcase opening and for leading such oil to the point of engagement between the arm and cup so as to minimize wear at said point.

7. Manual control means for adjusting the throttle shaft of an automatically governed combustion engine wherein the governor connection

to the throttle shaft includes a governor lever and a spring acting on the lever and the throttle shaft in a direction tending to maintain the shaft in a valve open position, comprising: an abutment fixed to the throttle shaft; a disc having a series of holes about its edge for adjustable connection to remote control means, said disc being loosely journaled on the throttle shaft; and an abutment on the disc projecting into the plane of the shaft carried abutment to provide for transmission of rotation from the disc to the throttle shaft independently of automatic adjustment of the throttle shaft by the governor.

8. In a governor for internal combustion engines having timer gears and a throttle valve: a gear adapted to be driven by one of said timing gears; a relatively short axial stem integral with the gear and projecting from one face thereof; a pair of fly-balls having substantially right angular shaped arms each having an end portion thereof nested into a common slot in said stem; a common pivot near the end of the stem joining the extremities of said end portions of the arms to the stem so that the fly-balls swing outwardly away from the gear in response to centrifugal force; a cup slidable on said stem having a flange at its open end engaging the fly-balls whereby response of the fly-balls to centrifugal force slides the cup axially along the stem, said cup having its closed end extending around the end of the stem; and means engaged by the closed end of the cup so as to be actuated by the cup during sliding motion thereof along the stem providing a source of motion necessary for the control of the throttle valve.

9. In a governor for small internal combustion engines having an open faced protuberance on the crankcase thereof, the face of which is substantially normal to the adjacent wall of the crankcase, the governor including a part slidably mounted inside the protuberance to move toward and from its open face and centrifugally responsive means driven from a rotating part of the engine for moving said part outwardly toward the open face of the protuberance: a cover for the open face of the protuberance having a cavity to receive the end portion of said slidable part; a tapped hole in the cover, the axis of which is parallel with the face of the cover; a bushing threaded into said hole; a shaft journaled in said bushing with its inner end projecting into the cavity and its outer end outside the cover and adapted for connection to the throttle valve of the engine; a lever arm fixed to the inner end of the shaft and engaging the end of said part; and a spring acting on said shaft in a direction such that the lever arm is held against said part.

10. In an internal combustion engine having a throttle valve to be automatically and manually controlled: a governor including centrifugally responsive fly-balls and a part actuated by response of said fly-balls to centrifugal force; a pivoted arm connected with said part; a spring acting on the arm and applying force thereon in a direction to maintain the same drivingly connected with said part to thereby oppose centrifugal force acting on said fly-balls, said arm being adapted to have a motion transmitting connection with the throttle valve; an adjustable spring anchor for increasing and decreasing the spring force applied to the arm to thereby determine the engine speed to be maintained by the governor; a pivot for the spring anchor providing for angular adjustment thereof, said

pivot including friction retaining means for holding the anchor against accidental angular adjusting motion; a stop on the spring anchor to limit increase in spring force, said stop being adjustable to a predetermined engine speed limit; and a remote control arm providing for manual adjustment of the angular position of said spring anchor.

11. In a governor for internal combustion engines having an open faced protuberance on the crankcase thereof communicating with the inside of the crankcase, the open face of which is substantially normal to the adjacent wall on the crankcase, said governor having a part slidably mounted inside the protuberance to move toward and from its open face and centrifugally responsive means driven from a rotating part of the engine for moving said part outwardly toward the open face of the protuberance, the open communication of the interior of the protuberance with the inside of the crankcase affording lubrication for said designated parts by lubri-

cants splashed into the protuberance: a cover for the open face of the protuberance having a cavity to receive the end portion of the slidably mounted governor part; a lever pivotally mounted on the cover with its free end in the cavity and engaging the end of said slidably mounted governor part; an arm on the outside of the cover connected with said lever to move in unison therewith, said arm being connectible with the throttle valve of the engine to control the same; a spring connected with said arm and applying a force thereon to hold the lever against said slidably mounted governor part; and means for assuring the presence of lubricant at the juncture of said lever and the slidably mounted governor part comprising a projection on the cover extending into the hollow protuberance to have lubricant deposited thereon, and a passageway leading from the base of the projection to a point adjacent to the juncture of the lever and slidably mounted governor part.

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