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GOVERNOR

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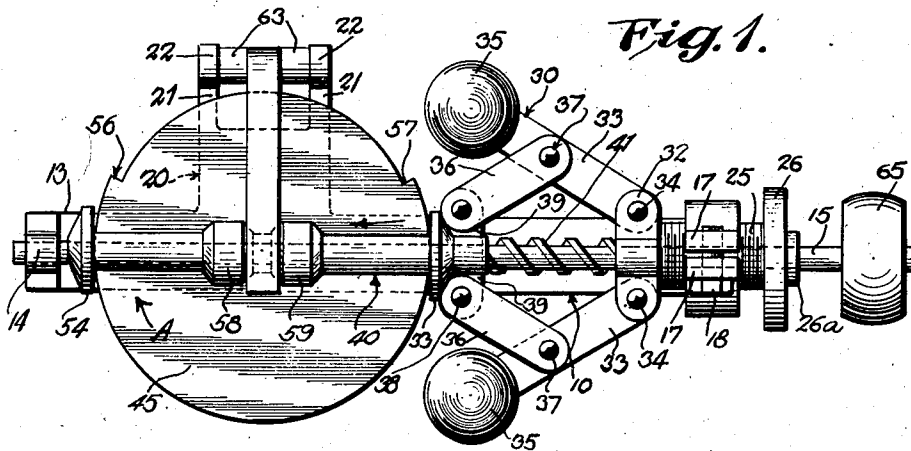


Fig. 1.

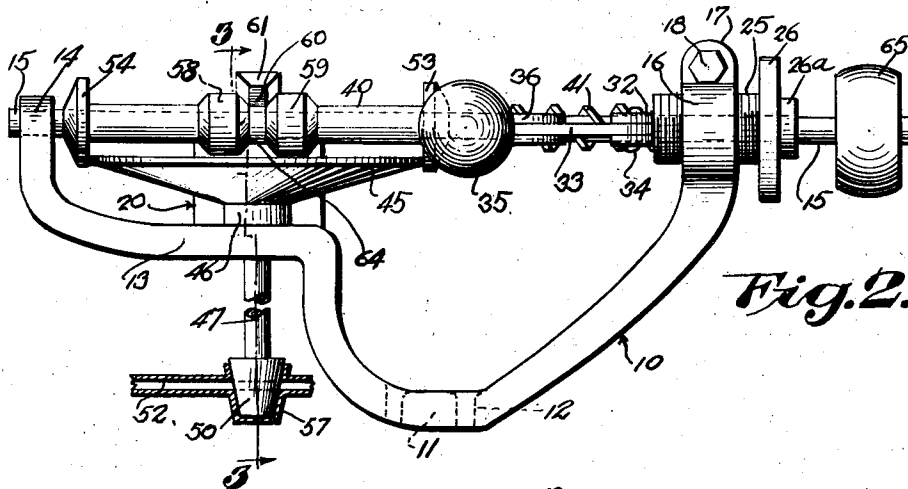


Fig. 2.

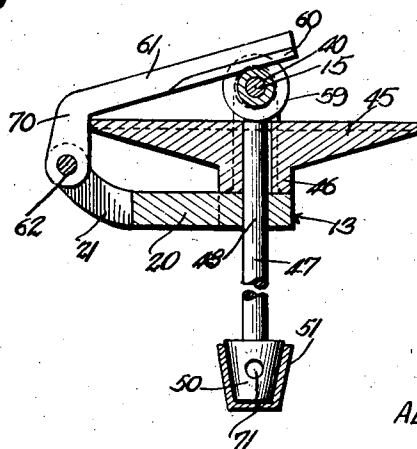


Fig. 3.

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GOVERNOR

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7 Claims. (Cl. 74-404.5)

This invention relates to governors.

An object of the invention is the provision of a governor which is particularly adapted to maintain the proper supply of fuel to the engine wherein a constant speed is maintained.

Another object of the invention is the provision of a governor on which all of the elements of the governor are supported on a single shaft, thereby avoiding complicated gearing.

A further object of the invention is the provision of a governor for controlling the flow of fuel to an internal combustion engine in accordance with the needs, in which the speed adjustments for the engine are stabilized automatically when the adjustments have been completed by the governor.

A still further object of the invention is the provision of a sleeve-spool friction gear type of governor for limiting automatically the function of the governor in accordance with the capacity of an internal combustion engine at varying loads.

This invention will be best understood from a consideration of the following detailed description, in view of the accompanying drawing forming a part of the specification; nevertheless, it is to be understood that the invention is not confined to the disclosure, being susceptible of such changes and modifications as define no material departure from the salient features of the invention as expressed in the appended claims.

In the drawing:

Fig. 1 is a plan view of a centrifugal governor with accessories constructed according to the principles of my invention.

Fig. 2 is a side view of the same.

Fig. 3 is a transverse vertical section taken along the line 3-3 of Fig. 2.

Referring more particularly to the drawing, 10 generally designates a bracket which has a portion 11, adapted to be secured by means of bolts passing through perforations 12, formed in the portion 11 of the bracket. These bolts are connected to a fixed part such as the housing of the engine. The bracket has an off-set 13 provided with a vertical projection 14 forming a bearing for the outer end of a drive shaft 15. The opposite end of the bracket, as shown at 16, has a split sleeve for a purpose which will be presently explained. The ends of the split sleeve have flanges 17 which are brought together by means of a bolt 18 passing through threaded perforations in the flanges.

The bracket has a lateral extension 20 adjacent its outer end, and a pair of spaced ears 21 ex-

tend outwardly and then curve upwardly from the extension. A bearing 22 is formed at the free end of each ear.

The split ring 16 has an internal passage which is threaded to receive the threads of a sleeve 25 which has a manipulating disk 26. This sleeve has a longitudinal passage forming a bearing for the governor shaft 15. The sleeve 25 may be adjusted longitudinally of the split ring 16 by rotation of the disk 26 for a purpose which will be presently explained.

The governor element per se is generally designated by the numeral 30 and includes a collar 31 with a pair of diametrically spaced ears 32 in which the inner ends of the usual weighted arms 33 are pivotally connected as shown at 34. Weights 35 are secured to the outer ends of the arms 33.

The collar 31 is firmly attached to the governor shaft 15, by set screws or otherwise, and abuts on the inner end of the threaded sleeve 25. A set collar 26^a is abutted on the outer end of the sleeve 25 and is also firmly secured to the governor shaft 15 whereby the threaded sleeve 25 becomes a double thrust bearing to determine the longitudinal position of the shaft 15 and the governor 30 thereto attached.

A link 36 is connected with each arm 33 by a pin 37. These links extend inwardly from the arms and are pivotally connected at 38 to ears 39 diametrically disposed on the inner end of the sleeve 40. The sleeve 40, slidably fitted to the governor shaft 15, is keyed with a feather to rotate in unison with the governor 30, and is limited in longitudinal movement. A coiled spring 41 surrounds the shaft 15 and has one end in contact with the collar 31 while the other end contacts the inner end of the sleeve 40. The spring will at all times tend to force the sleeve to the left in Fig. 1, and in the direction indicated by the arrow in said figure, so that the weights 35 tend to move towards each other and this is particularly true when the speed of rotation of the shaft 15 falls below a pre-determined rate.

A friction gear 45 has an integrally formed collar 46 resting on the portion 13 of the bracket 10. This gear is secured to a shaft 47 which has a bearing 48 in the portion 13 of the bracket.

A plug valve 50 is secured to the lower end of the shaft 47 and is enclosed within a casing 51 incorporated within a fuel supply pipe 52.

A friction disk 53 is mounted on the inner end of the sleeve 40 adjacent the periphery of the gear 45. A second friction disk 54 is secured to

the outer end of the sleeve 40 adjacent the bearing 14 on the bracket 10. These disks are adapted to engage the periphery of the gear 45 alternately. These disks, however, do not at any time come into engagement with the periphery of the cut-away portion 55 of the gear 45. The cut-away portion, as shown at 56 and 57, forms shoulders on the disk for a purpose which will be presently explained.

A friction valve gear 45 is mounted in the bracket member 13 of the bracket 10, adjacent to the sleeve 40, of such diameter as will permit alternating contact of the friction disks 53 and 54 with the periphery of the said gear 45 but without contact when centered on the sleeve 40.

It will be noted that the sleeve 40 is provided with a pair of spaced collars 58 and 59, and the opposite ends of these collars are tapered with the inner ends being spaced from each other to form a tapered groove to receive a complementarily tapered portion 60 of a weighted arm 61 which is pivotally mounted on a pin 62 carried by the bearings 22 on the ends of the ears 21. Collars 63 which form a long bearing and which are mounted on the pin 62 maintain the arm 61 in such position that it will fall into the central groove 64 formed by the oblique sided portions of the collars 58 and 59 when these collars are in alinement with the center of the friction valve gear. At the time of assembling the valve 50, the shaft 47 and the friction valve gear, with an aperture 71 of the valve 50 is alined with the fuel supply pipe 52, and the friction valve gear positioned with the shoulders 56 and 57 equidistant from a brake member 70 when the arm 61 lies in the groove 64. A pulley 65 is secured to the inner end of the shaft 15 and is driven by a belt from a revolving part of the engine. It will be seen from this construction that all of the elements of the governor and its associated parts are carried by the shaft 15 which in turn is supported by the bracket 10. The sleeve 40 is splined to the shaft 15 so that it may be moved back and forth and revolved simultaneously by said shaft for rotating the disks 53 and 54 whereby when one of these disks is moved into contact with the periphery of the gear 45, said gear will be revolved for operating the valve 50 to closed or open position or to intermediate positions. It is to be borne in mind that when the valve 50 and likewise the disk 45 has been moved through 90 degrees from its position shown in Figs. 2 and 3, said valve will be closed. This is true whether the disk 45 is moved in one direction or in the opposite direction. The closed position for the valve 50 in either direction of rotation will be determined by the shoulders 56 and 57 when said shoulders engage the upstanding or bent portion 70 of the arm 61, so that the gear 45 will be held against further rotation. When the shaft 15 is rotated, in either direction, a point of equilibrium is induced between the centrifugal force of the governor arms 33 and the tension of the spring 41. This point is constant in position at any constant speed of the governor, but varies, longitudinally, with any change of the speed of the governor. This point I have designated "the normal" for any given speed of the engine.

Adjustment of the threaded sleeve to the left in the threaded passage 16 will move the governor to the left, together with the shaft 15 and the sleeve 40, in the direction of the arrow in Fig. 1, by the increased tension on the spring

41, to open the valve 50 to the extent required to increase the speed of the engine, and thereby the governor, increasing the centrifugal force to withdraw the sleeve 40 at the normal of the newly adjusted position, whereby the aperture 71 of the valve 50 is stabilized by the brake member 70. On the other hand, adjustment of the threaded sleeve to the right reverses the effect, reducing the tension on the spring 41, closing the valve 50 to the newly adjusted position and stabilizing the normal at the reduced speed. After the proper adjustment of the sleeve 25 had been made, the bolt 18 which had been previously loosened is then tightened to retain the sleeve 25 in its adjusted position.

With the elements shown in their respective positions, it will be noted that the disks 53 and 54 are out of contact with the periphery of the disk 45 and the weighted arm 61 is resting in the groove 64 on the sleeve 40. These positions of the elements are maintained until disturbed by a change of speed of the governor, by change of load or pressure on the engine, or otherwise, which is automatically corrected by the governor, as described.

The independent throttle is provided for starting and stopping the engine, and may be used, incidentally, to approximate a desired normal. The reduced speed, as the engine stops, causes the governor to open the valve 50 to full capacity, whereby the full volume of the fuel supply is available for starting the engine under load, and as the engine gains speed, is automatically adjusted and stabilized by the governor at the normal of the previous adjustment.

This normal is referred to the valve 50 by the automatic action of the governor through the sleeve 40, friction gear 45, and valve shaft 47, adjusting the opening 71 in the valve 50 according to the requirements of the engine at the adjusted normal.

The normal is now stabilized by the clamp screw 18 on the threaded sleeve 25, and the independent throttle fully opened, referring control of the engine speed to the valve 50 of the governor assembly.

An increased speed of the engine, through reduction of load, pressure on the engine, or otherwise, increases the centrifugal force of the weighted arms 33 of the governor 30 and withdraws the sleeve 40 against the tension of the spring 41 by the links 36, raising the arm 61 of the brake member 70 on the oblique side 58 of the groove 64 to release the brake member 70 from contact with the reduced section 55 of the periphery of the friction gear 45, and contact the friction disk 54 with the periphery of the friction gear 45 to reduce the opening in the valve 50, through the valve shaft 47, until all the governing parts resume their normal positions, through the reduced flow of the fuel to the engine through the valve 50.

A reduced speed of the engine reduces the centrifugal force of the weighted arms 33 of the governor 30, whereby the tension of the spring 41 advances the sleeve 40, raising the arm 61 on the face 59 of the groove 64, to release the brake member 70, and contact the friction disk 53 with the periphery of the valve gear 45, to open the valve 50 to a point where the normal is restored and the opening of the valve 50 is again stabilized at the normal for the engine speed.

It is apparent by this construction, that the governor provides a normal point of equilibrium for any speed within the capacity of the engine,

which when referred to the opening of the supply valve of the engine is stabilized by the clamp screw 18 on the threaded sleeve 25 and maintained by the action of the sleeve 40 on the fuel supply valve 50 of the engine through the valve shaft 47, and automatically stabilized by the brake member 70, when adjusted by the governor 30.

The engine is stopped and started by the independent throttle, and resumes the adjusted speed automatically, under any load or pressure on the engine, and may be changed by manipulation of the sleeve 25 to any speed within the capacity of the engine while in motion.

In operation with the engine in motion, the crown belt pulley drive 65 driven from the engine shaft rotates the governor shaft in a defined relation to the engine speed and at any speed of the governor shaft an equilibrium exists between the centrifugal force of the weights 35 and the spring 41. At this time, the sleeve 40 is stationary on the shaft.

When the shaft is adjusted by the governor, the central groove will be centered on the valve gear 45 and the brake member 61 will lie in the groove 64 thereby stabilizing the flow of the fuel to the engine through the valve 50.

If the speed of the engine is too great, the centrifugal force of the weights 35 will move the sleeve inwardly and the brake member is thus raised by the collar 58, so that the friction disk 54 will engage the periphery of the valve gear 45 as has been previously explained.

When the speed of the engine is reduced, the spring 41 reverses the movement of the sleeve 40 and the friction disk 53 engages the periphery of the valve gear 45 and thus rotates the valve 50 to a point where the flow of fuel to the engine is the amount required to produce the speed of the governor as adjusted.

The speed of the engine is determined by the longitudinal position of the governor, with relation to the valve gear 45, which is controlled by adjustment of the threaded sleeve 25 to centralize the sleeve 40 on the valve gear when the governor is in the desired, normalized position, but such adjustment is always made with the view of locating the groove 64 in the sleeve 40 in alinement with the free end of the brake lever 61 so that the free end of said lever can fall into the groove. The change in adjustment of the member 25 can be made during the time when the engine is idle or when the governor is in operation.

It will be seen by this construction that a slight change of the engine speed will show by a slight contact of the friction gear for a slight correction of speed while a greater change of the speed of the engine will apply a greater amount of power in proportion to the work to be done. Thus, full throttling to idling is accomplished almost as quickly as a slight change.

I claim:

1. A centrifugal governor comprising a shaft, a bracket supporting the shaft, a sleeve slidable on one end of said shaft and feathered thereon, a valve gear below the sleeve, said governor including links connecting weighted arms thereof to the sleeve and mounted on the other end of the shaft, friction disks connected to the sleeve at diametrically opposite points on the gear, said friction disks being spaced from the periphery of the gear and adapted to engage said gear alternately when the sleeve is oscillated by the governor, the governor including a resilient means

opposed to centrifugal force tending to maintain the disks out of contact with the gear, said sleeve having a circumferential groove, a weighted arm pivoted at one end on the bracket, the free end of the arm being received by the groove when said groove is alined with the center of the gear, and means for causing rotation of the shaft.

2. A centrifugal governor comprising a shaft, a bracket supporting the shaft, a sleeve slidable on one end of said shaft and feathered thereon, a valve gear below the sleeve, said governor including links connecting weighted arms thereof to the sleeve and mounted on the other end of the shaft, friction disks connected to the sleeve at diametrically opposite points on the gear, said friction disks being spaced from the periphery of the gear and adapted to engage said gear alternately when the sleeve is oscillated by the governor, the governor including a resilient means opposed to centrifugal force tending to maintain the disks out of contact with the gear, said sleeve having a circumferential groove, a weighted arm pivoted at one end on the bracket, the free end of the arm being received by the groove when said groove is alined with the center of the gear, and means for causing rotation of the shaft.

3. A centrifugal governor comprising a shaft, means for supporting said shaft, a sleeve having an annular groove midway of its ends and slidably keyed to said shaft, a gear carried by the supporting means with the axis of the gear alining with the center of the groove, a weighted arm pivoted at one end, the free end of the arm resting in the groove when said groove is alined with the center of said gear, the governor including centrifugally operated arms with links connecting the arms with sleeve, a resilient means opposed to the centrifugal force acting on the sleeve tending to maintain the annular groove in alinement with the center of the gear, means on the sleeve adapted to engage alternately diametrically opposite points on the gear for causing rotation of the gear in opposite directions, and means for causing rotation of the shaft.

4. A centrifugal governor comprising a shaft, means for supporting said shaft, a sleeve having an annular groove midway of its ends and slidably keyed to said shaft, a gear carried by the supporting means with the axis of the gear alining with the center of the groove, a weighted arm pivoted at one end, the free end of the arm resting in the groove when said groove is alined with the center of said gear, the governor including centrifugally operated arms with links connecting the arms with the sleeve, a resilient means opposed to the centrifugal force acting on the sleeve tending to maintain the annular groove in alinement with the center of the gear, means on the sleeve adapted to engage alternately diametrically opposite points on the gear for causing rotation of the gear in opposite directions, co-operating means between the gear and arm for limiting rotation of the gear in two directions, and means for causing rotation of the shaft.

5. A centrifugal governor comprising a shaft, means for supporting said shaft, a sleeve having an annular groove midway of its ends and slidably keyed to said shaft, a gear carried by the supporting means with the axis of the gear alining with the center of the groove, a weighted arm pivoted at one end, the free end of the arm resting in the groove when said groove is alined with the center of said gear, the governor including centrifugally operated arms with links connecting the arms with the sleeve, a resilient

means opposed to the centrifugal force acting on the sleeve, tending to maintain the annular groove in alinement with the center of the gear, means on the sleeve adapted to engage alternately diametrically opposite points on the gear for causing rotation of the gear in opposite directions, a shoulder on the gear at each side of the arm adapted to engage the arm for limiting angular rotation of the gear in one direction or in the opposite direction, and means for causing rotation of the shaft.

6. A valve operating mechanism comprising a shaft adapted to be revolved at varying speeds, a bracket for supporting the opposite ends of the shaft and provided with a lateral extension, an arm extending transversely over the shaft and having a bent portion pivoted on the free end of the extension, a sleeve slidably keyed on the shaft and provided with an annular groove to receive the free end of the arm tending to maintain the sleeve in a predetermined position, a governor mounted on the shaft and having centrifugally-operated arms connected to the sleeve for causing oscillation of said sleeve, a spring acting against the centrifugal force on the arms, a gear associated with the sleeve for actuating the valve, spaced means on the sleeve rotated thereby and adapted to engage alternately dia-

metrically opposite portions of the periphery of the gear when the sleeve is reciprocated for causing the gear to be rotated in opposite directions.

7. A valve operating mechanism comprising a shaft adapted to be revolved at varying speeds, a bracket for supporting the opposite ends of the shaft and provided with a lateral extension, an arm extending transversely over the shaft and having a bent portion pivoted on the free end of the extension, a sleeve slidably keyed on the shaft and provided with an annular groove to receive the free end of the arm tending to maintain the sleeve in a predetermined position, a governor mounted on the shaft and having centrifugally-operated arms connected to the sleeve for causing oscillation of said sleeve, a spring acting against the centrifugal force on the arms, a gear associated with the sleeve for actuating the valve, spaced means on the sleeve rotated thereby and adapted to engage alternately diametrically opposite portions of the periphery of the gear when the sleeve is reciprocated for causing the gear to be rotated in opposite directions, said gear having a shoulder at each side of the arm and engageable with the bent portion of the arm for limiting the angular rotation of the gear in either direction.

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