

Dec. 24, 1940.

R. LOZIVIT

2,226,345

THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

Filed Oct. 4, 1938

3 Sheets-Sheet 1

Fig: 1

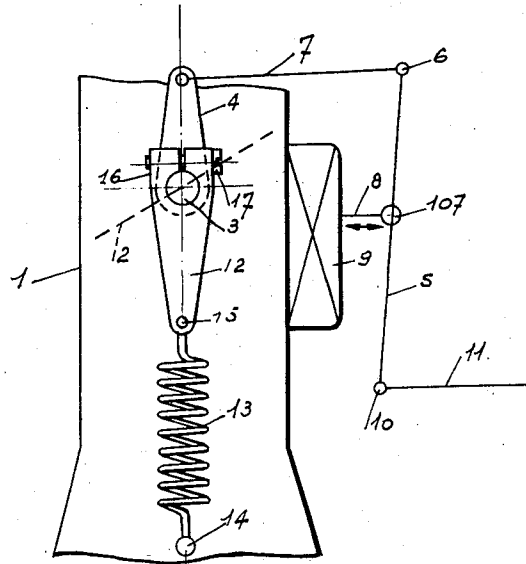
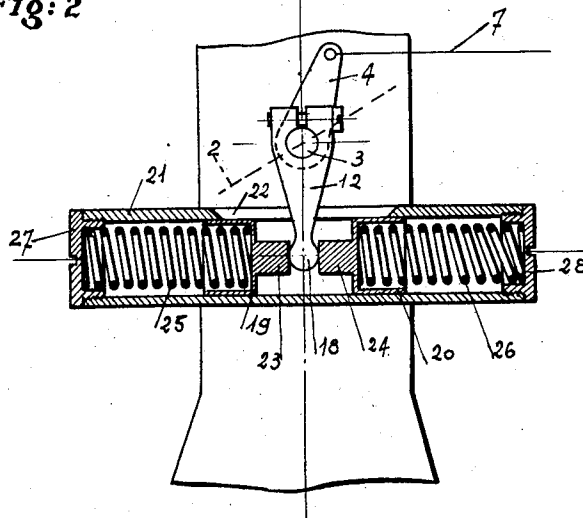


Fig: 2



Inventor:
Rene' Lozivit,
By Jesse B. Heller,
att'y.

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Fig: 3

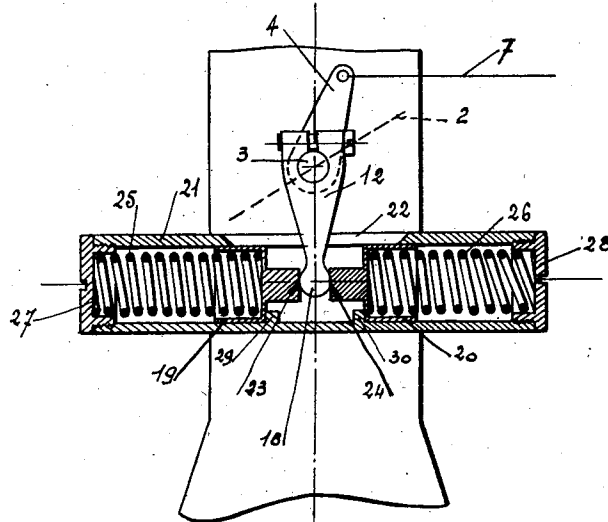
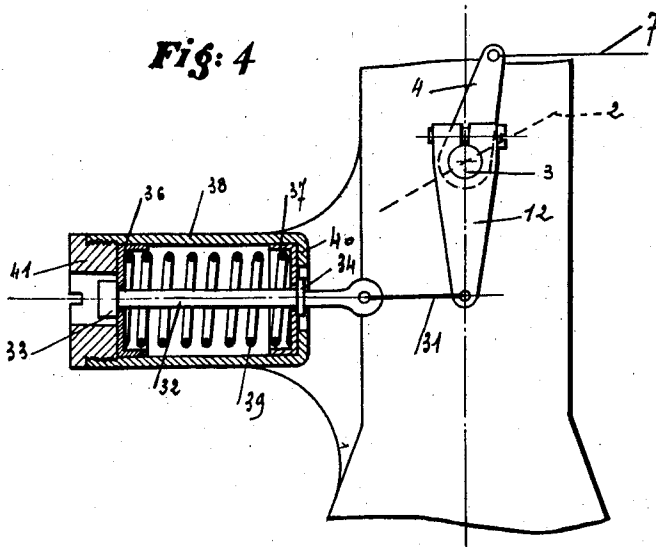


Fig: 4



Inventor:
Rene Lozivit,
By Jesse B. Heller
att'y.

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Fig: 5

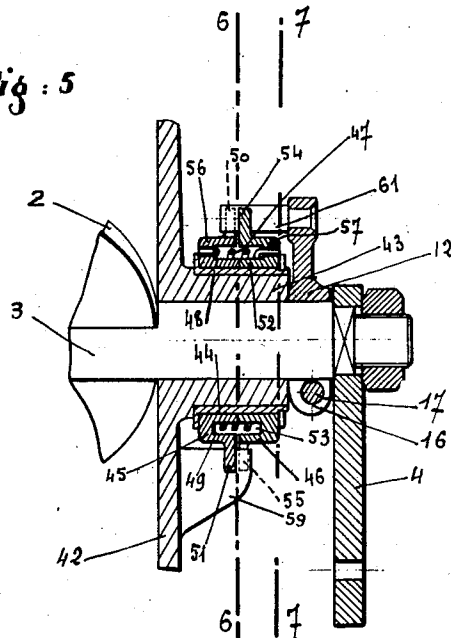


Fig: 6

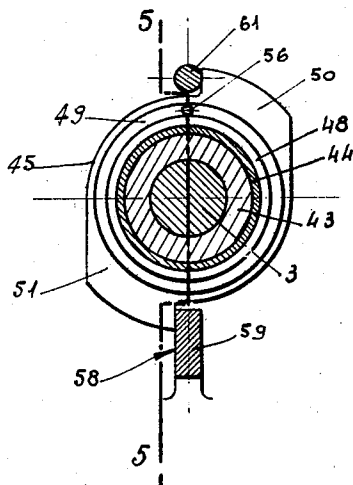
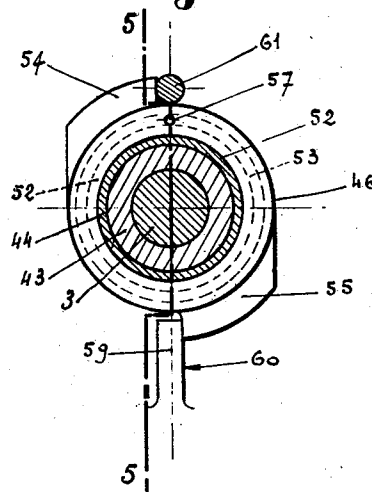


Fig: 7



Inventor:
René Lozivit,
By Jesse B. Heller,
att'y

UNITED STATES PATENT OFFICE

2,226,345

THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

René Lozivit, Paris, France, assignor to Societe Generale Des Carburateurs Zenith, Geneva, Switzerland

Application October 4, 1938, Serial No. 233,336
In France October 4, 1937

12 Claims. (Cl. 137—139)

The present invention relates to devices for controlling the throttle of internal combustion engines and more particularly for aviation engines.

The throttle of the engine is normally controlled by the pilot but it sometimes occurs that the pilot's throttle control is ruptured owing to the vibrations of the engine.

In the usual aviation engines a spring is provided which tends to bring the throttle to its full open position in the event of a rupture of the normal control of the throttle. Under these conditions if such an accident occurs the throttle opens automatically and allows the engine to develop its full power, whereby the pilot can land his aeroplane although he no longer has control of the throttle of the engine.

This arrangement is open to objection in modern engines which are capable of developing their full power up to a predetermined altitude called the rated height. In such engines which are generally supercharged it is necessary at altitudes lower than the rated height and particularly on the ground that the opening of the throttle should not exceed a definite partial opening in order to avoid too high a charging pressure for the engine which would be prejudicial to the latter. Generally this function is assured by a boost control which acts on the opening of the throttle at the same time as the pilot's control and which prevents the throttle from passing the maximum opening allowable at each altitude. If in such engines with limited charging the device, hereinbefore mentioned, which brings the throttle of the engine to the full open position in the event of a rupture of the normal control of the throttle is used, the engine becomes charged under too great a pressure owing to such rupture and this excess of charging pressure can damage or even bring about fracture of certain parts of the engine, thus nullifying the advantage which the above mentioned device had the object of securing.

The present invention has for object a safety device available in the event of a rupture of the pilot's throttle control in engines having a limited charging rate at ground level.

Further objects and advantages of the invention will appear from the following description taken in conjunction with the accompanying drawings wherein:

Figs. 1 to 4 illustrate diagrammatically in elevation partly in section various embodiments of the invention.

Fig. 5 illustrates diagrammatically in transverse

section along the line 5—5 of Figs. 6 and 7 a modification of the invention, and

Figs. 6 and 7 illustrate sections along 6—6 and 7—7 of the device illustrated in Fig. 5.

According to the invention, resilient means tend to bring back the throttle into the position of maximum opening allowed on the ground when the pilot's throttle control becomes inoperative. In these conditions in the case of a rupture of such control the throttle automatically takes the position of maximum opening allowed at ground level and for which the engine develops its full power at such level.

The engine thus continues to function normally and the pilot can bring his plane down without damage and he benefits by the full power of the engine at the moment of landing without supercharging taking place at any minute.

In the preferred embodiments of the invention one movable element acts on the throttle in the direction of closing between fully open and a determined partial opening which is defined by a stop limiting the movements of the said element. A second movable element acts on the throttle in the direction of opening between the position of completely closed and the same determined partial opening, the movements of the said second element being limited by a suitably placed stop. The said determined partial opening which corresponds to the said two stops represents the maximum opening allowable on the ground and it is preferably adjustable. The said movable elements are urged towards the corresponding stops either by two separate springs or by a single spring.

If two separate springs are used one of the stops could be omitted on the condition that the spring responsible for the movable element without a stop is not so strong as the spring responsible for the other movable element.

The device illustrated in Fig. 1 comprises an induction pipe 1 one part of the passage of which is regulated by a throttle 2. On the axis 3 of the throttle 2 is mounted a lever 4. A floating lever 5 is connected at a point 6 on the lever 4 by means of a link 7; it is likewise connected at a point 107 to the actuating member 8 of a boost control 9 and it is finally connected at a point 10 to the control lever manipulated by the pilot (not illustrated) by means of a rod 11. The boost control 9 is of any type whatever and can be actuated by the atmospheric pressure or by the pressure existing in the induction pipe. It is unnecessary to describe this boost control which is well known in the art of carburation and the construction of

which is of no interest as regards the present invention.

The throttle 2 is thus controlled in the usual manner by the combined action of the rod 11 controlled by the pilot and the power member 8 of the boost control. When the pilot brings the rod 11 into the position of maximum opening, the power member 3 pivoted to the floating lever 5 causes said floating lever to pivot round the pivot 10 and the movements of the lever are transmitted by the link 7 to the lever 4 and to the throttle 2, so as to keep the throttle in the position of maximum opening allowed.

On the axis 3 of the throttle 2 a lever 12 is also mounted. This lever can be clamped on to the axis 3 by means of a clamp 16 which can be tightened by means of a screw 17.

The position of the lever 12 relative to the throttle 2 is thus adjustable. A spring 13 is extended between a fixed point 14 and the end 15 of the lever 12.

In normal times, the position of the throttle 2 is regulated by the pilot by means of the rod 11 combining its action with the power member 8 of the boost control 9. The spring 13 does not interfere with the regulation of this position. In the following description, the whole assembly of rods which in the normal state of affairs regulates the opening of the throttle 2 through the intermediary of the lever 4 is called the pilot's throttle control.

If the pilot's throttle control becomes inoperative owing to a rupture of any one of its elements the spring 13 brings the throttle 2 back into a predetermined position which is illustrated in Fig. 1 and in which the lever 12 and the spring 13 are aligned with each other, that is to say in which the force of the spring is at a minimum. The adjustment of the lever 12 relative to the throttle 2 is made in such a way that this position corresponds to the maximum opening permissible on the ground.

In the following figures the illustration of the control of the lever 4 by the combined action of the pilot's lever and the boost control has been omitted, but this control can be effected in the same way as in the construction illustrated in Fig. 1 or in any other usual manner.

In the device illustrated in Fig. 2 two piston members 19, 20 are capable of sliding in a cylinder 21 fixed to the body of the carburettor. The lever 12, the level of which on the throttle can be regulated as in the device illustrated in Fig. 1 passes through a slot 22 made in the wall of the cylinder 21 and terminates in a head 18 which is interposed between the ends 23 and 24 of the members 19 and 20. The members 19 and 20 are respectively loaded by springs 25 and 26 compressed between the said members and plugs 27 and 28 closing the ends of the cylinder. The springs 25 and 26 have the purpose of keeping the ends 23 and 24 of the members 19 and 20 in contact with the head 18 of the lever 12.

During normal working the throttle 2 is controlled by the lever 4, that is to say by the pilot's throttle control and the two members 19 and 20 follow the head 18 of the lever 12 in its movements. If the pilot's throttle control becomes inoperative due to rupture, the throttle is moved into the position illustrated in Fig. 2 wherein the springs 25 and 26 are in equilibrium. The position of the lever 12 on the pin 3 is such that the position is one of maximum opening allowable on the ground.

The device illustrated in Fig. 2 has the fault

of not being absolutely exact. In fact, if the friction on the pin of the throttle is considerable it is possible that the throttle will stop in a position slightly out of the position of maximum allowable opening in which the two springs are strictly in equilibrium the preponderance of one of the springs over the other in such out of position not being sufficient to overcome the force of friction. In general nevertheless the vibrations of the engine are sufficient for the throttle to reach its position of real equilibrium very quickly under such vibration effect.

The device illustrated in Fig. 3 eliminates this fault completely. To this end, a stop 29 limits the movements of the member 19 in the direction of opening the throttle 2 under the thrust of the spring 25 and similarly a stop 30 limits the movements of the member 20 in the direction of closing the throttle under the thrust of spring 26. Should the springs 25 and 26 have unequal forces these springs always tend to bring back the lever 12 to the position illustrated in Fig. 3 and for this purpose it is sufficient that the force of each of the springs should be greater than the forces of friction, care naturally being taken to bring this about.

The functioning of the apparatus illustrated in Fig. 3 differs from the functioning of the apparatus illustrated in Fig. 2 in the following point: when the throttle 2 is moved by the pilot's throttle control by means of the lever 4 into a position which is more open than the position illustrated in Fig. 3 (maximum opening allowed on the ground) the head 18 of the lever 12 pushes back the member 20, compressing the spring 26 but the part 19 does not follow the movement of the head 18 in this displacement. Inversely, the member 20 does not follow the movements of the head 18 in the movement of closing the throttle beyond the position illustrated.

In the device illustrated in Fig. 3 one of the stops 29 or 30 can be omitted. If for example the stop 29 is omitted, the spring 25 must be weaker than the spring 26.

In the device illustrated in Fig. 4, the lever 12 is connected by a link 21 to a rod 32 carrying two collars 33 and 34. Two movable piston members 36 and 37 are adapted to slide in a cylinder 38 fixed to the body of the carburettor and they are traversed by the rod 32. A spring 39 is compressed between the members 36 and 37. The movements of the member 37 under the effects of the thrust of the spring 39 are limited by a stop 40 and the movements of the member 36 under the effects of the thrust of the spring 39 are limited by a stop 41 formed by a plug screwed into the end of the cylinder 38.

During normal working, the position of the throttle 2 is regulated by the lever 4. When the lever 4 displaces the throttle 2 in the direction of closing starting from the position illustrated, the lever 12 pushes the rod 32 towards the left and in this movement the collar 34 pushes the member 37 compressing the spring 39 against the member 36 which remains stationary the movements of the rod being guided by the latter member. When conversely the lever 4 displaces the throttle 2 in the direction of opening starting from the position illustrated, the lever 12 brings the rod 32 towards the right and in this movement the collar 33 pushes the member 36 compressing the spring 39 against the member 37, the movements of the rod being guided by the latter member.

If the pilot's throttle control becomes inoperative the spring 39 brings back the two members

36 and 37 into contact with the corresponding stops 41 and 40. The collars 33 and 34 are placed on the rod 32 in such a way that they are then in contact with the members 36 and 37 respectively. The throttle 2 is thus brought into the predetermined position illustrated in Fig. 4, the lever 12 being clamped to the pin 3 in such a way that such position of the throttle 2 is the position of maximum permissible opening at ground level.

In the device illustrated in Figs. 2, 3 and 4, the two movable members which under the effect of two different springs or under the effect of a common spring tend to bring back the throttle towards its position of maximum opening permissible on the ground, have rectilinear displacements, but it is clear that these displacements could be circular. In this case, the two movable members would rotate around the pin of the throttle. One of the movable members is acted on by a spring in the direction of closing and a stop limits the displacements of this movable member under the effect of the spring. The other movable member is acted on by a spring in the direction of opening of the throttle and its displacements are limited by a stop. Preferably a single torsion spring the two ends of which are fixed respectively to the members acts on the two members at the same time. In its movement in the direction of closing the first movable member moves the throttle by means of a suitable device such as a projection carried by the movable member and cooperating with a projection of a lever mounted on the pin of the throttle. In its movement in the direction of opening the second movable member carries the throttle along similarly by analogous means. The various members are disposed in such a way that when the one and the other member are in contact with their respective stops, the throttle occupies the position of maximum opening allowed on the ground.

An arrangement of this nature is illustrated in Figs. 5 to 7. In this arrangement, the throttle pin 3 passes through a boss 43 carried by the wall 42 of the induction pipe and carries at its end a lever 4 by means of which the control of the throttle by the pilot takes place normally, as in the devices described above. On the pin 3 a lever 12 is likewise mounted by means of a clamp 16 secured by means of a screw 17 whereby the level of the lever 12 on the pin of the throttle 3 can be adjusted in the same manner as in the devices previously described.

Movable members 45 and 46 rotate on a sleeve 44 fixed on the boss 43. The form of these members can be seen well in Figs. 6 and 7. For clearness in drawing the member 46 only has been illustrated in Fig. 7, it being assumed that the member 45 has been removed. The member 45 comprises a sleeve 48 a circular recess 49 forming a part housing for a torsion spring 47 and two wings 50 and 51. The member 46 similarly comprises a sleeve 52 a circular recess 53 forming a part housing for the spring 47 and two wings 54 and 55. The torsion spring 47 is rolled in the housing 49-53 and its end engaged respectively in holes 56 and 57 of the two members 45 and 46. For clearness in the drawings this spring is omitted on Figs. 6 and 7.

By its elasticity the spring 47 tends to unroll and thus tends to bring the wing 51 of the member 45 into contact with the face 58 of a stop 59 carried by the inlet pipe 42 and the wing 55 of the member 46 into contact with the face 60 of the stop 59. When the two members 45 and 46 come in contact with their stops respectively,

their wings 50 and 54 bring back the spur 61 carried by the lever 12 into the position illustrated in Figs. 6 and 7 and the fixing of the lever 12 on the pin 3 of the throttle 2 is such that the throttle 2 then occupies the position of maximum opening allowed on the ground. The two members 45 and 46 form in a way a pair of scissors the wings 51 and 52 of which tend to close on to the stop 59 under the action of the spring 47. In this movement the two arms 54 and 50 of the scissors close on the spur 61 of the lever 12 thus bringing it back into the position indicated.

During normal working, the position of the throttle is fixed by the pilot's throttle control by means of the lever 4. When this control displaces the throttle 2 in the direction of opening, starting from the position of maximum opening allowed on the ground, the member 46 remains stationary and the member 45 is moved in a clockwise direction by the spur 61 of the lever 12. If on the contrary the lever 4 displaces the throttle 2 in the direction of closing starting from the position of maximum opening allowed on the ground, the member 45 remains stationary and the spur 61 of the lever 12 moves the member 46 in a counter-clockwise direction. If the pilot's throttle control becomes inoperative by the rupture of one of its elements the spring 47 closes the scissors formed by the members 45 and 46 on to the stop 59 and the spur 61 is brought back to the position illustrated as was explained above. The throttle 2 then occupies the position of maximum opening permissible on the ground.

The invention is obviously not limited to the devices illustrated. All arrangements capable of bringing back elastically a member into a determined position could be used according to the invention to bring back the throttle to its position of maximum opening allowable on the ground when the pilot's throttle control becomes inoperative.

What I claim is:

1. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a shaft for the throttle, a pilot's throttle control, resilient means urging said throttle towards a predetermined position of partial opening, and adjustable means surrounding the shaft of the throttle and connected to the resilient means for varying the predetermined open position of the throttle.

2. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a shaft for the throttle, a pilot's throttle control, a boost control therein, resilient means urging said throttle towards a predetermined position of partial opening, and adjustable means surrounding the shaft of the throttle and connected to the resilient means for varying the predetermined open position of the throttle.

3. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a shaft for the throttle, a pilot's throttle control, resilient means for urging said throttle in one direction, resilient means for urging said throttle in the opposite direction, and adjustable means surrounding the shaft of the throttle and connected to the resilient means.

4. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, resilient means for urging said throttle in one direction, a stop for said resilient means, and resilient means weaker than said first mentioned resilient means for urging said throttle in the opposite direction.

5. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a shaft for the throttle, a pilot's throttle control, resilient means for urging said throttle in one direction, a stop for said resilient means, resilient means for urging said throttle in the opposite direction, a stop for said second mentioned resilient means, an adjustable means surrounding the shaft of the throttle and connected to the resilient means.

6. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, resilient means for urging said throttle in one direction, a stop for said resilient means, resilient means for urging said throttle in the opposite direction, and a stop for said second mentioned resilient means, said stops corresponding both to a sane predetermined position of partial opening of said throttle.

7. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a first movable member, a stop for said first movable member, a second movable member, a stop for said second movable member, a spring interposed between said movable members, urging the same towards the corresponding stops, means operative by said first movable member adapted to urge said throttle in one direction, when said first movable member moves towards said first mentioned stop, and means operative by said second movable member adapted to urge said throttle in the opposite direction, when said second movable member moves towards said second mentioned stop.

8. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a first movable member, a stop for said first movable member, a second movable member, a stop for said second movable member, a spring interposed between said movable members urging the same towards the corresponding stops, means operative by said first movable member adapted to urge said throttle in one direction towards a predetermined position of partial opening when said first movable member moves towards said first mentioned stop, and means operative by said second movable member, adapted to urge said throttle in the opposite direction towards said predetermined position of partial opening when said second movable member moves towards said second mentioned stop.

9. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a first cylinder, a sliding member in said cylinder, a spring for loading said sliding member, a second cylinder, a sliding member in said second cylinder, a spring for loading said second mentioned sliding member, and a movable member, operatively connected with said throttle, adapted to urge said first mentioned sliding member against said first

mentioned spring as said throttle moves in one direction and to urge said second mentioned sliding member against said second mentioned spring as said throttle moves in the opposite direction.

10. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a first cylinder, a sliding member in said cylinder, a stop for said sliding member, a spring for urging said sliding member towards said stop, a second cylinder, a sliding member in said second cylinder, a spring, weaker than said first mentioned spring, for loading said second mentioned sliding member, and a movable member, operatively connected with said throttle, adapted to urge said first mentioned sliding member away from said stop against said first mentioned spring as said throttle moves in one direction away from a predetermined position of partial opening and to urge said second mentioned sliding member against said second mentioned spring as said throttle moves in the opposite direction.

11. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a first cylinder, a sliding member in said cylinder, a stop for said sliding member, a spring for urging said sliding member towards said stop, a second cylinder, a sliding member in said second cylinder, a stop for said second mentioned sliding member, a spring for urging said second mentioned sliding member towards said second mentioned stop, and a movable member, operatively connected with said throttle, adapted to urge said first mentioned sliding member away from said first mentioned stop against said first mentioned spring as said throttle moves in one direction away from a predetermined position of partial opening and to urge said second mentioned sliding member away from said second mentioned stop against said second mentioned spring as said throttle moves in the opposite direction away from said predetermined position.

12. A device for controlling the throttle of an internal combustion engine, which comprises, in combination, a pilot's throttle control, a cylinder, a first sliding member in said cylinder, a stop for said first sliding member, a second sliding member in said cylinder, a stop for said second sliding member, a spring interposed between said sliding members, urging the same towards the corresponding stops, a rod operatively connected with said throttle, a projection on said rod, adapted to engage said first sliding member and to urge the same away from said first mentioned stop against said spring as said throttle moves in one direction away from a predetermined position of partial opening, and another projection on said rod, adapted to engage said second sliding member and to urge the same away from said second mentioned stop against said spring as said throttle moves in the opposite direction away from said predetermined position.

RENÉ LOZIVIT.