Jan. 7, 1964 L. F. CALLAHAN 3,116,906

THROTTLE VALVE ACTUATING APPARATUS

Filed July 21, 1961

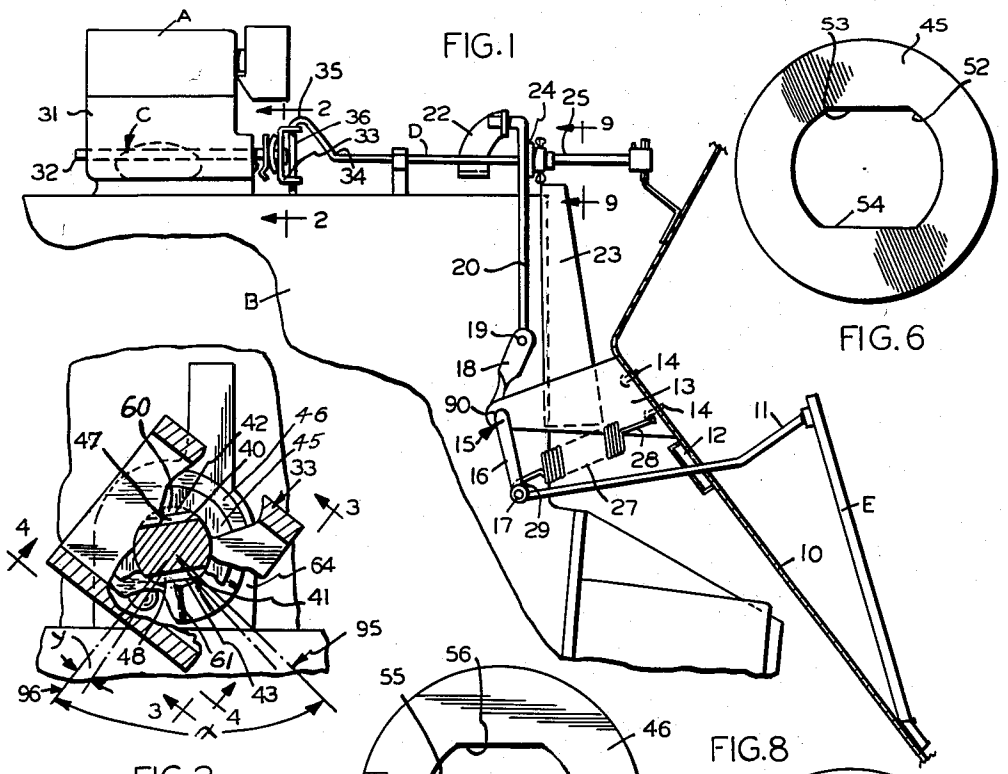



FIG. 1




FIG. 2

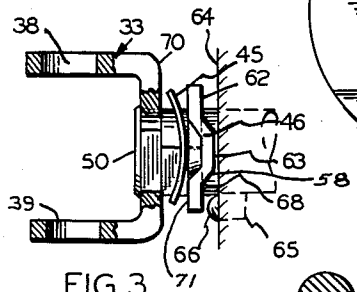



FIG. 3

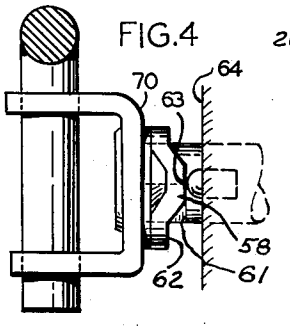



FIG. 4

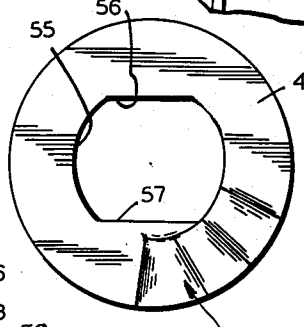



FIG. 5




FIG. 6



FIG. 7

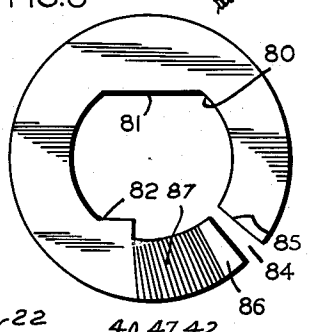



FIG. 8

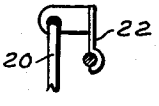



FIG. 9

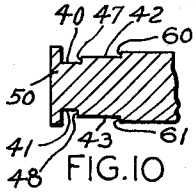



FIG. 10

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# THROTTLE VALVE ACTUATING APPARATUS

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8 Claims. (Cl. 251—64)

The invention relates to a throttle valve actuating device for an internal combustion engine and has particular reference to a mechanism for momentarily retarding valve closing throughout the final few degrees of valve operating range.

The principal object of the invention is to provide mechanical means for momentarily retarding final valve closing.

Another object is to provide such a mechanism for the purpose of reducing the possibility of "killing" the engine by too rapid valve closing.

A further specific object of the invention is to provide mechanism for effecting limited frictional resistance to valve closing throughout the final 4 or 5 degrees of the valve closing range.

Other objects and advantages of the invention will be apparent from the ensuing specification and appended drawing in which:

FIG. 1 is a side elevational view of a typical throttle valve actuating apparatus employing the inventive subject matter.

FIG. 2 is a fragmentary end view taken generally on the line 2—2 of FIG. 1 with parts broken in section.

FIG. 3 is a fragmentary view taken on the line 3—3 of FIG. 2 with parts broken in section.

FIG. 4 is a fragmentary view taken on the line 4—4 of FIG. 2, but with the throttle valve rotated to closed position.

FIG. 5 is a detail plan view of one component.

FIG. 6 is a detail plan view of another component.

FIG. 7 is a fragmentary sectional view similar to FIG. 3 but showing a modified form of the invention.

FIG. 8 is a detail plan view of a component of the device shown in FIG. 7.

FIG. 9 is a sectional detail view taken generally on the line 9—9 of FIG. 1.

FIG. 10 is a fragmentary sectional detail view of the end portion of the throttle valve shaft.

Referring to FIG. 1, I have shown a typical throttle valve actuating assembly as utilized in an automotive vehicle. A carburetor A is mounted on engine B and the throttle valve C is actuated by the rotation of accelerator shaft D. A foot pedal E is initially actuated for effecting rotation of the accelerator shaft.

The accelerator pedal E is mounted on the toeboard **10** and its upper end is connected to actuating rod **11** which projects through a suitable opening **12** in the toeboard. A bracket **13** has its base portion anchored to the toeboard as by means of screws **14**. Crank **15** is carried by the bracket and one crank arm **16** is pivotally connected at **17** to the inner end of the actuating rod **11** and crank arm **18** is pivotally connected at **19** to the lower end of link **20**. The upper end of link **20** is pivotally connected to the bracket **22** which is anchored, as by welding, to the accelerator shaft D.

A bracket **23** is anchored at its lower end to the side face of bracket **13** and carries a bearing **24** at its upper end. The bearing rotatively accommodates the outer end **25** of the accelerator shaft.

A tension spring **27** has one end **28** anchored to the bracket **13** and its other end **29** anchored to the pivot pin **17** which interconnects the crank arm **16** and actuating rod **11**.



All of the foregoing throttle valve actuating mechanism forms the subject matter of a co-pending patent application, Serial No. 122,492, filed on July 7, 1961.

The throttle valve C is mounted within the carburetor housing **31** on the throttle valve shaft **32**. The valve shaft projects exteriorly of the carburetor housing and has a bracket **33** anchored to the outer end thereof. The accelerator shaft D is bent at **34** and at **35** to provide the transverse end portion **36** which extends through the aligned openings **38** and **39** in bracket **33**. Thus, rotation of the accelerator shaft is transmitted to the valve shaft **32** via rotation of bracket **33**.

Referring to FIGS. 2 and 10, it will be noted that the outer end of the valve shaft has diametrically opposed flats **40** and **41** which lock the bracket **33** to the shaft so that it effects rotation of said shaft. A second set of diametrically opposed flats **42** and **43** serve to accommodate the spring washer **45** and cam washer **46**. At the ends of the flats **40** and **41** radially extending shoulders **47** and **48** are formed, against which the underside of bracket **33** bottoms. The head portion **50** at the outer end of the valve shaft anchors the bracket against axial movement relative to said shaft.

Referring to FIGS. 5 and 6, the spring washer **45** is provided with a central opening **52** with flats **53** and **54** which coact with the shaft flats **42** and **43**. The cam washer **46** likewise has a central opening **55** with flats **56** and **57** which coact with shaft flats **42** and **43**. The cam washer has a cam surface identified generally with the numeral **58** formed therein, preferably as by means of a punch press operation. At the ends of the shaft flats **42** and **43** shoulders **60** and **61** are formed and when the underside **62** of the cam washer engages said shoulders under the influence of spring washer **45**, the apex portion **63** of the cam will be slightly spaced from the end face **64** of the carburetor housing **31**. A plug **65** may be pressed into the end wall of the carburetor housing and has a semi-spherical end surface **66** projecting outwardly therefrom. When the underside **62** of the cam washer is in contact with shaft shoulders **60** and **61**, then there is preferably a slight clearance between the end of the nose portion **66** and the underside of the cam washer.

When the throttle valve moves to within 4 or 5 degrees of fully closed position, the inital portion **68** of the cam engages the nose of the plug **65** and when the throttle valve reaches fully closed position, the apex portion **63** of the cam will be resting on the plug nose as viewed in FIG. 4 and the spring washer **45** will be substantially fully compressed between the underside **70** of the bracket **33** and the upper side **71** of the cam washer as shown in FIG. 4.

In the modified form of the invention as shown in FIGS. 7 and 8, the spring washer and cam means are incorporated in one component. The component is provided with a central opening **80** having flats **81** and **82** which coact with the shaft flats **83** (only one of which is shown in FIG. 7). The washer forms a nearly complete circle; however, the gap **84** between the ends **85** and **86** make it possible to utilize the cam **87** as the spring (comparable to the spring washer **45**). When the underside **88** of the washer is in contact with the shaft shoulders provided at the ends of the flats **83**, there will preferably be a slight clearance between the cam and the end shoulder **64***a* of the carburetor housing and between the underside of the washer and the end **66***a* of the plug **65***a*.

*Operation*

In the operation of the throttle valve actuating apparatus, the accelerator pedal is depressed to effect opening of the throttle valve. Downward movement of such pedal causes rod **11** to swing the crank arm **16** and **18** clockwise about the horizontal axis **90**. Crank arm **18**

pulls link 20 and bracket 22 downward to effect rotation of accelerator shaft D in a counter-clockwise direction viewing FIG. 9. Rotation of such shaft to fully open valve position will rotate the valve shaft 32 and bracket 33 to the position as indicated in FIG. 2. When the foot pressure on the accelerator pedal is released, the return spring 27 takes over and automatically returns the valve to fully closed posiiton. In fully closed position, the apex of the cam will overlie the nose of the plug 65 as shown in FIG. 4.

Viewing FIG. 2, the closing of the valve will cause rotation of the bracket 33 clockwise to a position approximately 80 degrees beyond that shown in FIG. 2. The range of movement of the accelerator shaft from fully opened to fully closed position is indicated by the dimension X. Open position is indicated by the line 95 and closed position is indicated by the line 96. The final 4 or 5 degrees of valve closing is indicated by the dimension Y and it is during this range of movement of the valve shaft that the cam commences riding up on nose 66 against the resistance offered by the spring washer 45 until the washer is substantially flattened as indicated in FIG. 4. The resistance occasioned by the spring washer is calibrated in conjunction with the tension exerted by spring 27 so that the final 4 or 5 degrees of valve closing results in a slowing down of the closing movement of the valve shaft thereby preventing an abrupt valve closing condition. Thus, the likelihood of the engine dying as a result of abrupt valve closing is lessened.

Viewing FIG. 3, it will be noted that the clearance shown, for example, between the periphery of the spring washer 45 and the underside 70 of bracket 33 is greatly exaggerated for purposes of clarity in detail of the drawing; however, in practice the clearance between the various components need only be such as to assure that little or no frictional drag occurs during valve opening and closing throughout the range of operation other than the final few degrees of closing. Thus, in FIG. 3 the clearance shown between washer surface 62 and nose 66 and the clearance shown between the cam apex 63 and carburetor housing face 64 are also exaggerated.

Clearance exaggeration also exists in FIG. 7 between washer face 88 and nose 66*a* and between the cam surface and carburetor housing wall 64*a*.

I claim:

1. A carburetor throttle valve control mechanism comprising: a throttle valve; a shaft for rotatively actuating the valve between closed and open positions; a carburetor housing rotatively supporting the shaft, said shaft projecting beyond an end wall of the housing; means for actuating the rotation of the shaft to open the valve; spring means for effecting rotation of the shaft automatically to close the valve and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means comprising: a cam surface rotatable with the shaft; an abutment on the carburetor housing situated in the path of rotation of the cam surface and resilient means on the shaft and being energized when the cam surface rides over the abutment.

2. A carburetor throttle valve control mechanism comprising: a carburetor housing; a throttle valve within the housing; a valve shaft carrying the valve and being rotatably supported by the housing and having an end projecting through one wall of the housing; means for effecting rotation of the shaft in valve opening direction to open the valve; spring means for automatically rotating the shaft in valve closing direction upon inactivation of the valve opening means; and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means comprising: a cam surface rotatable with the shaft; cam receiving means non-rotatable with reference to the shaft and situated in the path of rotation of the cam surface and resilient means on the shaft for resisting movement of the cam surface over the cam receiving means.



3. A carburetor throttle valve control mechanism comprising: a carburetor housing; a throttle valve within the housing; a valve shaft carrying the valve and being rotatably supported by the housing and having an end projecting through one wall of the housing; means for effecting rotation of the shaft in valve opening direction to open the valve; spring means for automatically rotating the shaft in valve closing direction upon inactivation of the valve opening means; and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means comprising: a washer non-rotatably mounted on the shaft and axially movable relative thereto; a cam surface on the washer; an abutment on the carburetor housing wall and situated in the path of rotation of the cam surface; resilient means on the shaft and normally urging the washer in an axial direction along the shaft toward the abutment, said cam surface riding over the abutment and the resilient means serving to resist the riding of the cam surface over the abutment.

4. Apparatus as set forth in claim 3 wherein the torque load imposed on the shaft by the spring means in rotating the shaft in valve closing direction exceeds the resistance to such torque load occasioned by the resilient means as the cam surface rides over the abutment.

5. Apparatus as set forth in claim 3 wherein the shaft has a shoulder for limiting the axial movement of the washer toward the abutment.

6. A carburetor throttle valve control mechanism comprising: a carburetor housing; a throttle valve within the housing; a valve shaft carrying the valve and being rotatably supported by the housing and having an end projecting through one wall of the housing; means for effecting rotation of the shaft in valve opening direction to open the valve; spring means for automatically rotating the shaft in valve closing direction upon inactivation of the valve opening means; and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means comprising: a washer non-rotatably mounted on the shaft and axially movable relative thereto; a resilient cam surface on the washer; an abutment on the carburetor housing wall and situated in the path of rotation of the cam surface; said resilient cam surface riding over the abutment and simultaneously serving to resist the rotative torque imparted to the shaft by the spring means.

7. A carburetor throttle valve control mechanism comprising: a throttle valve; a shaft for rotatively actuating the valve between closed and open positions; a carburetor housing rotatively supporting the shaft, said shaft projecting beyond an end wall of the housing; means for actuating the rotation of the shaft to open the valve; spring means for effecting rotation of the shaft automatically to close the valve and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means comprising: cam means and resilient means associated with the shaft and with the carburetor housing; whereby rotation of the shaft in valve closing direction throughout the final few degrees of rotative movement causes energizing of the resilient means to effect such resistance to valve closing.

8. A carburetor throttle valve control mechanism comprising: a carburetor housing; a throttle valve within the housing; a valve shaft carrying the valve and being rotatably supported by the housing and having an end projecting through one wall of the housing; means for effecting rotation of the shaft in valve opening direction to open the valve; spring means for automatically rotating the shaft in valve closing direction upon inactivation of the valve opening means; and means for resisting the valve closing effort of the spring means immediately prior to such valve reaching fully closed position, said means

comprising: a cam surface mounted on the shaft for axial movement relative thereto and being rotatable with the shaft; cam receiving means non-rotatable with reference to the shaft and situated in the path of rotation of the cam surface and resilient means on the shaft and being energized when the cam surface moves over the cam receiving means, thereby resisting the movement of the cam surface over the cam receiving means.



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