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THROTTLE CONTROL LINKAGE

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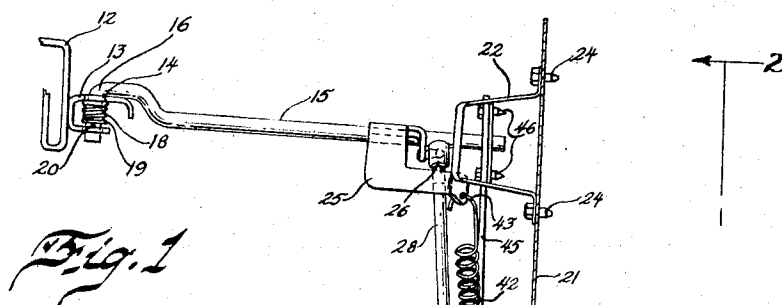


Fig. 2

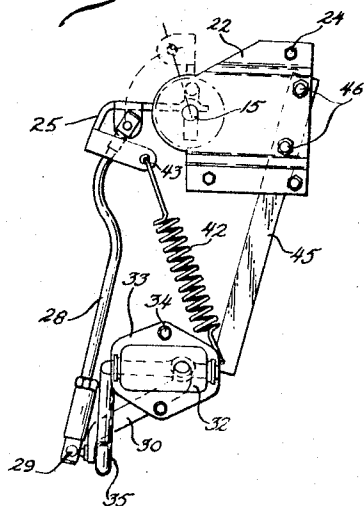
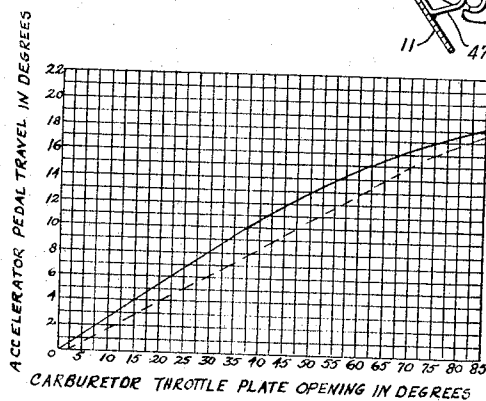


Fig. 3

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THROTTLE CONTROL LINKAGE

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This invention relates generally to throttle control linkages for internal combustion engines and more particularly to an improvement in accelerator pedal and bellcrank coaction to achieve slow and rapid opening of the throttle.

A conventional throttle control linkage includes an accelerator pedal that is pivotally mounted at one end on the floor, by way of example, of a vehicle. The other end of the pedal bears against the ball-like extremity of one leg of a bellcrank which is pivotally mounted on the firewall. The second leg of the bellcrank extends through an opening in the firewall into the engine compartment and connects to a rod which in turn connects with a lever which is integrally joined to a throttle valve actuating shaft. Rotation of the shaft controls the extent of the valve throttle plate opening. A spring returns the lever and, therefore, the throttle plate to the idle or substantially closed position. Since pedal and bellcrank angular travel are relatively limited whereas the throttle plate opening may total as much as 85°, the lever may conveniently be made ½ the length of the second bellcrank leg to provide the full range of throttle plate operation.

While the above detailed linkage is reasonably effective besides being economical to produce, it has the disadvantage of providing substantially equal throttle opening angular increments for equal pedal angular travel. A graph of these two functions through their entire range discloses virtually a straight line. In actual vehicle operation, however, it is preferred that the throttle open slowly with a relatively large amount of pedal travel to provide smooth vehicle movement from a stationary position. At higher vehicle speeds, a large amount of throttle travel for correspondingly small pedal travel is desirable for rapid acceleration besides being essential to achieve full range operation due to the limited pedal travel still available.

Although the preferred throttle control can be accomplished by the addition of other elements to the linkage, by the use of asymmetrical elements or by the selection of various centers of rotation and the use of resilient items therewith, all of these possibilities unduly increase the cost besides providing a design package problem. Applicant, therefore, has modified the linkage detailed above to achieve the preferred throttle control with a minimum of departure therefrom. Specifically, applicant has designed a bellcrank in which the leg in contact with the accelerator pedal has an elongated cam type bearing surface. When the spring returns the lever and thus the bellcrank and pedal to the idle position, the end of the leg contacts the pedal. In this situation, the length of the leg is at its greatest and movement of the pedal produces relatively small and consistent bellcrank and throttle angular travel. As the pedal is depressed, the pedal makes contact with the bellcrank leg closer to its pivot thereby in effect shortening the bellcrank leg and producing larger amounts of throttle angular travel. As the pedal reaches its fully depressed position, the rate of shortening of the leg becomes very pronounced because the curve of pedal and bellcrank contact is not as flat as in the idle position. Consequently, small pedal movement produces the large increase in throttle opening which is desirable at higher vehicle speeds. Lowering the bellcrank pivot to flatten the aforementioned contact curve would further slow the

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rate of throttle opening from the idle position. A curve of accelerator pedal travel in degrees versus throttle plate opening travel (also in degrees) varies significantly from the straight line function previously discussed and illustrates the improved throttle operation achieved. While it is conceivable that the cam type surface could be incorporated in the accelerator pedal rather than in the bellcrank, the bellcrank modification is preferred on the basis of economy.

It is, therefore, an object of this invention to provide a new and improved throttle control linkage.

Another object of this invention is to provide a throttle control linkage that provides slow opening of the throttle from the throttle idle position and rapid opening of the throttle thereafter.

Another object of this invention is to provide a throttle control linkage that provides slow opening of the throttle and rapid opening thereafter by the gradual shortening of the radial distance from the bellcrank pivot to the point of contact with the accelerator pedal.

Another object of this invention is to provide a throttle control linkage for a vehicle that provides slow opening of the throttle and rapid opening thereafter that can be produced at less cost.

Other objects and advantages will become apparent from the following description in conjunction with the drawing in which:

FIGURE 1 is an elevational view (partially in section) of the throttle control linkage of this invention installed on a vehicle.

FIGURE 2 is a view of the linkage along line 2-2 of FIGURE 1 but with the pedal and firewall removed.

FIGURE 3 is a graph illustrating pedal travel related to throttle plate opening.

Referring to FIGURES 1 and 2, 10 indicates generally the throttle control linkage which is installed on vehicle 11. Carburetor 12 has an extension 13 with aperture 14 therein projecting therefrom that is connected to the carburetor throttle valve for rotation therewith. Shaft 15 has a hooked end 16 that extends through aperture 14 and is resiliently maintained therein by spring 18, washer 19 and cotter pin 20. Shaft 15 also extends toward firewall 21 and is rotatably supported in bracket 22 fixed to firewall 21 by screws 24.

Integral with shaft 15 is lever 25. Lever 25 through ball and socket joint 26 is connected to one end of rod 28. The other end of rod 28 through ball and socket joint 29 is connected to a leg 30 of bellcrank 31. Bellcrank 31 is pivotally supported at mounting portion 32 in housing 33 which is affixed to firewall 21 by screws 34. The other leg 35 of bellcrank 31 extends away from the firewall 21 into the passenger compartment. Leg 35 has an elongated curved bearing surface 36 extending from the end 38 of leg 35 toward mounting portion 32 in housing 33 and generally stopping at point 39.

Accelerator pedal 40 is pivotally mounted on the floor of the vehicle 11 by pivot support 47 and pin 48 and has hard surface 41 in contact with the end 38 of leg 35. Pedal return coil spring 42 has end 43 connected to lever 25 and the other end 44 to a strap 45 attached to bracket 22 by screws 46.

In operation, the accelerator pedal 40 is shown in solid lines in its starting position with the carburetor throttle valve substantially closed. In this pedal position, coil spring 42 also causes the balance of the throttle control linkage elements to assume their corresponding positions which are likewise shown in solid lines. Pedal 40 at surface 41, therefore, contacts bearing surface 36 at end 38 of bellcrank leg 35.

As the pedal 40 is depressed to assume the positions shown in dotted lines which correspond to 2 degree angu-

lar increments to a total of 18 degrees of pedal travel, the leg 35 in contact therewith is forced to move accordingly. In full depressed or final pedal position, leg 35 through rod 28 and lever 25 has rotated shaft 15 and the attached throttle valve to a full throttle plate opening of 85 degrees (see FIGURE 2). During the movement of pedal 40 from its starting to final position, pedal surface 41 contacts curved bearing surface 36 of leg 35 from end 38 and along same to point 39.

From FIGURE 1, it is readily apparent that the radial distance from the bellcrank pivot to the point of contact with pedal surface 41 is considerably shortened. Consequently, increasingly greater angular travel of leg 35 and, therefore, lever 25 and the related throttle plate opening for the same amount of pedal travel is achieved as the pedal is depressed. The result is that the throttle valve is opened slowly from the pedal starting position and then rapidly from about 40 percent of the total pedal travel to the final pedal position.

FIGURE 3 illustrates the improved slow and then fast opening of the throttle by the throttle control linkage of this invention compared with that of the previously detailed conventional arrangement (shown in dotted lines) where there is no substantial shortening of the bellcrank leg that contacts the pedal.

Having thus described the invention, it will be apparent to those skilled in the art that various modifications and changes can be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A throttle control linkage for use with the throttle valve of a carburetor for an internal combustion engine comprising:

- (a) a shaft adapted to be connected to the throttle valve of a carburetor for opening and closing thereof;
- (b) a lever connected to said shaft for rotation therewith;
- (c) a rod pivotally connected to said lever;
- (d) a bellcrank having a pair of legs, one of said legs being pivotally connected to said rod, the end of said other leg having a bearing surface thereon, said bearing surface being generally an elongated curved surface extending from said end along said leg;
- (e) first support means for pivotally mounting said bellcrank;
- (f) an accelerator pedal contacting said bearing surface at said end of said other bellcrank leg;
- (g) second support means for pivotally mounting said pedal, whereby upon pivoting said pedal, said pedal moves said other bellcrank leg to open the valve and the radial distance of said other leg from said bellcrank pivot to contact with said pedal along said bearing surface in the final position of said pedal travel is substantially less than the radial distance in the starting pedal position for slow and then rapid opening of the throttle.

2. The throttle control linkage of claim 1 further comprising: third support means for rotatably mounting said shaft and spring means for returning said pedal to the starting position and closing the valve.

3. A throttle control linkage for use with the throttle valve of a carburetor for an internal combustion engine comprising:

- (a) a shaft adapted to be connected to the throttle valve of a carburetor for opening and closing thereof;
- (b) a lever connected to said shaft for rotation therewith;
- (c) a rod pivotally connected to said lever;
- (d) a bellcrank having a pair of legs and a mounting portion therebetween, one of said legs being pivotally connected to said rod, the end of said other leg having a bearing surface thereon, said bearing surface being generally an elongated curve surface ex-

tending from said end along said other leg toward said mounting portion, the radial distance from said mounting portion to the bearing surface approaching thereto being less than 95% of the radial distance to the end of said other leg;

- (e) first support means for pivotally mounting said bellcrank at said crank mounting portion;
- (f) an accelerator pedal contacting said bearing surface at said end of said other bellcrank leg;
- (g) second support means for pivotally mounting said pedal, whereby upon pivoting said pedal, said pedal moves said other bellcrank leg to open the valve, said pedal contacting said bearing surface at the end of said other leg in the pedal starting position and contacting said bearing surface therebetween and where same approaches said mounting portion in the final pedal position for slow and rapid opening of the throttle.

4. The throttle control linkage of claim 3 in which the curved bearing surface of said other bellcrank leg is an arc of a circle.

5. The throttle control linkage of claim 4 further comprising: third support means for rotatably mounting said shaft and spring means for returning said pedal to the starting position and closing the valve.

6. The throttle control linkage of claim 5 in which said spring means is a coil spring connected at one end to said lever and the other end to said third support means.

7. The throttle control linkage of claim 6 in which the radial distance from said crank mounting position to the bearing surface approaching thereto is less than 85% of the radial distance to the end of said other leg.

8. A lever linkage arrangement adapted for actuation of a member to be rotated, said lever linkage arrangement comprising:

- (a) a shaft adapted to be connected to the member for rotation thereof;
- (b) a lever connected to said shaft for rotation therewith;
- (c) a rod pivotally connected to said lever;
- (d) a bellcrank having a pair of legs joined by a mounting portion, one of said legs being pivotally connected to said rod, the end of said other leg having a bearing surface thereon, said bearing surface being an arc of a circle extending from said end toward said mounting portion, the radial distance from said mounting portion to the end of the arc approaching thereto being less than 90% of the radial distance to the end of said other leg;
- (e) first support means for pivotally mounting said bellcrank at said crank mounting portion;
- (f) a pedal contacting said bearing surface at said end of said other bellcrank leg;
- (g) second support means for pivotally mounting said pedal, whereby upon pivoting said pedal, said pedal moves said other bellcrank leg to rotate the member, said pedal contacting said bearing surface at the end of said other leg in the starting pedal position and moving along said arc and finally contacting the end of said arc in the pedal final position for slow and then rapid rotation of said member.

9. The lever linkage arrangement of claim 8 further comprising: spring means to return the member and the pedal to the pedal starting position.

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