May 23, 1961 J. F. MORSE 2,985,268

SINGLE LEVER ENGINE CONTROL UNIT

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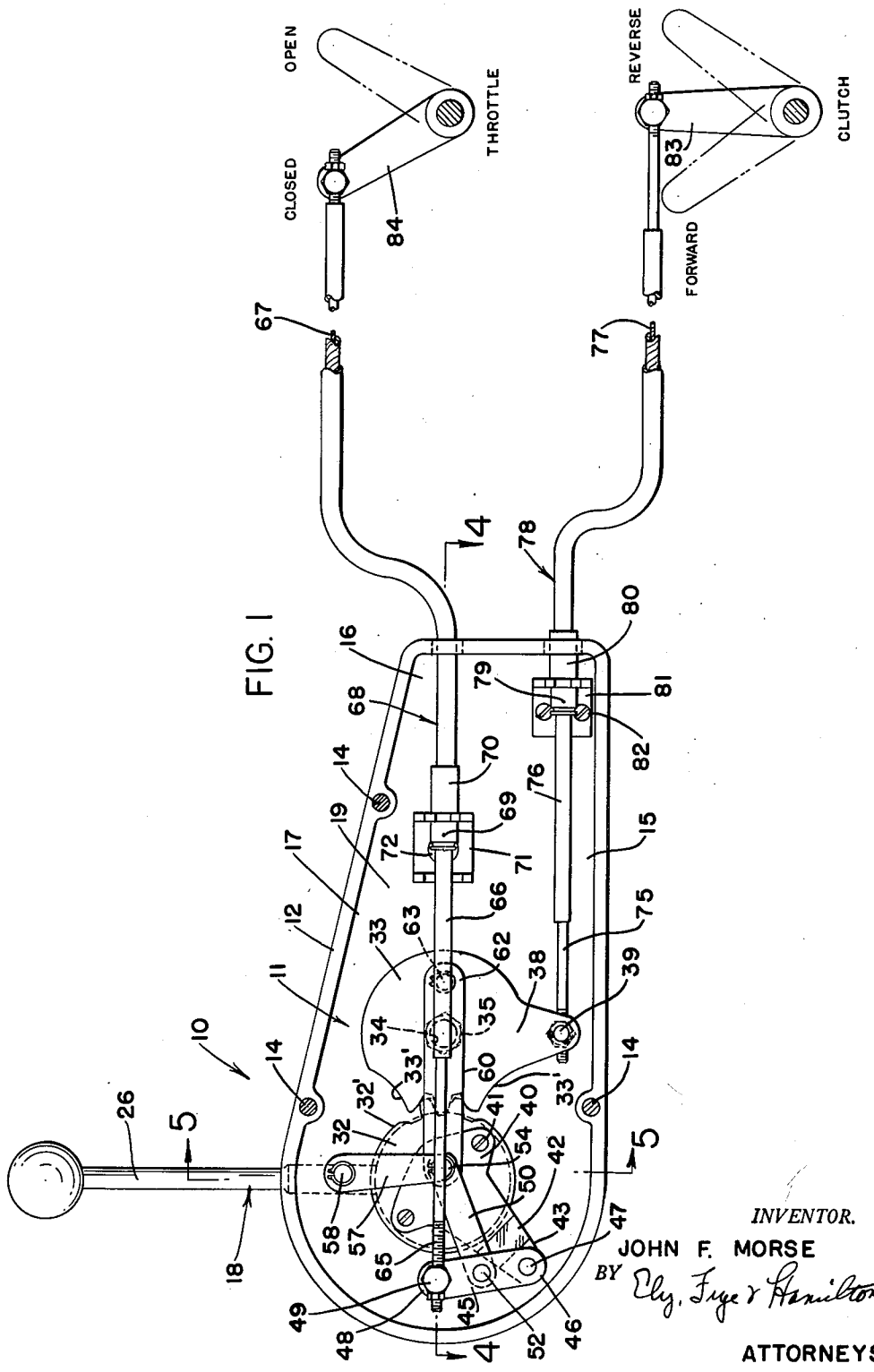


FIG. 1

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FIG. 2

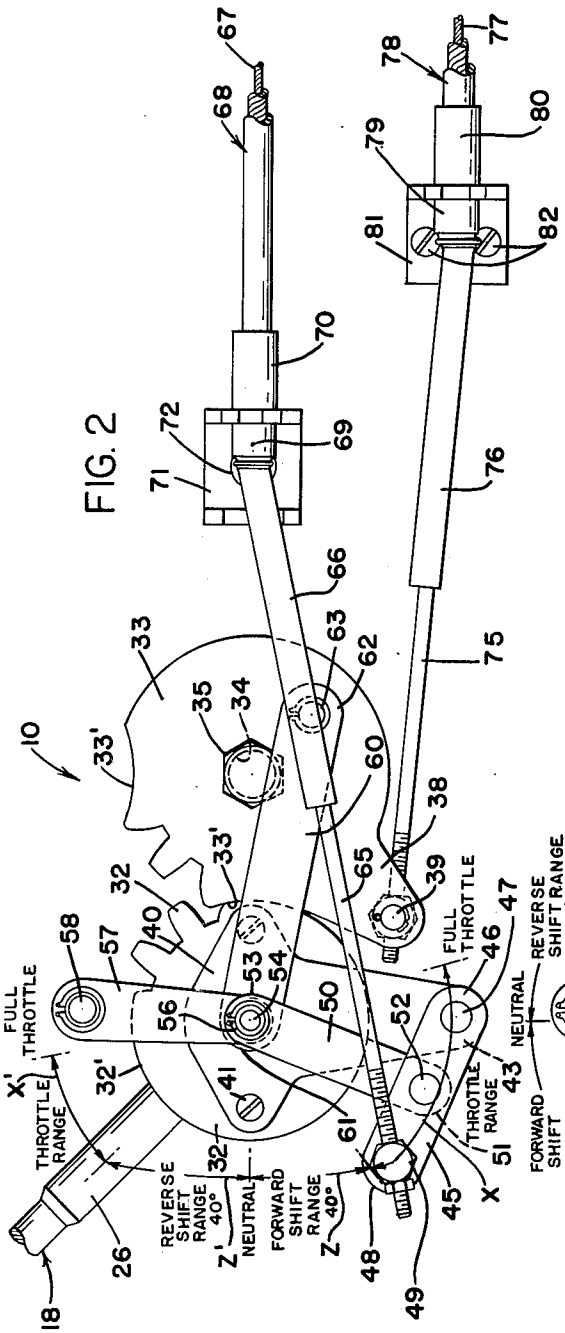
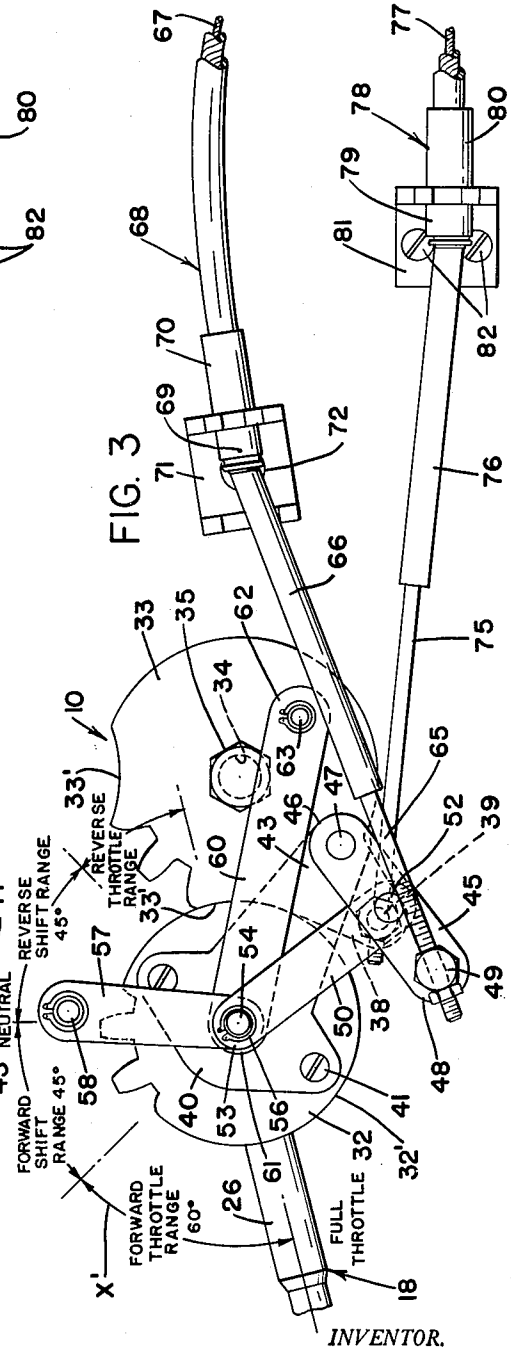


FIG. 3



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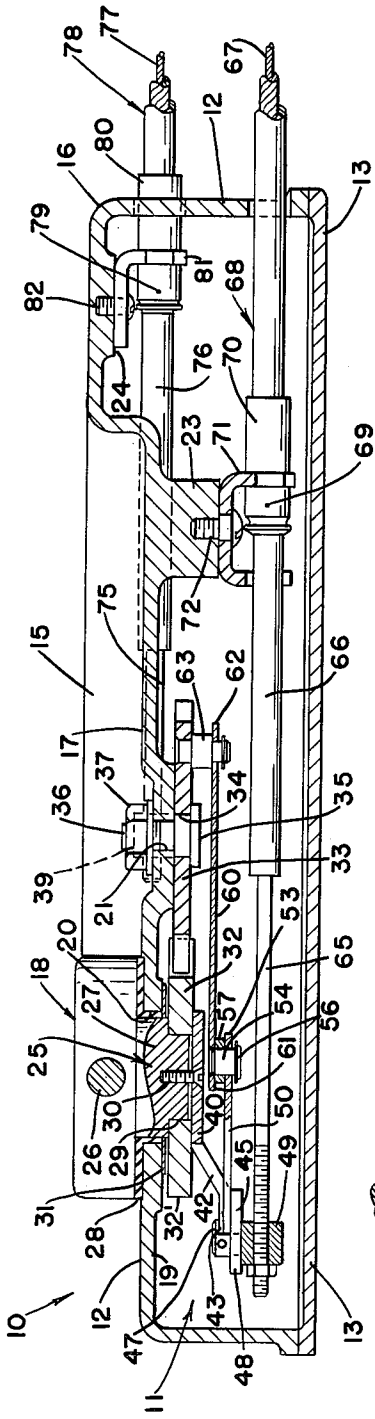


FIG. 4

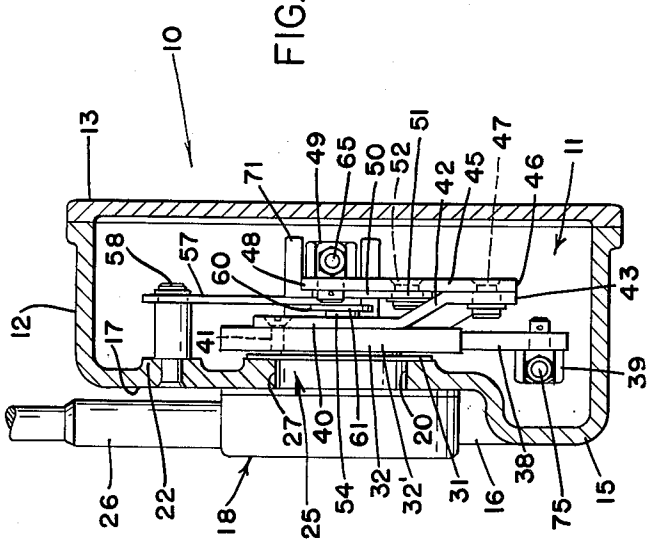


FIG. 5

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2,985,268

SINGLE LEVER ENGINE CONTROL UNIT

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Filed Aug. 5, 1958, Ser. No. 753,326

9 Claims. (Cl. 192—.098)

The invention relates generally to a control unit having a single lever for operating the clutch and throttle of an internal combustion engine, or other mechanism requiring sequencing controls. More particularly, the invention relates to a single lever engine control which provides for substantially eliminating advance of the engine throttle during movement of the engine clutch from neutral position to either forward or reverse.

In single lever controls for marine engines, the clutch and throttle control arms are geared together so that movement of the single control lever forward from neutral position first engages the engine clutch in forward position and then advances the throttle as the boat moves forward, while movement of the control lever rearward from neutral position first engages the engine clutch in reverse position and then advances the throttle as the boat moves astern. The forward throttle range is normally substantially greater than the reverse throttle range, as advanced speeds in reverse are not desirable or necessary.

In such control systems, the control lever is connected to the engine throttle lever by a linkage which may include a push-pull cable, and a small advance of the throttle normally inherently occurs when the control lever is moved in either direction through the clutch shifting range. Some of this throttle advance movement is absorbed by backlash in the system, particularly where push-pull cables of substantial length are present, but a slight advance of the throttle still takes place in practically all systems as the control lever is moved through the shifting range.

While this slight advance of the throttle does not normally damage the shifting mechanism because the shifting is completed before the throttle has accelerated the engine enough to cause damage, nevertheless, at the end of the shifting range, the throttle has been advanced sufficiently to drive the engine substantially faster than the idling speed at neutral position of the control lever.

The purpose of the present invention is to provide an improved single lever control which enables operating a marine engine at minimum forward or reverse speeds substantially equivalent to idling speed at neutral.

A further object is to provide an improved throttle operating arm mechanism in a single lever control unit for substantially eliminating throttle advance as the control lever is moved through the forward or reverse shifting range.

A specific object is to provide an improved mechanism in which the single lever control arm may be moved substantially 45° to engage the engine clutch in either a forward or reverse position, without a significant amount of throttle advance.

These and ancillary objects which will appear from the following description are attained by the improvements comprising the present invention, a preferred embodiment of which is shown by way of example in the accompanying drawings, in which:

Fig. 1 is a rear side elevation of a single lever control unit embodying the invention, with the control lever in neutral position;

Fig. 2 is a schematic representation showing the control unit with the control lever having been moved approximately 45° from the neutral position to fully engage the engine clutch in the forward position and commence advance of the engine throttle;

Fig. 3 is also a schematic representation with the control lever having been moved approximately 105° from the neutral position to advance the engine throttle to its full open position;

Fig. 4 is a horizontal section taken substantially on line 4—4 of Fig. 1; and

Fig. 5 is a vertical section taken substantially on line 5—5 of Fig. 1.

The control unit 10 has a single operating lever. The operating lever is connected to a shaft journaled in the control unit housing. The shaft carries a rotating member for throttle control which engages another rotating member for clutch control. The rotating members are geared so that they are engaged for cooperative rotation only during the first portion of movement of the lever in the forward or reverse direction from neutral. A linkage connects the rotating members in such manner that during cooperative movement of the rotating members, the engine throttle connector pivots on an elongated radius. After the clutch control is fully engaged, the linkage acts to shorten the pivot radius of the throttle connector and causes it to swing about the axis of its rotating member as a center.

The control unit indicated generally at 10 has a housing 11 comprising a peripherally flanged face plate 12 and a cover plate 13. The housing plates 12 and 13 are held together in abutment by a series of bolts 14 passing through registering countersunk holes in both plates. Suitable means (not shown) may be provided for attachment of the housing 11 to a control pulpit or to the side of the boat.

As shown in Figs. 4 and 5, the housing plate 12 has a lower wall portion 15 terminating at the rear end of the housing in a vertical wall portion 16. Above wall portion 15 and forwardly of wall portion 16, the face plate preferably has a recessed outer face portion 17, permitting flush mounting of the single operating lever 18 described in detail below.

The face portion 17 of the front housing plate 12 has side-by-side or longitudinally parallel shaft bores 20 and 21. Above the larger and forward shaft bore 20 is a small mounting boss 22. At the rear of face portion 17 and preferably aligned with bores 20 and 21, is a larger mounting boss 23. Below and to the rear of boss 23, on the inner face of the vertical wall portion 16, is another mounting boss 24.

The operating lever 18 includes a hub shaft, indicated generally at 25, extending through the forward bore 20 at right angles to the lever operating shank 26. The hub shaft 25 has a collar portion 27 rotatably mounted in a bushing 28 fitted in bore 20. Inwardly of collar 27, the shaft has a reduced portion 29 which is preferably squared. A washer 31 encircles the shaft collar portion 27 between the inner face of plate 12 and a mutilated or interrupted gear member 32 keyed on shaft portion 29.

The interrupted gear member 32 meshes in the neutral position of lever 18 with a second interrupted gear member 33 rotatably mounted on a collar portion 34 of a stud 35 preferably having a threaded shank 36 extending through bore 21 and secured by a bolt and washer 37. To control the engine clutch upon rotation of hub shaft 25 and gear member 32, as described below, the gear member 33 is provided with a lever projection 38 which carries a swivel connector 39 for the end of a clutch control push rod.

As shown, the gear members 32 and 33 have the same pitch and are meshed for 45° rotation in either direc-

tion from the neutral position (Fig. 1). This movement of the control lever 18 and gear 32 in either direction up to 45° rotates the gear 33 a corresponding number of degrees in the opposite direction. Past 45°, the gears become unmeshed and gear 32 can be further rotated to advance the engine throttle control as described below. During further rotation of gear 32 one of the arcuate faces 33' on gear 33 slidably engages the circular edge 32' on gear 32 so that the engaged clutch control remains stationary.

In the alternative forms of the invention, the relative pitches of gear members 32 and 33 may vary as desired. Further, other well-known mechanisms, such as a Geneva mechanism, may be substituted for gears 32 and 33 to obtain a similar relative movement of the engine clutch and throttle control linkages described below.

Selective rotation of hub shaft 25 controls the engine throttle through a lever arm 40 mounted over shaft portion 29 and preferably attached by screws 41 to the face of gear member 32 and by the screw 30 to the shaft 25. The lever arm 40 may be generally T-shaped with the stem extending radially from the axis of hub shaft 25, preferably bent as at 42 away from gear member 32 and terminating radially outwardly of the gear member in an end portion 43. A link 45 is connected at its end 46 by a swivel pin 47 to lever arm end 43. The opposite end 48 of the first link 45 carries a swivel connector 49 for the end of a throttle control push rod.

A second link 50 is connected at its end 51 by a second swivel pin 52 to approximately the midpoint of link 45. The opposite end 53 of link 50 extends generally toward the axis of hub shaft 25 and carries a third swivel pin 54, and the link end 53 is secured thereto by a clip washer 56. The swivel pin 54 is positioned and supported adjacent to the lower end of but slightly behind the axis of hub shaft 25 by a guide arm 57 secured at its upper end by a swivel pin 58 inserted in mounting boss 22.

A third link 60 is connected at its end 61 to swivel pin 54. The opposite end 62 of link 60 extends rearwardly from the axis of hub shaft 25, terminating rearwardly of the mounting stud 35 for gear member 33. The link end 62 is eccentrically secured to the inner face of gear member 33 by a fourth swivel pin 63. The location of swivel pin 63 is such that when the operating lever is in the neutral position, the third swivel pin 54, the mounting stud 35 and swivel pin 63 will be located in horizontal alignment.

The engine throttle control push rod 65 carried by the swivel connector 49 telescopes within a sleeve 66 and is connected to the core 67 of a push-pull cable indicated generally at 68. The opposite end of sleeve 66 has a pivot connection substantially at 69 in one end of a bushing 70, the other end of which is secured to the end of the cable casing or sheath. The bushing 70 is preferably mounted in a U-shaped bracket 71 movably attached as by a bolt 72 to mounting boss 23. The mounting provided for cable 68 by elements 70 and 71 permits maximum deflection of the cable without causing excessive friction or binding of the cable core and the construction thereof is disclosed in detail and claimed in my co-pending application Serial No. 739,711, filed June 4, 1958, reference being made thereto.

The engine clutch control push rod 75 carried by the swivel connector 39 telescopes within a sleeve 76 and is connected to the core 77 of a push-pull cable indicated generally at 78. The opposite end of sleeve 76 has a pivot connection substantially at 79 in one end of a bushing 80, the other end of which is secured to the cable casing. The bushing 80 is mounted in an L-shaped bracket 81 secured as by bolts 82 to mounting boss 24.

As shown in Fig. 1, a counterclockwise rotation of the lever 18 will move the engine clutch control rod 83 toward the forward position. During the first 40° of this movement, the pivot connector 49 will follow in an arc indicated at Z in Fig. 2. Arc Z has a long radius extending between the connector 49 and the pivot 69 of the sleeve 66 in bushing 70. This radius is such that there will be no movement of cable 68 to advance the engine throttle control rod 84.

After passing 40° from neutral, the pivot connector will follow in the arc indicated at X. Arc X has a much shorter radius extending between the connector 49 and the axis of the third swivel pin 54. This radius is such that while the engine clutch control is being engaged the throttle control remains in an idling position and will provide minimum forward and reverse speeds with only slight throttle advance.

Referring to Fig. 2, when lever 18 has been moved about 40°, the engine clutch will be fully engaged in the forward position and rotation of the gear 33 will have moved the third link 60 forwardly so that the guide arm 57 is swung slightly forward and pivot pin 54 is aligned with hub shaft 25, which is the axis of rotation of gear member 32. During the movement of control lever 18 from the position of Fig. 1 to that of Fig. 2, the pivot pin 54 for the second link 50 is eccentric of shaft 25 so that the swivel connector 49 on the end 48 of the first link 45 follows arc Z, and there is no advance of the engine throttle.

Referring to Fig. 3, as the control lever 18 is moved to the full throttle advance position, the gear teeth of members 32 and 33 are disengaged, surfaces 32' and 33' permitting relative movement of gear 32 in a counterclockwise direction. The first link 45 pivots on pin 54 and the swivel connector 49 follows arc X to move the throttle push rod 65 to the full open position.

The unit 10 controls the engine in the reverse direction by movement of the control lever 18 in a clockwise direction, as shown in Figs. 1–3. During the first 40° of movement, the swivel connector 49 moves on the radius Z', fully engaging the engine clutch in the reverse position without advance of the engine throttle. After the gear teeth of members 32 and 33 disengage, movement of the swivel connector 49 is on the arc X'.

Various modifications and changes in details of construction are comprehended within the scope of the invention defined in the appended claims.

What is claimed is:

1. In a single lever control unit for the clutch and throttle of an engine having a single operating lever and a first rotating member for operating a throttle control linkage, a second rotating member for clutch control connected to said first member for cooperative rotation therewith only during the first portion of movement of said lever in forward or reverse direction from neutral, and a lever arm attached to said first member and extending radially thereof, the improvement comprising a first link pivotally connected at one end to said lever arm, the other end of said first link carrying a connector for the throttle linkage, a second link pivotally connected at one end to said first link between its ends, the other end of said second link carrying a pivot pin, means to support said pivot pin adjacent to the axis of rotation of said first rotating member, and a third link pivotally connected at one end to said pivot pin and at the other end to said second rotating member whereby said pivot pin is moved by said second and third links into alignment with the axis of said first member upon completion of said cooperative rotation of the first and second members.

2. In a single lever control unit for the clutch and throttle of an engine having a single operating lever and a first rotating member for operating a throttle control linkage and a second rotating member for clutch control connected to said first member for cooperative rotation therewith only during the first portion of movement of said lever in forward or reverse direction from neutral, the improvement comprising a first link pivotally carried by said first member, a throttle connector carried at the free

end of said first link, a second link pivotally connected at one end to said first link between its ends and the other end of said second link carrying a pivot pin, means to support said pivot pin in approximate alignment with the axis of rotation of said first rotating member, and a third link pivotally connected at one end to said pivot pin and at the other end to said second rotating member whereby said pivot pin is moved by said second and third links into alignment with the axis of said first member upon completion of said cooperative rotation of the first and second members.

3. In a control unit for the clutch and throttle of an engine, said unit having a single operating lever, a first rotating member for throttle control actuated by said lever, and a second rotating member for clutch control engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a radial projection on said first member, a first link pivotally connected to said projection and carrying at its free end a throttle connector, a pivot pin, and additional links connecting said pivot pin to said first link and to said second member so that when said first and second members are disengaged said pivot pin is aligned with the axis of rotation of said first member.

4. In a control unit for the clutch and throttle of an engine, said unit having a single operating lever, a first rotating member for throttle control actuated by said lever, and a second rotating member for clutch control engaged with said first member only during a movement of the order of about 45° in either the forward or reverse direction from neutral, the improvement comprising, a radial projection on said first member, a first link pivotally connected to said projection and carrying at its free end a throttle connector, a pivot pin, and additional links connecting said pivot pin to said first link and to said second member for locating said pivot pin eccentric to the axis of rotation of said first member when said operating lever is in neutral position, and for aligning said pivot pin with the axis of said first member when said first and second members are disengaged.

5. In a single lever control unit for the clutch and throttle of an engine having a single operating lever and a first rotating member for operating a throttle control mechanism and a second rotating member for clutch control operatively engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a lever arm on said first member, a first link pivotally connected to said lever arm radially of the center of rotation of said first member and carrying a swivel connector at its free end, a push rod assembly connected at one end to the swivel connector and having a pivotal connection at its other end with the throttle control mechanism, a pivot pin, and linkage means connecting said pivot pin to said first link and to said second rotating member for positioning said pivot eccentric of said first rotating member during its engagement with said second member to swing said push rod assembly about its pivotal connection as a center, and for moving said pivot pin into concentric relation to said first member when said member is rotated out of operative engagement with said second member.

6. In a single lever control unit for the clutch and throttle of an engine having a single operating lever and a first rotating member for operating a throttle control mechanism and a second rotating member for clutch control operatively engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a lever arm on said first member, a first link pivotally connected to said lever arm radially of the center of rotation of said first member and carrying a swivel connector at its free end, a push rod assembly connected at one end to the swivel connector and having a pivotal connection at its other end with the throttle control mechanism, and linkage means connecting said first link to said second rotating member for swinging said swivel connector about the pivotal connection of the push rod assembly with the throttle control mechanism as the first member rotates in operative engagement with the second member, and for swinging said swivel connector about the center of said first rotating member when said member is rotated in either direction out of operative engagement with said second member.

7. In a control unit for the clutch and throttle of an engine, said unit having a single operating lever, a first rotating member for throttle control actuated by said lever, and a second rotating member for clutch control engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a lever arm on said first member, a first link pivotally connected to said lever arm and carrying at its free end a throttle connector, a pivot pin, a second link connecting said pivot pin to said first link, and a third link connecting said pivot pin to said second rotating member for causing said throttle connector to swing concentric of said first member when said first member has been rotated out of operative engagement with said second member, and for shifting said pivot pin to cause the throttle connector to swing eccentric of said first member on a relatively long radius when said first member rotates in operative engagement with said second member.

8. In a control unit for the clutch and throttle of an engine, said unit having a single operating lever, a first rotating member for throttle control actuated by said lever, and a second rotating member for clutch control engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a lever arm on said first member, a first link pivotally connected to said lever arm and carrying at its free end a throttle connector, and linkage means connecting said first link to said second rotating member for causing said throttle connector to swing concentric of said first rotating member when said first member has been rotated out of operative engagement with said second member and for causing said throttle connector to swing eccentric of said first member on a relatively long radius when said first member is rotated in operative engagement with said second member.

9. In a control unit for the clutch and throttle of an engine, said unit having a single operating lever, a first rotating member for throttle control actuated by said lever, and a second rotating member for clutch control engaged with said first member only during the first portion of movement of said lever in either the forward or reverse direction from neutral, the improvement comprising, a lever arm on said first member, a first link pivotally connected to said lever arm and carrying at its free end a throttle connector, a pivot pin, means movably supporting said pivot pin adjacent to the axis of rotation of said first rotating member, a second link connecting said pivot pin to said first link, and a third link connecting said pivot pin to said second rotating member for causing said throttle connector to swing concentric of said first member when said first member has been rotated out of operative engagement with said second member, and for shifting said pivot pin to cause the throttle connector to swing eccentric of said first member on a relatively long radius when said first member rotates in operative engagement with said second member.

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