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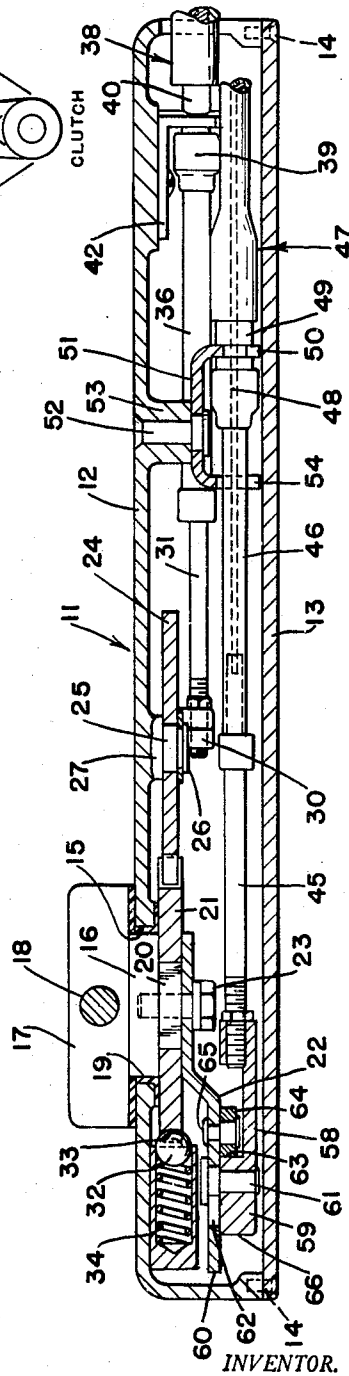
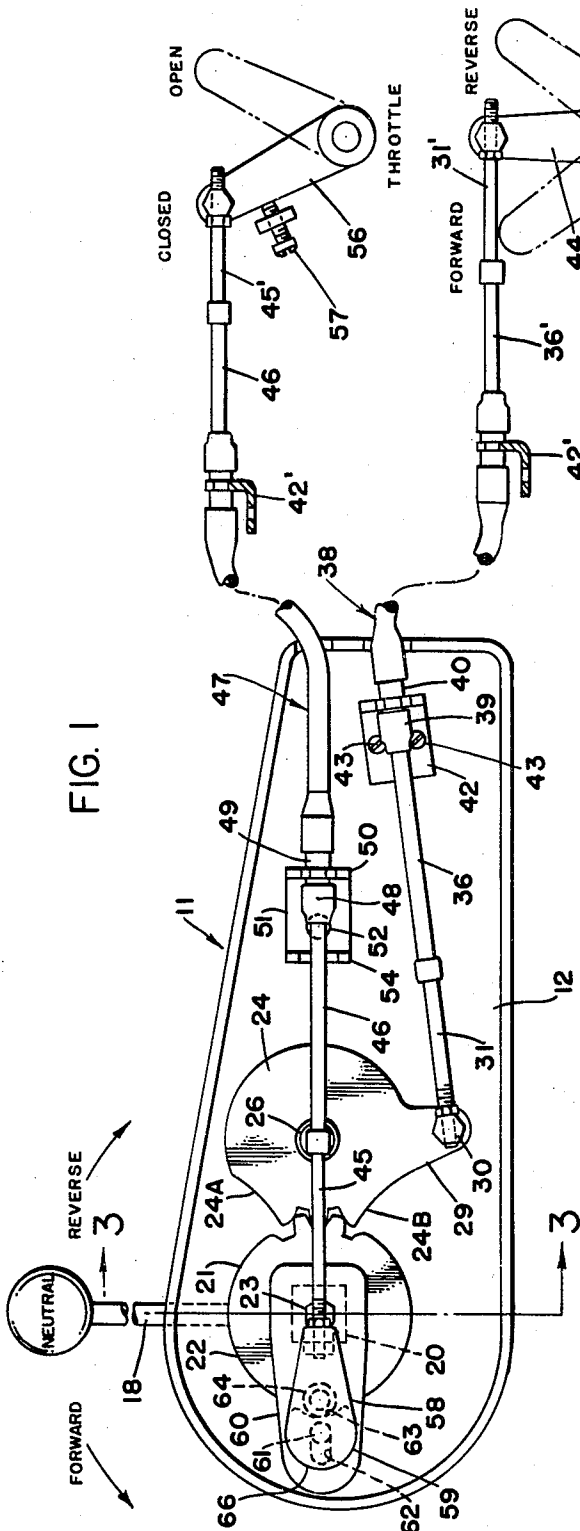
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2,949,988

THROTTLE OPERATING LINKAGE FOR SINGLE LEVER CONTROL

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4 Sheets-Sheet 1



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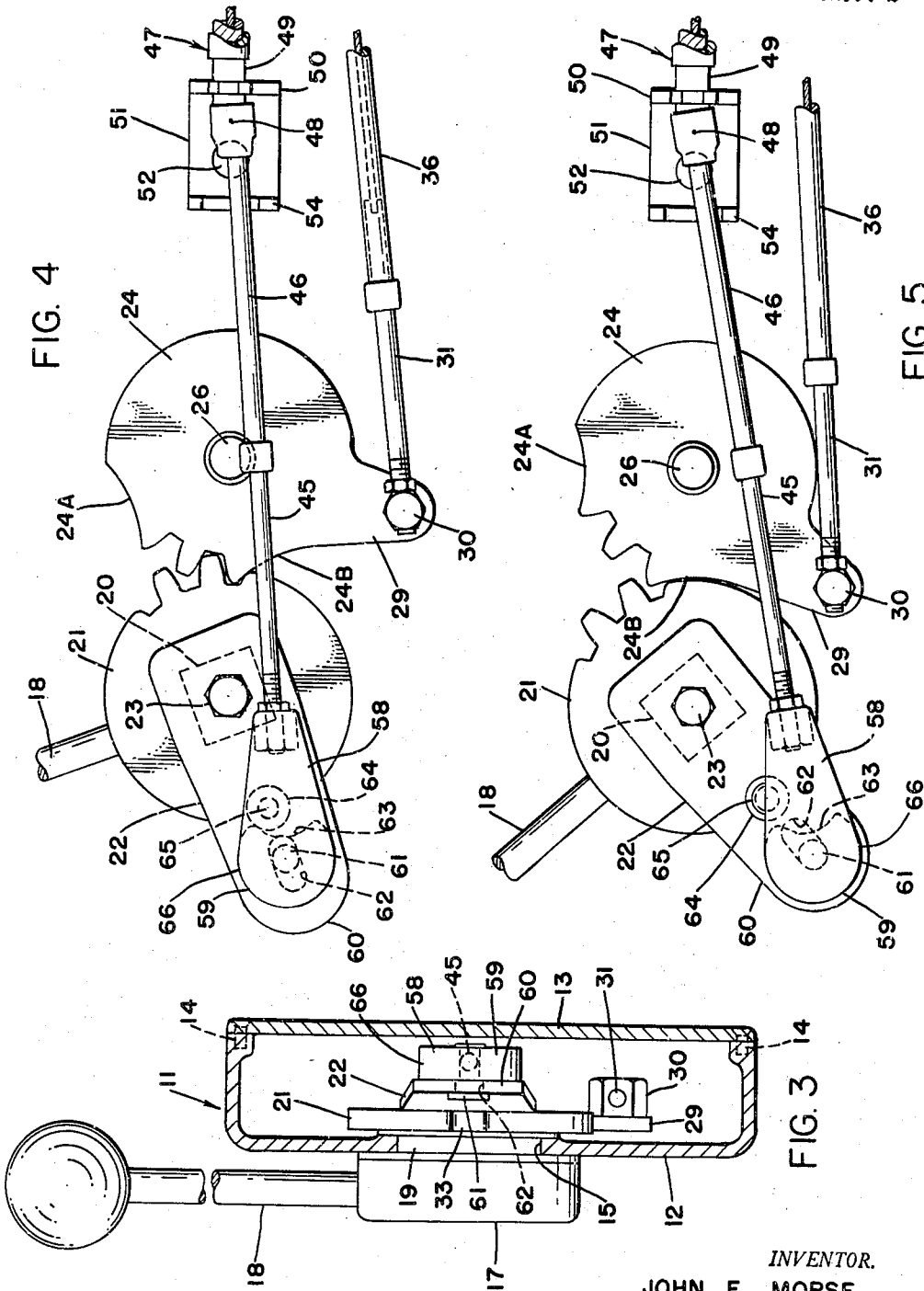
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FIG. 7

REVERSE THROTTLE RANGE

REVERSE SHIFT RANGE

NEUTRAL

FORWARD SHIFT RANGE

FORWARD THROTTLE RANGE

35°

40°

40°

65°

61B

61A

61C

23'

R

R'

48

X

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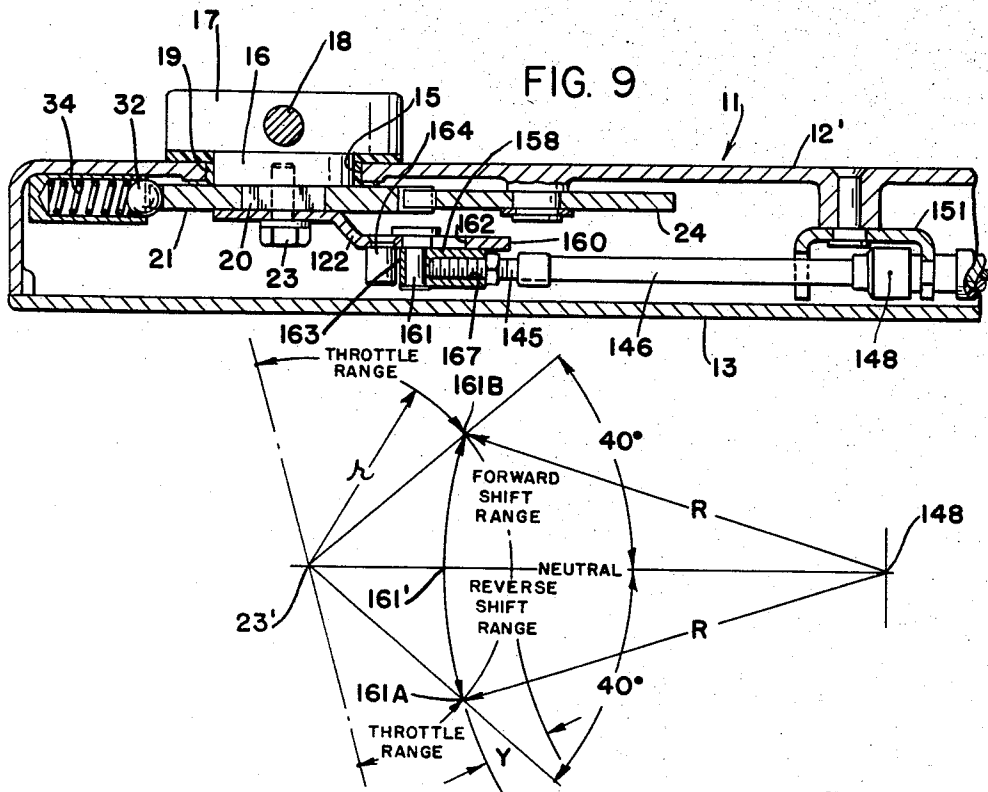
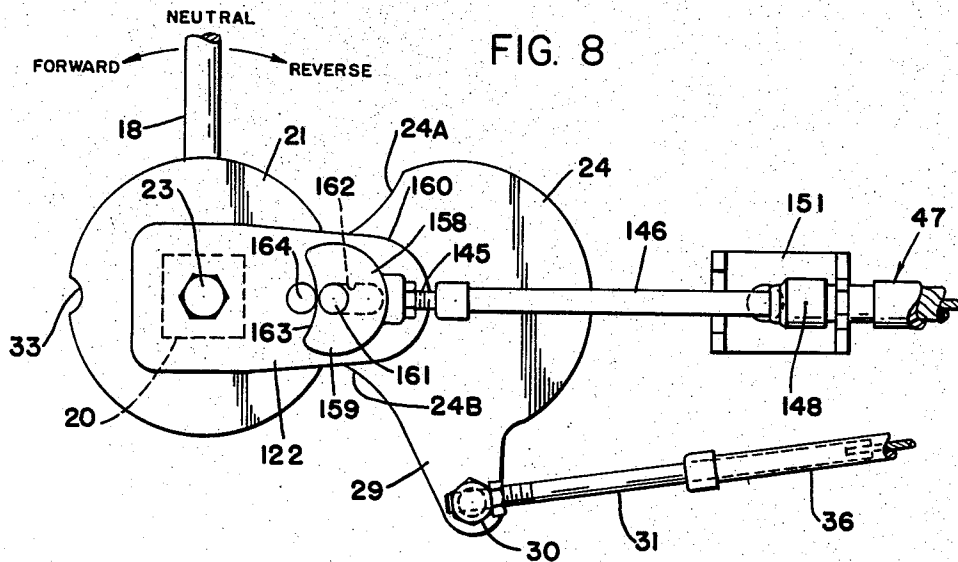


FIG. 10

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THROTTLE OPERATING LINKAGE FOR SINGLE LEVER CONTROL

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Filed Sept. 23, 1958, Ser. No. 762,848

8 Claims. (Cl. 192—.096)

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

In my copending application Serial No. 753,326, I have shown a mechanism for accomplishing this particular purpose, and the present application discloses improved relatively simple means for attaining substantially the same purpose.

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:

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Fig. 1 is a rear side elevation of a single lever control unit embodying the invention, adapted for a push-open throttle, with the control lever in neutral position.

Fig. 2 is an enlarged plan sectional view of the unit.

Fig. 3 is a vertical sectional view on line 3—3 of Fig. 1.

Fig. 4 is a schematic view showing the position of the throttle and clutch control arms when the control lever has been moved forward approximately 20° from neutral position.

Fig. 5 is a similar view with the control lever forward about 40° from neutral position.

Fig. 6 is a similar view with the control lever advanced to full forward throttle position.

Fig. 7 is a diagrammatic view showing the path of movement of the throttle control arm throughout the throttle operating and clutch shifting ranges.

Fig. 8 is a schematic view similar to Fig. 1, showing a throttle control linkage according to the invention adapted for a pull-open throttle.

Fig. 9 is a plan sectional view thereof.

Fig. 10 is a diagrammatic view showing the path of movement of the throttle arm of Figs. 8 and 9.

The control unit has a housing indicated generally at 11 comprising a front face plate 12 and a rear cover plate 13 secured to the periphery of plate 12 by screws 14. Suitable means (not shown) may be provided for attaching the housing to a mounting pad or the like on the side of the boat at the control station.

The face plate 12 has a bore 15 near its front end in which is journaled a reduced portion 16 of the hub shaft 17 in which the control lever 18 is mounted. Preferably, a bushing 19 journals the portion 16 in the bore. Inwardly of the portion 16 the shaft 17 has a squared portion 20 on which an interrupted or multitilted gear 21 is non-rotatively mounted. A throttle control lever arm 22 has its inner end overlying said squared portion and is secured thereto in abutment with gear 21 by a screw stud 23. In the embodiment of Figs. 1-7, the arm extends forwardly of shaft 17 in the neutral position of control lever 18.

The interrupted gear 21 meshes in the neutral position of lever 18 with a second interrupted gear 24 rotatably mounted on the collar portion 25 of a stud 26 secured in a boss 27 on the interior of the face plate 12 and preferably horizontally aligned with the stud 23 extending axially of hub shaft 17. The gear 24 has a radial arm 29 which is preferably integral with the gear, and a swivel connector 30 is carried on the rear side of said arm for connection with a clutch control push rod 31. Preferably, a ball detent 32 is urged into a notch 33 in the gear 21 by a spring 34 to yieldingly hold the gears in the neutral position of Figs. 1 and 2.

The gears 21 and 24 may have the same pitch diameter and are meshed for about 40°-45° rotation in either direction from the neutral position of Fig. 1. Movement of the control lever 18 and gear 21 in either direction through about 40° rotates gear 24 in the opposite direction through a corresponding number of degrees to engage the clutch in forward or reverse. Beyond that angle, the gears become unmeshed and further rotation of the gear 21 advances the engine throttle while one of the arcuate faces 24A or 24B slidably engages the periphery of gear 21 (Fig. 5) to hold the clutch control gear 24 stationary with the clutch engaged.

Other well-known mechanisms, such as Geneva mechanisms, may be substituted for the gears 21 and 24 to obtain similar relative movement of the clutch and throttle controls, and the relative pitches of the gears may be varied, as desired.

The clutch control push rod 31 telescopes within one

end of a sleeve 36 and is connected to the core of a push-pull cable indicated generally at 38. The opposite end of sleeve 36 has a pivot connection at 39 in one end of a bushing 40, the other end of which is secured to the end of the casing of cable 38. The bushing is mounted in an L-shaped bracket clip 42 secured to the face plate 12 of the housing by screws 43. As shown in Fig. 1, the cable 38 may be connected at its remote end to the clutch lever 44 of the engine by a similar push rod 31' telescoped in a sleeve 36' pivotally connected to a bracket clip 42' mounting the cable end.

The throttle control arm 22 is connected by mechanism to be described to a push rod 45 which telescopes within one end of a sleeve 46, and the push rod is connected to the core of a push-pull cable 47. The opposite end of sleeve 46 has a pivot connection at 48 in one end of a bushing 49, the other end of which is secured to the end of the cable casing. The bushing 49 is preferably mounted in the rear leg 50 of a U-shaped bracket 51 pivotally mounted by a stud 52 on a boss 53 on the interior of face plate 12. The forward leg 54 of the bracket is slotted and the sleeve 46 passes through the slot.

Accordingly, as the sleeve 46 swings about pivot 48 due to rotation of the throttle control arm 22, it abuts one or the other end of the slot in leg 54 and rotates the bracket, so that further swinging permits maximum deflection of the cable without binding of the cable core in its casing. The construction of this swivel mounting bracket 51 is disclosed in detail and claimed in my copending application Serial No. 739,711, filed June 4, 1958.

The cable 47 may be connected at its remote end to the throttle lever 56 of the engine by a push rod 45' telescoped in a sleeve 46' pivotally connected to an L-shaped bracket clip 42' mounting the cable end. An adjustable idle limit stop 57 is preferably provided on the engine for abutting the lever 56 in its closed position.

According to the present invention, the means connecting the throttle control arm 22 to push rod 45 comprises a terminal link 58 having one end threaded onto the end of push rod 45 and the other end 59 connected to the laterally offset portion 60 of arm 22 by a pin 61 secured in portion 59 and extending slidably through a radial slot 62 in arm 22. The convex outer surface of end 59 of the link is curved about the pin 61 as a center. The under side of the link 58 adjacent to arm 22 is cut away to form a slot adjacent to the arm 22, and the forward end of the slot has a concavely curved cam surface 63. A roller or pin follower 64 journaled on the offset portion 60 of arm 22 by a pin 65 abuts the medial portion of surface 63 in the neutral position of Figs. 1 and 2.

In the neutral position of Fig. 1, the idle limit stop 57 on the engine causes the cable 47 to hold the pin 61 in the inner end of slot 62, as shown, with the roller 64 bearing against the medial portion of arcuate surface 63. This position of pin 61 corresponds to the point 61' of the diagram in Fig. 7, the axis of shaft 17 being shown at point 23'.

As the control lever 18 is rotated in either direction from neutral to rotate the arm 22 on axis 23, the roller 64 rolls toward one end of concave surface 63 and starts to move the pin 61 outwardly in slot 62. In Fig. 4, for example, the lever 18 has been moved part way through the forward shift range and the pin 61 has started to move forwardly in the slot, that is, outwardly of its inner end. When the control lever has been moved forwardly about 40° from neutral, as shown in Fig. 5, the pin 61 reaches the outer end of the slot 62 and the roller passes out of the concave surface. This position of pin 61 corresponds to point 61A in Fig. 7, the corresponding point in the reverse direction being shown at 61B.

Accordingly, between the points 61A and 61B the pin

61 follows an arc on the elongated radius R, having point 48 as a center, so that instead of displacing the push rod 45 by the amount X, which would occur if the pin 61 rotated about the point 23', there is no displacement of the push rod and no movement of the throttle lever 56.

Further rotation of the control lever in either direction causes the roller 64 to follow the arcuate outer surface 66 of end portion 59 of the terminal link, which is curved around the pin 61 as a center, and the roller holds the pin 61 in the outer end of slot 62 so that the pin swings about the point 23' as a center on the radius r (Fig. 7) and displaces the throttle push rod 45 to push open the throttle. In Fig. 6 the control lever 18 has been moved to the full forward position and the pin 61 is in the position corresponding to point 61C in Fig. 7.

On closing the throttle, the reverse of these actions occurs, so that throttle movement ceases when the pin reaches point 61A and then passes into the shifting range.

In the embodiment shown in Figs. 8-10 for use with a pull-open throttle, the arm 122 is reversed on shaft 17 so that it is turned 180° from arm 22 and extends rearwardly from the shaft toward the cable 47. The arm 122 has a laterally offset portion 160 at its radially outer end, and a radial slot 162 is provided in said portion 160. The throttle push rod 145 telescopes within one end of a sleeve 146 and the opposite end has a pivot connection at 148 with the cable casing, and is pivotally mounted on the housing by U-shaped bracket 151.

The terminal link 158 connecting the throttle arm 122 to push rod 145 has a threaded socket 167 into which the end of the push rod is screwed, and carries a pin 161 extending slidably through the slot 162. The body 159 of the link is convexly curved about the pin 161 as a center, and its forward end is a concavely curved surface 163. A pin or roller 164 carried in the arm 122 abuts the medial portion of the concave surface in the neutral position of Figs. 8 and 9.

As shown in the diagram, Fig. 10, the position of pin 161 in neutral position corresponds to point 161', and as the control lever is rotated in either direction about 40° the pin follows the arc of radius R, because roller 164 abuts concave surface 163 and moves pin 161 outwardly in slot 162 while it is traveling to point 161A or point 161B. Thus the push rod 146 is not displaced to operate the throttle, whereas if the pin 161 rotated about the point 23' the push rod would be displaced by the amount Y. Displacement Y is substantially greater than the amount X in the embodiment of Figs. 1-7, because the arm 122 extends rearwardly from shaft 17 toward cable 47, as a result of which the arm 122 and push rod 146 swing away from each other as the arm is rotated.

Beyond the points 161A or 161B, the roller 164 follows the convex outer surface of body 159 and the pin 161 is held in the outer end of slot 162, so that the pin 161 swings about the point 23' as a center on the radius r and displaces the throttle push rod 146 to pull open the engine throttle.

In both embodiments of the invention the improved linkage eliminates advance of the engine throttle as the control lever is moved through the forward or reverse shifting range to fully engage the engine clutch, thus enabling operation of the engine at minimum forward and reverse speeds.

What is claimed is:

1. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first

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member and extending radially thereof, and a push rod assembly having a pivotal connection at one end with said throttle control mechanism, the improvement comprising, a terminal link connected to the other end of said push rod assembly and carrying a pin, said lever arm having a radial slot slidably receiving said pin, said terminal link having a convex cam surface curved about the pin as a center and a concave cam surface, and a follower on said lever arm engaging said concave surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot and swing said push rod assembly about its pivotal connection as a center, and engaging said convex surface during further movement of said control lever in either direction to hold said pin in the outer end of said slot.

2. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, and a push rod assembly having a pivotal connection at one end with said throttle control mechanism, the improvement comprising, a terminal link connected to the other end of said push rod assembly and carrying a pin, said lever arm having a radial slot slidably receiving said pin, said terminal link having a concave cam surface, and a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot and swing said push rod assembly about its pivotal connection as a center.

3. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, the improvement comprising a terminal link connected to said throttle control mechanism and carrying a pin, said arm having a radial slot receiving said pin, said terminal link having a convex cam surface curved about the pin as a center and a concave cam surface, and a follower on said lever arm engaging said concave surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot, and engaging said convex surface during further movement of said control lever in either direction to hold said pin in the outer end of said slot.

4. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, the improvement comprising a terminal link connected to said throttle control mechanism and carrying a pin, said arm having a radial slot receiving said pin, said terminal link having a concave cam surface, and a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot and to swing on an elongated radius relative to the radius of rotation of said lever arm.

5. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to

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said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, and a push rod assembly having a pivotal connection at one end with said throttle control mechanism, the improvement comprising, a terminal link connected to the other end of said push rod assembly and carrying a pin, said lever arm having a radial slot slidably receiving said pin, said terminal link having a cam surface, and a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot and swing said push rod assembly about its pivotal connection as a center.

6. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, the improvement comprising a terminal link connected to said throttle control mechanism and carrying a pin, said lever arm having a radial slot receiving said pin, said terminal link having a cam surface, and a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction from neutral to cause said pin to move outwardly in said slot and to swing on an elongated radius relative to the radius of rotation of said lever arm.

7. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, the improvement comprising a terminal link connected to the throttle control mechanism and having a pin and slot connection with said lever arm to permit radial movement of said link, said link having a cam surface, and a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction from neutral to move said link radially of said lever arm and cause said link to swing on an elongated radius relative to the radius of rotation of said lever arm.

8. In a single lever control unit for the throttle and clutch of an engine having a first rotating member for operating a throttle control mechanism, a second rotating member for clutch control cooperatively connected to said first member for rotation only during the first portion of movement of said lever in forward or reverse direction from neutral, a lever arm attached to said first member and extending radially thereof, the improvement comprising a terminal link connected to the throttle control mechanism and having a radially movable connection with said lever arm, a cam surface on said link, a follower on said lever arm engaging said cam surface during the first portion of movement of said control lever in forward or reverse direction to move said link radially of said lever arm and cause said link to swing on an elongated radius relative to the radius of rotation of said lever arm.

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