Feb. 11, 1958 T. J. CICERO ET AL 2,822,795

CONTROL SYSTEM FOR ENGINES

Filed April 5, 1954

3 Sheets-Sheet 1

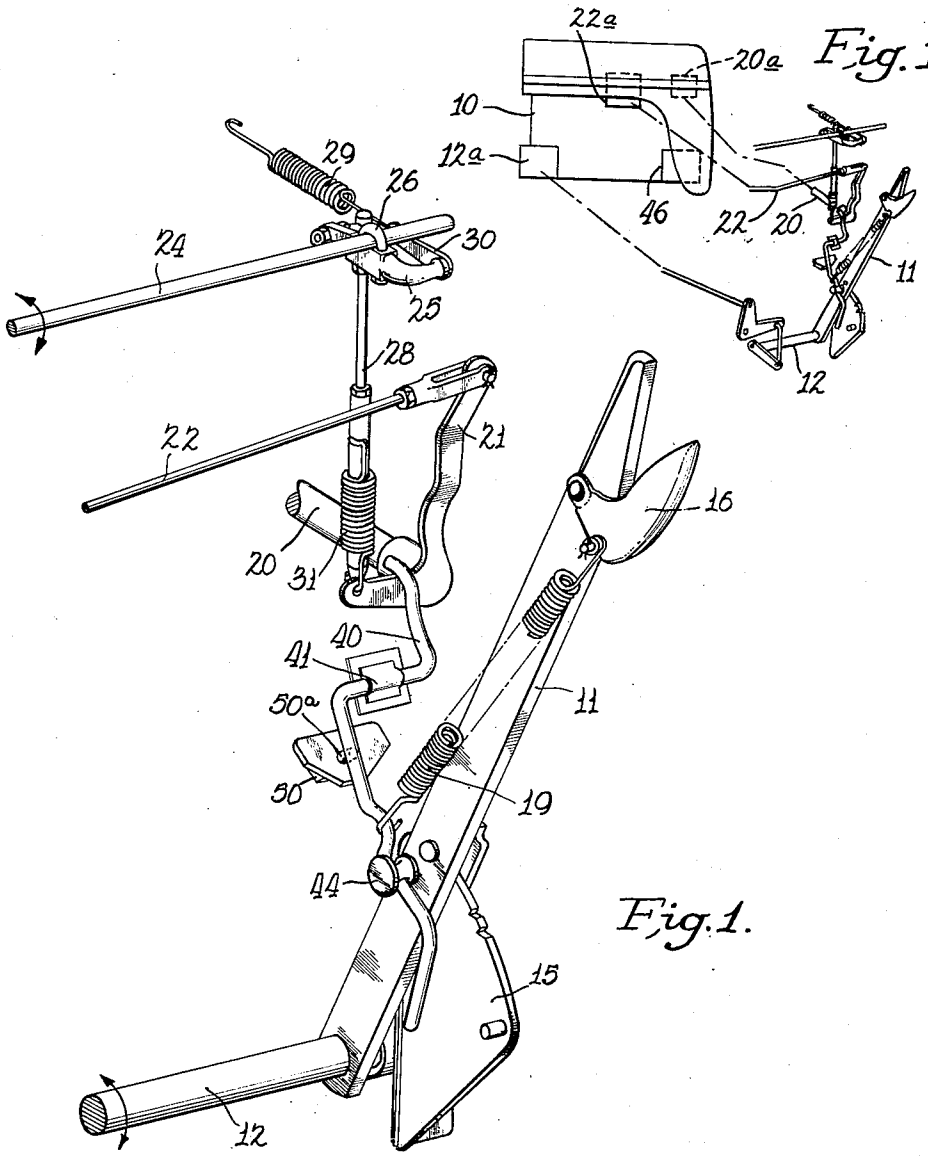

Fig. 1a.

Fig. 1.

Inventors
Theodore J. Cicero
Curtis P. Parsons
by Carlson, Dalziel, Hubbard & Wolfe
Atty's

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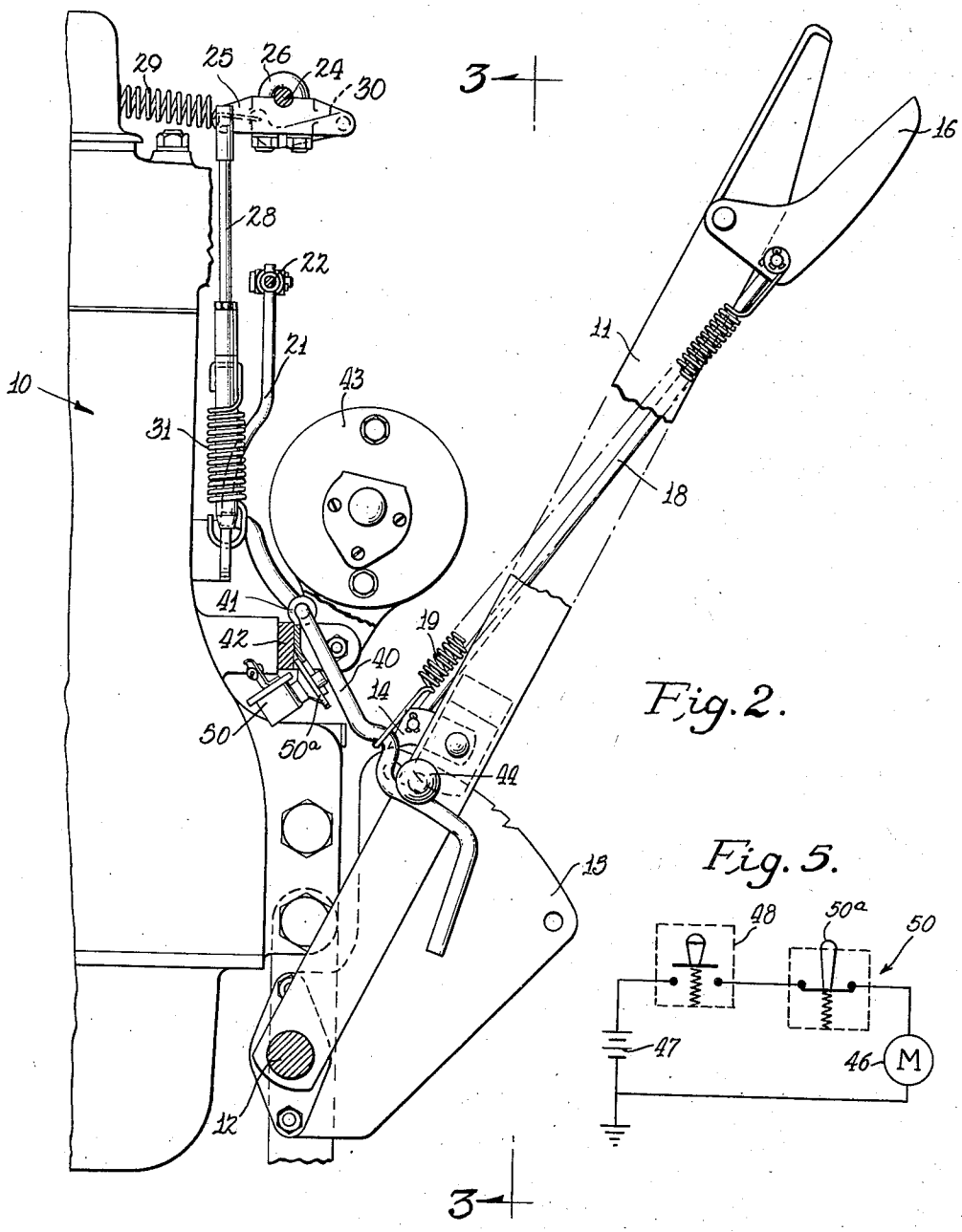

Fig. 2.

Fig. 5.

Inventors
Theodore J. Cicero
Curtis P. Parsons
by Carlson, Ditzner, Hubbard & Wolfe
Atty's

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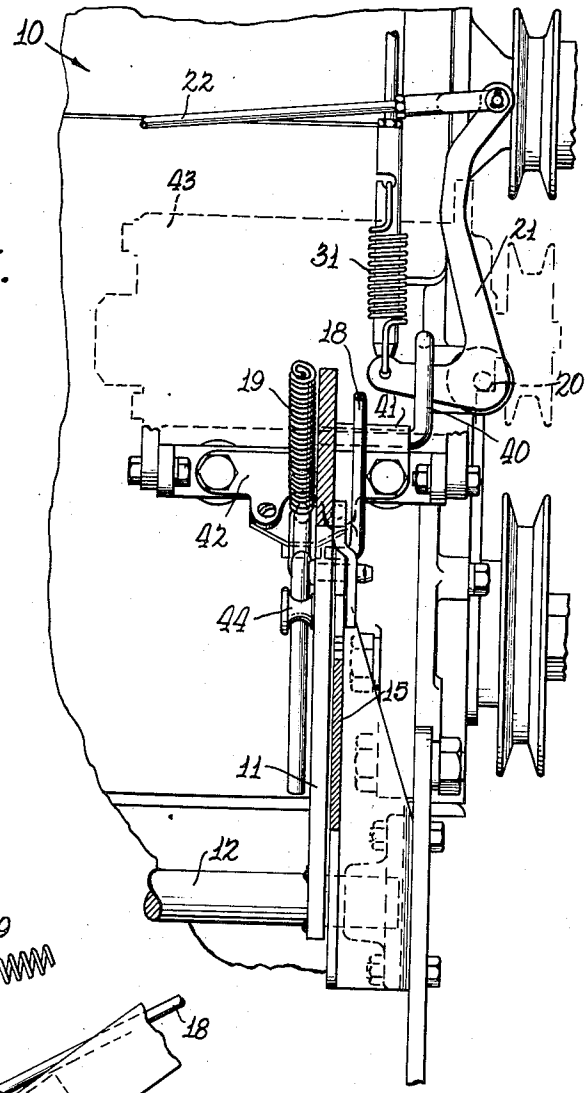
Fig. 3.



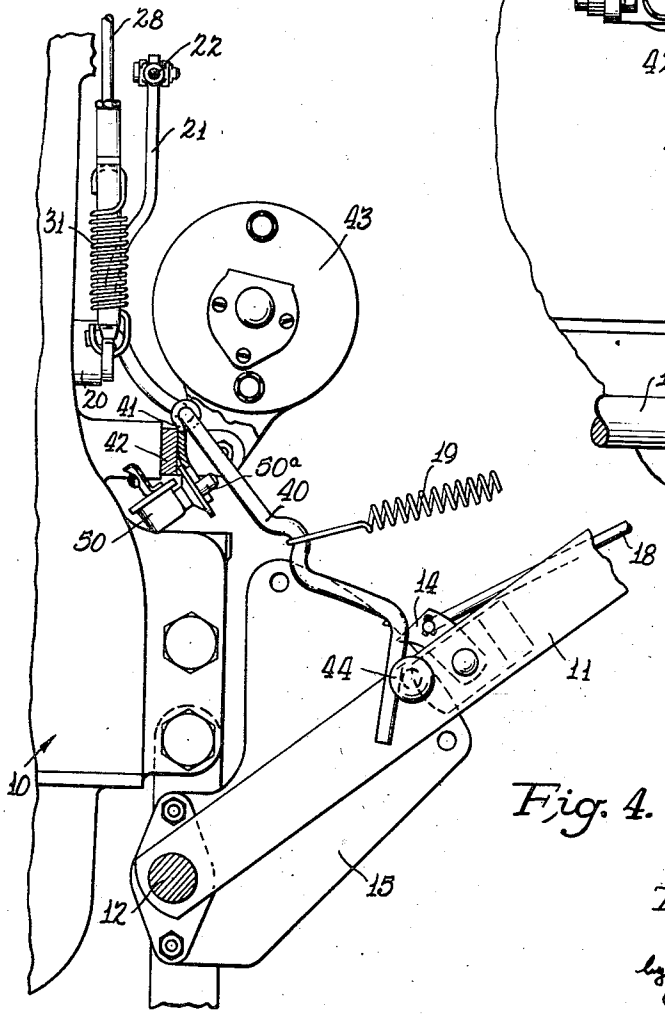


Fig. 4.

Inventors
Theodore J. Cicero
Curtis P. Parsons

by Carlson, Gitzner, Hubbard & Wolfe
Atty's

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CONTROL SYSTEM FOR ENGINES

Theodore J. Cicero and Curtis P. Parsons, Detroit, Mich., assignors, by mesne assignments, to Massey-Harris-Ferguson Inc., Racine, Wis., a corporation of Maryland

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4 Claims. (Cl. 123—179)

The present invention relates in general to control systems for engines and the like and, more particularly, to means for jointly controlling a plurality of instrumentalities on an internal combustion engine.

It is the general aim of the invention to provide a simple arrangement for jointly controlling the throttle valve and clutch of an engine, making possible the quick and convenient changing of engine operation from idling at no load to driving a load at a selected working speed, with a minimum of attention by an operator.

A further object of the invention is to provide, in combination with such a control system, means for assuring that the engine cannot be started when the clutch is engaged, thereby protecting the starting motor against overloads and workmen from injury by moving parts driven by the engine if the latter should be started suddenly without warning.

Other objects and advantages of the invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary perspective view of a control system embodying the features of the invention;

Fig. 1*a* is a fragmentary perspective and partially schematic view showing the control system of Fig. 1 linked to a conventional internal combustion engine;

Fig. 2 is a rear elevation of the control system, illustrated as employed on a partly shown exemplary engine and with the component parts in their respective positions when the engine clutch is engaged;

Fig. 3 is a side elevation of a part of the engine and the control system;

Fig. 4 is similar to Fig. 2, showing the positions of the control components when the engine clutch is disengaged; and

Fig. 5 is a schematic circuit diagram of a starting motor circuit.

While the invention has been shown and is described in some detail with reference to a particular embodiment thereof, there is no intention that it thus be limited to such detail. On the contrary, it is intended here to cover all alterations, modifications, and equivalents falling within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, the control system of the present invention is illustrated as employed on an internal combustion engine **10** (shown in Figs. 1*a*, 2, 3, and 4) which may be any one of a wide variety. The engine is equipped with the usual clutch **12***a*, carburetor including a throttle valve **22***a*, and preferably with a speed governor **20***a*. Since these engine components are well known and may take different forms, it has been deemed sufficient to illustrate them only schematically in the drawings. At appropriate points in the description, reference will be made to connections from the exemplary control system to such components.

The engine **10** in this instance is intended for use as

an auxiliary source of power on a heavy and bulky agricultural implement such as a combine or hay baler. In the operation of such implements, the capacity of the pulling or carrying tractor engine alone is not sufficient to power the implement operating mechanism through a power take-off shaft, as is often done with smaller, lighter implements. The auxiliary engine is therefore mounted on the implement and disengageably connected, by means of its clutch, to drive the implement operating mechanism. Accordingly, the controls for the engine may be hand operated in contrast to the partially foot operated controls of a tractor, for example. Such manually operated controls must, however, be susceptible of quick and convenient manipulation in order that the operator's time and attention in setting them are not diverted from control of the tractor.

For engaging and disengaging the engine clutch, a manual actuator is provided which, in the present instance, includes a hand lever **11** fast at its lower end on a clutch shaft **12** journaled in brackets fixed to the side of the engine and extending rearwardly to the clutch **12***a*. Positioning the lever **11** inwardly toward the engine rocks the shaft **12** to engage the clutch (Fig. 2), while pulling the lever outwardly (Fig. 3) disengages the clutch. The hand lever **11** is preferably equipped with a pivoted locking pawl **14** cooperating with teeth on a ratchet plate **15** bolted to the lever-mounting bracket. The pawl **14** is rocked clear of the ratchet teeth when a release grip **16** is squeezed by means of a connecting link **18**. The release grip **16** is biased by a tension spring **19** to hold the pawl **14** normally in locked position, thus preventing accidental movement of the lever **11** inwardly and consequent engagement of the engine clutch.

For controlling the engine throttle, both a governor and a manual adjustment linkage are provided. The governor **20***a* is operatively connected with a governor shaft **20** (Figs. 1 and 1*a*) which exerts a counterclockwise torque on a control member, here a bell crank **21**, such torque being related in magnitude to the speed of the engine. One portion or arm of the bell crank **21** is connected with a throttle link **22** which opens and closes the engine throttle valve as it is shifted fore and aft in response to rotation of the shaft **20**.

For balancing the governing torque exerted by the shaft **20**, a manual governor adjustment linkage is operatively connected to the other arm of the bell crank **21** and adapted to exert a selectable clockwise torque on the latter. As shown in the present instance, an angularly positionable adjustment rod **24** is connected with an adjustment handle at one end (not shown) and carries near its forward end a spring hook **25** held fast by a clamp or U bolt **26**. The spring hook **25** provides an eccentric pivotal connection for the upper end of a governor rod **28** which is thus moved substantially vertically as the adjustment rod **24** is rotated. To aid in maintaining the adjustment rod in a selected rotational position, a compensating spring **29** is connected by means of a lever **30** between the spring hook and the engine. In order that rotationl adjustments of the rod **24** may cause variable torques on the bell crank **21**, a governor tension spring **31** is connected between the other arm of the bell crank and the lower end of the rod **28**. In the preferred form, the lower end of the rod **28** extends through the coil spring **31** and bears directly against the bell crank when the rod **24** is rotated to its extreme counterclockwise position (as viewed in Fig. 1). It will be seen that rotation of the adjustment rod **24** in clockwise or counterclockwise directions raises or lowers the governor rod **28** and thus adjusts the force, and the resulting torque, exerted on the control member **24** by the spring **31**.

In normal operation, therefore, the fore and aft posi-

tion of the throttle link 22, the degree to which the engine throttle is open, and the speed of the engine are controlled by positioning the adjustment rod 24, tension exerted by the spring 31 tending to rock the bell crank clockwise. When the engine reaches the selected speed, the opposing torque exerted by the governor shaft 20 balances the tension in the spring 30 to maintain the throttle at a given setting. Any change in the speed of the engine, occasioned by changes in loading, results in a change in the governing torque and a repositioning of the bell crank 21 until the engine is returned to its original selected speed.

In accordance with the present invention, means are provided for automatically disabling the engine governor and returning the engine throttle valve to idling position whenever the hand lever is moved to its clutch-disengaging position, and without the necessity of resetting the manual adjustment means for the governor. In accomplishing this objective, means are connected between the bell crank 21 and the hand lever 11 in a manner such that the former is rocked to its extreme counterclockwise position when the hand lever 11 is moved to its clutch-disengaging position. On the other hand, the connection between the bell crank 21 and the hand lever 11 is such that when the latter is moved to its clutch-engaging position, the bell crank 21 has freedom for movement in a normal manner under the combined influence of the governing mechanism and the manual adjustment mechanism.

In the illustrated embodiment of such means, a lever or link 40 is pivoted along an offset midportion thereof in a pivot seat 41 bolted to the mounting bracket 42 for a generator 43 (Fig. 2). The upper end of the link 40 overlies the shorter, horizontal arm of the bell crank 21, while its lower end extends downwardly alongside the hand lever 11. A camming projection 44 is secured on the hand lever 11 and adapted to engage the link 40 such that upon movement of the lever 11 to its clutch-engaging position, the link 40 is rocked clockwise in its pivot seat 41 to swing its upper end free of the bell crank 24 (Fig. 2).

For biasing the link 40 in a counterclockwise direction (Fig. 2), the spring 19, which also serves to bias the pawl 14 into locking engagement with the ratchet teeth on the plate 15 is connected in tension between the release grip 16 at its upper end and the link 40 at its lower end. Thus, upon movement of the hand lever 11 to its clutch-disengaging position, the camming projection 44 permits the link 40 to be rocked in a counterclockwise direction under the influence of the tension spring 19 so that its upper end bears against the bell crank 21 and exerts a counterclockwise torque thereon which overcomes the biasing force of the spring 31 and rocks the bell crank to close the engine throttle valve to idling position. As a result of this action, the engine has its throttle and clutch jointly controlled. Simply moving the hand lever 11 to engage or disengage the clutch permits the throttle to be positioned for engine operation at a speed selected by the rotational setting of the manual adjustment rod 24, or the throttle valve to be closed for engine operation at idling speed, respectively. The rod 24 may be left in a given setting to cause the engine to operate at the speed best suited for the particular implement mechanism with which it is connected when the clutch is engaged. This working speed may be varied, as desired, simply by manually setting the rod 24 by means of the usual hand lever (not shown).

The engine 10 is provided with the usual electric starting motor 46 which, when energized, cranks the engine for starting. The motor 46 is connected in series circuit with a battery 47 and a normally open, manually operated push-button switch 48 (Fig. 5). The circuit is modified as described below, in order to provide a safety feature.

In accordance with another feature of the invention,

means are provided for preventing energization of the engine starting motor whenever the clutch of the engine is engaged, such means being operated in conjunction with the control system described above. In order to effect such safety lock-out of the starting motor, a switch is mounted on the engine and connected into the circuit for the motor, the switch being normally closed but actuated automatically so as to be opened whenever the hand lever 11 is moved to the position in which the clutch is engaged. As here shown, such means for actuating a lock-out switch are provided by the link 40 which, as previously described, also serves to slow the engine to idling speed when the hand lever 11 is moved to its clutch-disengaging position.

In the present instance, such an arrangement is embodied by a normally closed switch 50 mounted on the bracket 42, presenting its movable actuator 50*a* beneath the link 40 which extends up between the generator 43 and bracket 42. The actuator 50*a* is biased to an extended position (Fig. 4) in which the switch is closed (Fig. 5), but is located to be depressed when the lever 11 is moved to its clutch-engaging position and the link 40 rocked clock-wise in its pivot seat 41 (Fig. 3). It will thus be seen that the motor 46 cannot be energized even though the main manual switch 48 is closed when the clutch is engaged. However, the switch 50 is closed and the motor may be energized in the usual fashion by closing the main switch 48 whenever the clutch is disengaged and the link 40 rocked clockwise.

This combined action of the link 40 in positively positioning the bell crank 21 to close the engine throttle to idling position when the clutch is disengaged and in opening the switch 50 when the clutch is engaged affords a relatively simple and convenient joint control of the engine, as well as providing the safety feature of preventing the engine starting motor from being energized when the clutch is engaged. Thus overloads cannot be placed on the starting motor, nor can the engine be started while drivingly connected to apparatus having moving parts which might endanger workmen standing near them. The noise of the engine being started before the clutch is engaged serves as sufficient warning for workmen to move clear of such moving parts, and they have ample time to do so before the hand lever 11 is swung to its clutch-engaging position after the engine is started.

We claim as our invention:

1. A control mechanism for an engine having a clutch, a throttle control normally biased to a selectable running position, and a starting motor connected in circuit with a normally open manually operated starter switch, said mechanism comprising, in combination, a link pivoted intermediate its ends, biasing means yieldably urging said link into engagement with the throttle control and in a direction to shift the latter to its idling position, a manual clutch lever shiftable between clutch-engaging and clutch-disengaging positions, a projection on lever engageable with said link when said lever is shifted to its clutch-disengaging position for rocking said link against its biasing means to free the throttle control to return to its selected running position, an electric safety switch connectable in series with the starting motor and starting switch, and means for mounting said safety switch adjacent said link to be opened and closed by the latter in response respectively to shifting of said lever to its clutch-engaging and dis-engaging positions.

2. For use with an engine having a clutch, and a movable throttle control member biased by a spring to an adjustable throttle-opening position, a control mechanism comprising, in combination, a manual clutch-controlling lever shiftable between clutch-engaging and clutch-disengaging positions, a link pivoted intermediate its ends and having one end engageable with the throttle control member, spring means operative on said link to bias its one end against the throttle control member and to shift the latter against its spring to an engine-idling position,

and a projection on said lever engaged with the other end of said link when said lever is moved to its clutch-engaging position to shift said link against the force of said spring means and free said one end of said lever from the throttle control, whereby the throttle control returns to its adjusted throttle-opening position only when said lever is moved to its clutch-engaging position.

3. For use with an engine having a clutch, a movable throttle control member biased by a spring to an adjustable throttle-opening position, a control mechanism comprising, in combination, a manual clutch-controlling lever shiftable between clutch-engaging and clutch-disengaging positions, a stationary ratchet plate and a cooperating pawl pivoted on said lever to prevent movement of the latter toward its clutch-engaging position, a release grip pivoted on said lever and linked with said pawl to rock the latter free of said ratchet plate, a link pivoted intermediate its ends and having one end engageable with the throttle control member, a single tension spring connected between said link and said release grip (*a*) to bias the one end of said lever against the throttle control member and shift the latter against its spring to an engine-idling position and (*b*) to yieldably bias said pawl into engagement with said ratchet plate, and a projection on said lever engaged with the other end of said link when said lever is moved to its clutch-engaging position to shift said link against the force of said spring means and free said one end of said lever from the throttle control, whereby the throttle control returns to its adjusted throttle-opening position only when said lever is moved to its clutch-engaging position.

4. For use with an engine having a clutch, a governor

exerting a torque in a first direction related in magnitude to the engine speed on its output shaft, a movable throttle control member mounted on the governor shaft and biased by a spring in a direction opposite that of the governor torque to an adjustable throttle-opening position, a control mechanism comprising, in combination, a manual clutch-controlling lever shiftable between clutch-engaging and clutch-disengaging positions, a link pivoted intermediate its ends and having one end engageable with the throttle control member, spring means operative on said link to bias its one end against the throttle control member and to shift the latter against its spring to an engine-idling position, and a projection on said lever engaged with the other end of said link when said lever is moved to its clutch-engaging position to shift said link against the force of said spring means and free said one end of said lever from the throttle control, whereby the throttle control returns to its adjusted throttle-opening position only when said lever is moved to its clutch-engaging position.

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