SECTION 15

ACCESSORIES

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CRUISE-MASTER

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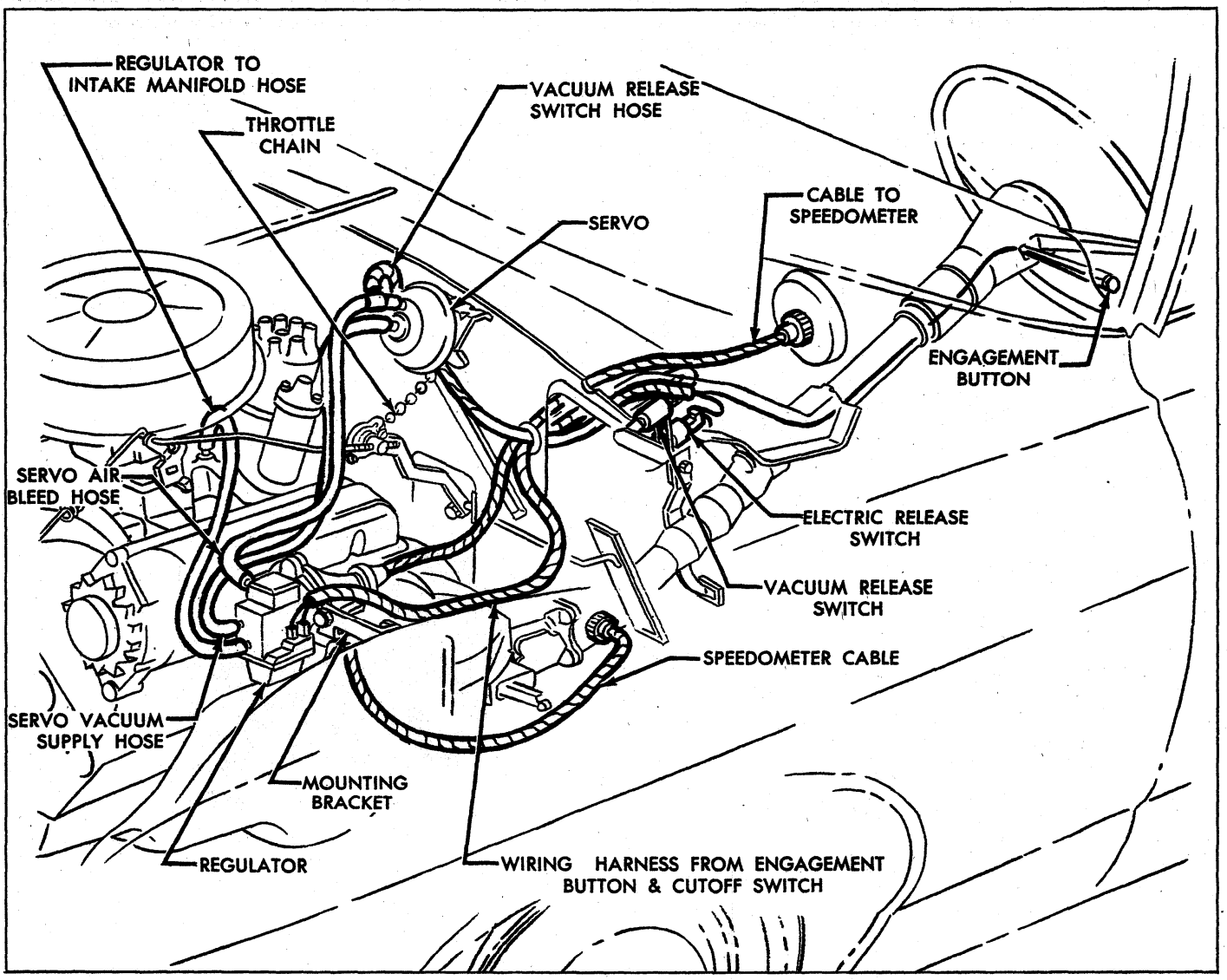


Fig. 1 - Cruise Master System

GENERAL DESCRIPTION

The Cruise Master is a speed control system which employs engine manifold vacuum to power the throttle Servo unit. The Servo moves the throttle when speed adjustment is necessary by receiving a varying amount of bleed air from the Regulator unit. The Regulator varies the amount of bleed air through a valve system which is linked to a speedometer-like mechanism. The speedometer cable from the transmission drives the Regulator, and a cable from the Regulator drives the instrument panel speedometer. The engagement of the Regulator unit is controlled by an Engagement Switch located at the end of the turn signal lever. Two brake release switches are provided: an Electric Switch disengages the Regulator unit and a Vacuum Switch decreases the vacuum in the Servo unit to quickly return the throttle to idle position.

The operation of each unit of the system and the operation of the entire system under various circumstances is described below. Figure 1 shows the location of the system components within the vehicle.

COMPONENT OPERATION

ENGAGEMENT SWITCH

This switch, located within the turn signal knob, has three positions. In the fully released position, the switch passes current through resistance wire to effect a "hold in" magnetic field in the Regulator solenoid. This current is sufficient only to hold the solenoid in place once it has been actuated by the "pull in" circuit. Depressing the button partially allows current to flow to the Regulator solenoid at full voltage which causes the solenoid to pull in. Depressing the button fully opens the circuit to both the resistance and standard solenoid feed wires and the solenoid becomes de-activated.

During vehicle operation the three switch positions have the following functions:

Released

a. System not engaged: No function of the system will occur although a small current is flowing through the solenoid via the resistance wire (at vehicle speeds over 20 mph).
b. System engaged: The small current flowing through the resistance wire is holding the solenoid in the engaged position.

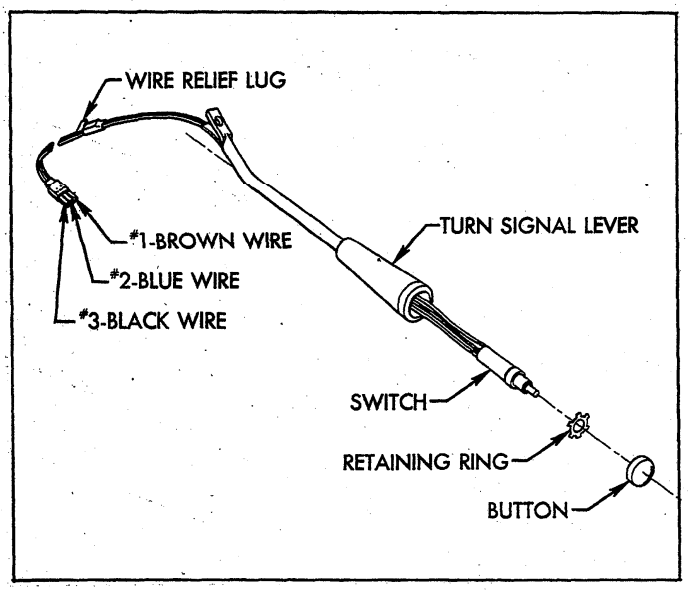


Fig. 2 - Cruise Master Engagement Switch

Partially Depressed

Full voltage is applied to the solenoid (vehicle speed over 20 mph) which sets the Regulator to maintain the vehicle speed at the time of Regulator engagement.

Fully Depressed

No electricity flows to the solenoid and the Regulator is inactive. This position is used by the driver when he desires to raise or lower his controlled speed. He may accelerate to his new speed, press the button fully (Regulator releases previously set speed) and release the button. Upon releasing the button, it passes through the partially depressed position and the solenoid is "pulled in", then into released position which provides "hold in" current. The driver may also press the button fully with no pressure on the accelerator pedal. In this case the regulator releases control of the throttle which returns to idle and the car slows. When the button is released the solenoid is pulled in and held in respectively and the regulator resumes speed control at the speed of the vehicle during the moment of button release (at vehicle speeds over 20 mph).

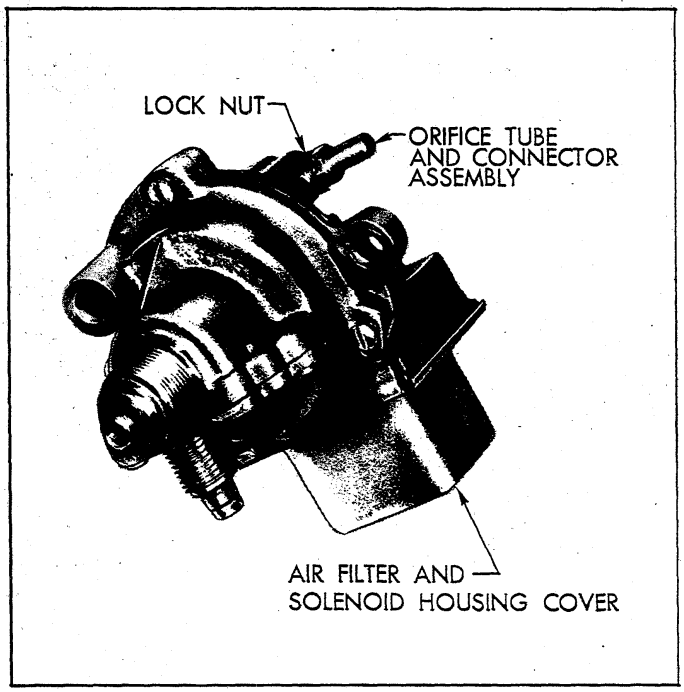


Fig. 3 - Regulator Unit

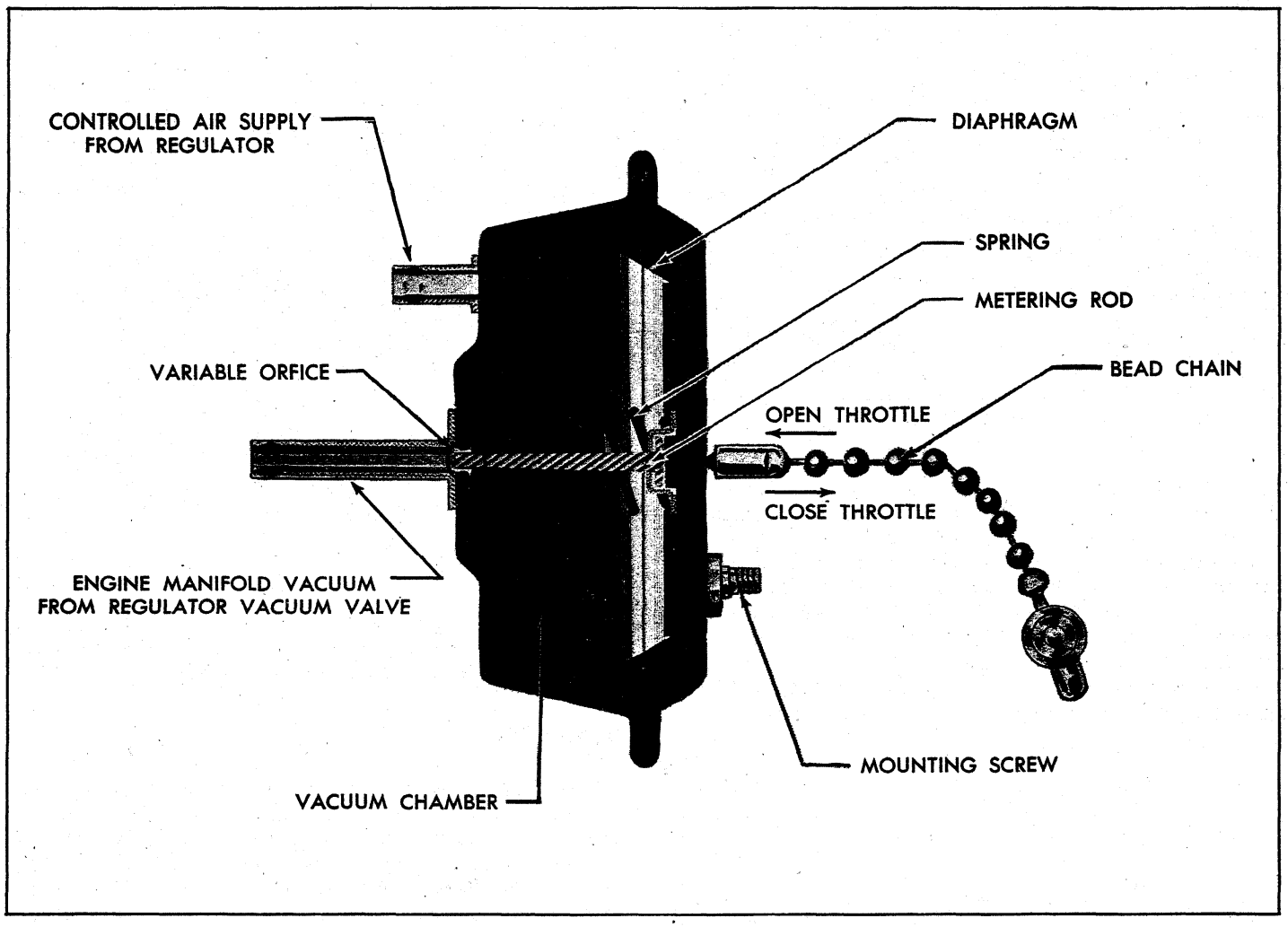


Fig. 4 - Servo Unit

BRAKE RELEASE SWITCHES

Two brake release switches are employed in the Cruise Master System. When the brake pedal is depressed, an Electric Release Switch cuts off the voltage supplied to the engagement switch, hence cuts off power to the Regulator unit. The Regulator is then disengaged and requires Engagement Switch operation to return it to operation. A Vacuum Release Switch operates simultaneously with the electric release switch whenever the brake pedal is depressed. This switch opens a port to atmospheric pressure which rapidly bleeds down the vacuum in the Servo unit thereby returning the throttle to the idle position.

SERVO UNIT

The Servo unit is a vacuum actuated, variable position diaphragm assembly which operates the carburetor throttle when the system is in operation (fig. 4). It is powered by engine intake manifold vacuum and operates the throttle linkage via a bead chain. The Servo has two ports on the sealed side of the diaphragm housing: one is supplied manifold vacuum, and the other is connected to a variable air bleed in the Regulator Unit. The vacuum port is located at the center of the unit and the air bleed port is near the outer wall. When vacuum is applied to the center port, atmospheric pressure moves the diaphragm which pulls on the bead chain opening the carburetor throttle. As the diaphragm moves, it positions a tapered needle within an orifice in the vacuum port so that as the diaphragm moves toward the port, the orifice becomes smaller; and as it moves away from the port, the orifice becomes larger.

The air bleed port serves to supply a variable quantity of air to the diaphragm chamber which causes the diaphragm to attain a balanced state (between the force of the atmospheric pressure to chamber pressure differential and the force of the diaphragm and throttle return springs). In operation then, the following events occur: Vacuum is applied to the center port and the diaphragm moves toward the port. The tapered needle restricts the vacuum port more and more as it moves into the orifice. If no air was allowed to bleed into the chamber, the diaphragm would move until it contacted the housing, however, the Regulator meters bleed air into the chamber and the diaphragm reaches a point at which the air is bled out of the chamber through the vacuum port orifice as fast as it enters the air bleed port. If the Regulator begins to supply less bleed air, (vehicle speed decreasing) the vacuum in the chamber increases and the diaphragm moves toward the vacuum port. In so doing, the tapered needle closes the vacuum port orifice even more

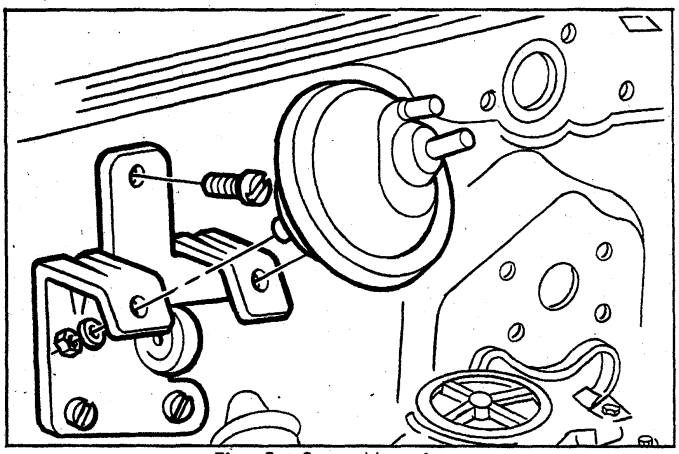


Fig. 5 - Servo Mounting

and the air bled into the chamber again equals the air bled out. A balance occurs again with the diaphragm in a new position. If the Regulator begins to supply more bleed air, (vehicle speed increasing) the vacuum in the chamber drops and the diaphragm moves away from the vacuum port, withdrawing the tapered needle from the orifice and enlarging it. Since the vacuum orifice is now larger, the greater quantity of air being bled into the chamber may be bled out by vacuum and a balance again occurs with the diaphragm in a new position.

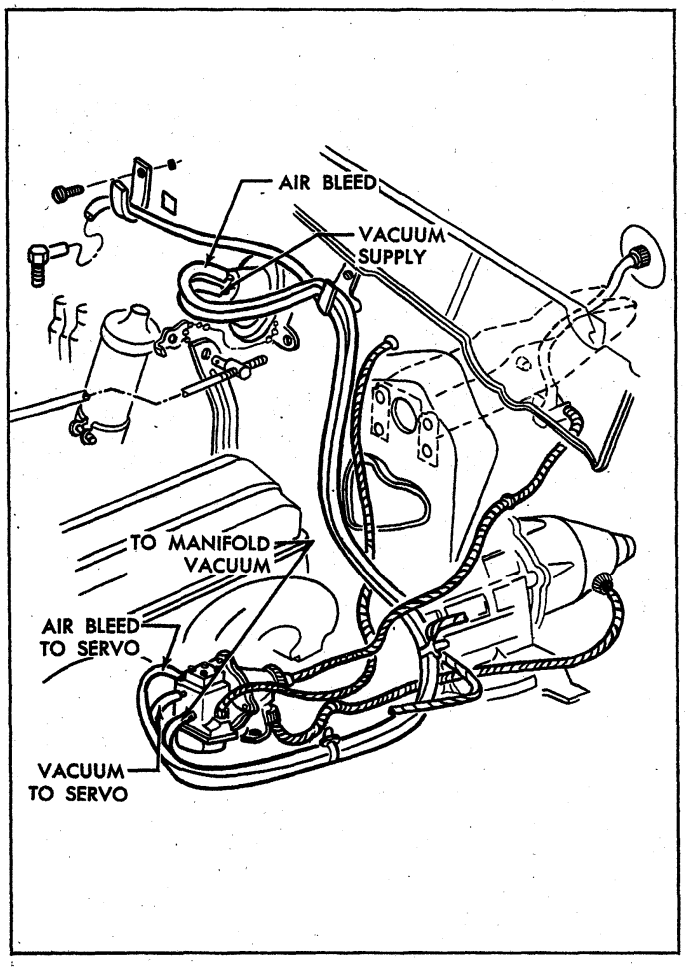


Fig. 6 - Servo, Regulator and Hose

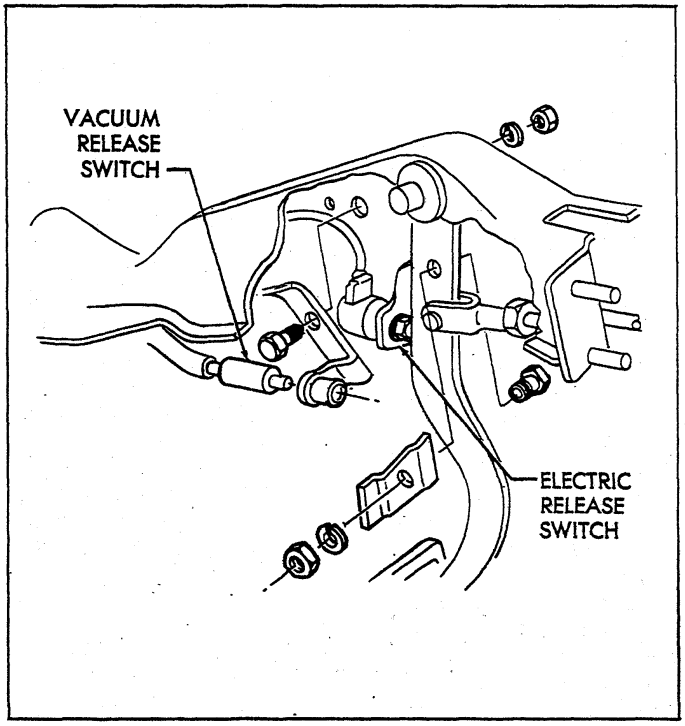


Fig. 7 - Release Switches and Brackets

REGULATOR

The Regulator is a device which has two primary functions: First, it is a vacuum switch which, when engaged by the driver, supplies engine manifold vacuum to the Servo. Second, it meters a small variable quantity of air to the Servo unit in order to change the carburetor throttle opening to effect speed control. A secondary function of the Regulator is to drive the speedometer. Since the car speed is sensed by a speedometer-like mechanism within the unit, the speedometer cable from the transmission drives the Regulator which drives a second cable (at a one to one ratio) to the speedometer.

The Regulator is electrically engaged and disengaged through operation of the Engagement Switch and the Electric Brake Release Switch. It has two sub-assemblies which make up the unit: one being the magnetic speed sensing assembly and the other being the solenoid actuated vacuum switch, air bleed and filter, and low limit speed switch assembly (fig. 8 and 9).

Magnetic Speed Sensing Assembly

The speed sensing assembly operates in the same manner as a speedometer unit except that instead of rotating a needle through an angle proportional to the vehicle speed, it rotates a rubber drum which is clutched to the air bleed valve when the system is in operation. The assembly is driven by the speedometer cable from the transmission which turns a disk shaped ferrite magnet. Facing the magnetic disk is the driven brass disk mounted on a shaft with the rubber drum mounted on the same shaft. A spiral hairspring connects the shaft to the housing and allows it to rotate through an angle which is proportional to car speed. If the car doubled its speed, the shaft would rotate to twice its previous angle as may be seen by noting the operation of a speedometer. The

driven disk is sandwiched between the magnetic disk and a field plate. The field plate forms a returning path for the magnetic field from the magnetic disk.

The gear drive for the magnetic disk is a 90 degree nylon gear drive with the driven gear rotating both the magnetic disk and the speedometer drive cable.

Vacuum Switch, Air Bleed and Filter, and Low Limit Speed Switch

The end of the shaft from the speed sensing assembly with the rubber drum extends into the air bleed metering assembly. This rubber drum has a tang extending from its surface which allows a set of points to close at a specific car speed. When the car reaches about 20 mph, the rubber drum has rotated far enough (moved by the brass driven disk in the magnetic field) so that its tang has allowed a spring loaded electrical point to contact another point. These points are in series with the solenoid coil so that under 20 mph, no Regulator operation is possible.

Surrounding the rubber drum is a "U" shaped spring clip which is held spread away from the drum by the nose or cam of the solenoid when the solenoid is in the relaxed position. The rubber drum and this clip comprise the speed clutch of the regulator. When the solenoid is energized, the solenoid nose moves toward the drum and releases the ends of the clip. The clip springs inward and attaches itself by friction to the drum. Now, any change in car speed will rotate the drum and move the "U" clip just as a speedometer moves its needle. The top of the "U" clip is attached to the air bleed valve. The clip moves a sleeve which slides on the orifice tube thereby covering and uncovering air ports in the wall of the tube (the tube inner end is plugged) whenever car speed changes from the speed at which the solenoid was energized. The direction of drum rotation is such that resulting bleed valve operation will cause the Servo to decrease engine power if the car exceeds the preset speed and increase engine power if car speed decreases. The air which passes out the orifice tube enters the Regulator through the openings in the solenoid housing, passes through the oil wetted polyurethane filter, and then enters the orifice tube ports.

When the solenoid is de-energized, the nose retracts and cams the ends of the "U" clip outward so that it releases the rubber drum.

The solenoid also operates a vacuum switch simultaneously with the clutching and declutching of the "U" clip. The vacuum switch supplies the Servo unit with manifold vacuum. The solenoid operated vacuum valve slides over two ports in the Regulator wall. One port is connected to manifold vacuum and the other is connected to the center port of the Servo unit. When the solenoid is de-energized, the valve closes the manifold vacuum port and opens the Servo port to the inside of the regulator case. When the solenoid is energized, the valve connects the Servo port to the manifold vacuum

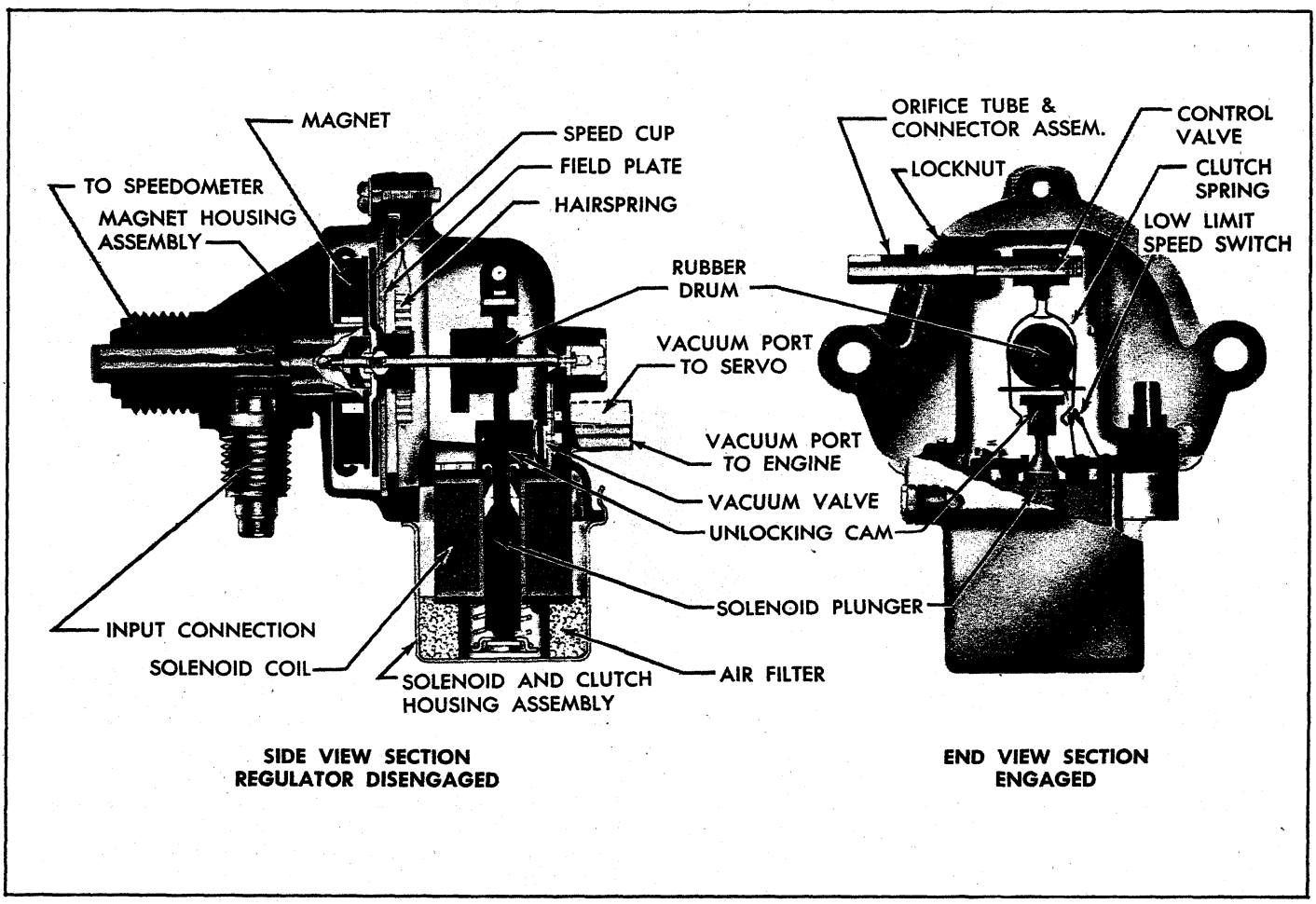
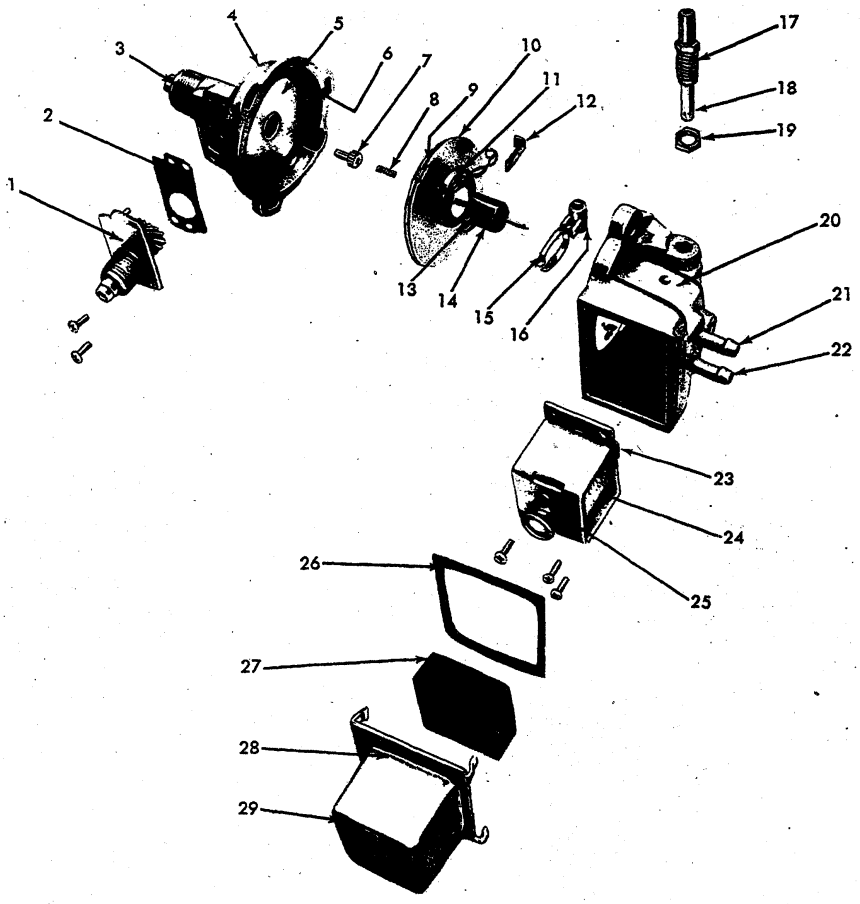


Fig. 8 - Regulator-Cross Section

port thereby supplying vacuum to the Servo unit.

During system operation the following events occur:

1. Car speed below 20 mph--no function of the unit because the rubber drum has not rotated far enough to close the solenoid points. No energizing current can flow through the solenoid coil.
2. Car speed above 20 mph--The tang on the rubber drum has closed the solenoid points and current is flowing through the 40 ohm resistance wire to the solenoid coil. This current is not sufficient to "pull in" the solenoid.
3. Driver partially presses Engagement Switch--full voltage flows through the solenoid to pull it into operation. Solenoid cam tension on the "U" clip is released and the clip grips the rubber drum. Simultaneously the vacuum switch operates; applying manifold vacuum to the Servo unit which tightens the throttle chain. When the driver releases pressure from the accelerator pedal the unit will position the throttle to maintain the speed at the time of solenoid operation.
4. Driver releases the Engagement Switch--current flows to the solenoid through the 40 ohm wire and since the solenoid is "pulled in", the reduced current flow is sufficient to hold it in position.
5. The car begins to ascend a hill--car speed drops slightly (very slightly) and the magnetic force on the driven disk of the speed sensor is decreased. The disk rotates slightly (as would a speedometer shaft because of hairspring tension) turning the rubber drum. Since the "U" clip is gripping the drum, it moves the slide which COVERS the air bleed ports more. With less air bleeding into the Servo, greater vacuum exists in it and the diaphragm moves toward the vacuum port opening the throttle wider. The tapered needle moves into the orifice further and the diaphragm balances in a new position with the wider throttle opening. Car speed has been maintained automatically.



1. Speedometer Cable Adapter (From Transmission)
2. Gasket
3. Speedometer Cable Adapter (To Speedometer)
4. Adapter and Magnet Housing
5. Rotating Magnet
6. Helical Ramp
7. Field Plate Adjusting Pinion
8. Adjusting Pinion Locating Spring
9. Brass Magnetically Driven Disk
10. Field Plate
11. Hair Spring
12. Hair Spring Keeper
13. Rubber Drum Tang
14. Rubber Drum
15. "U" Shaped Clutch Spring
16. Air Bleed Sleeve
17. Orifice Tube
18. Orifice
19. Orifice Tube Locknut
20. Clutch and Solenoid Housing
21. Vacuum Supply Port (To Servo)
22. Vacuum Port (To Intake Manifold)
23. Vacuum Valve Slide
24. Solenoid Coil
25. Solenoid Plunger Return Spring
26. Solenoid Cover Gasket
27. Air Filter
28. Solenoid Cover
29. Air Inlets

Fig. 9 - Regulator - Exploded

6. The car begins to descend a hill--car speed increases slightly and the regulator movements occuring above occur again except in reverse. The rubber drum is turned further against spring tension and the air bleed orifices are uncovered more. This bleeds more air to the Servo reducing the vacuum in the unit. The diaphragm moves away from the vacuum port, closes the throttle slightly, and withdraws the tapered needle from the vacuum orifice. With the orifice enlarged, the increased vacuum counteracts the increased air bleed and the diaphragm finds a balance again at a reduced throttle opening.
7. Driver accelerates by pressing accelerator pedal--car speed increases and the system responds by moving the diaphragm to decrease throttle opening. Since a bead chain is used, the chain merely relaxes and has no effect on throttle operation. After the driver releases pressure from the pedal, the throttle will close until car speed decreases to the pre-set speed. At that point the Regulator bleeds less air to the Servo which opens the throttle enough to maintain the pre-set speed. The system returns to a stable condition.
8. Driver desires higher controlled speed, presses accelerator until new speed is reached, and depresses Engagement Switch fully and releases button--speed sensing assembly tries to turn in a direction that would decrease the throttle opening until the driver fully depresses the Engagement Switch. Then the current is cut off to the solenoid which retracts; the solenoid nose expands the "U" clip releasing its grip on the rubber drum. The drum and disk assembly then rotates to a new position because of the higher car speed. When the solenoid retracts, it also shuts off vacuum to the Servo and opens the vacuum port to atmospheric pressure within the Regulator thereby bleeding down the Servo toward idle throttle position. As the driver releases the Engagement Switch, the contacts cause "pull in" and "hold in" of the solenoid respectively. The system is engaged to maintain the car speed at the time of Engagement Switch release.
9. Driver desires lower cruising speed, presses Engagement Switch fully, waits until car speed decreases to desired speed then releases Switch--when the Engagement switch is fully depressed the solenoid is de-energized causing the vacuum switch to bleed down the Servo to idle throttle position and the "U" clip of the idle bleed valve is released from the rubber drum. The drum and disk assembly is free to rotate to a position which corresponds to vehicle speed as the car slows. When the driver releases the Engagement Switch, the unit "pulls in" and "holds in" in the normal manner. The air bleed valve is clutched to the rubber drum at the car speed during switch release. Vacuum is again applied to the Servo and throttle control is assumed by the Regulator to maintain the car speed at the time of switch release.
10. With system in operation, driver applies brakes--simultaneously the Vacuum Release and Electric Release Switches operate. The Vacuum Switch bleeds air into the Servo through the air bleed line coming from the Regulator. The vacuum is reduced in the Servo and the throttle returns to idle position. The Electric Release Switch cuts off power to the entire system and the solenoid is de-energized. If the driver removes his foot from the brake pedal the Electric Switch again feeds voltage to the Engagement Switch and the Vacuum Switch seals the air bleed line. If the vehicle speed is above 20 mph when this occurs, reduced voltage will flow to the solenoid through the 40 ohm wire which will not be sufficient to "pull in" the unit. If vehicle speed is below 20 mph no current will flow since the tang on the rubber drum has opened the low limit switch points in the Regulator. In either case, after depressing the brake pedal, the system will not control car speed until the driver operates the engagement switch above 20 mph.

SERVICE OPERATIONS

The components of the Cruise Master system are designed to be replaced should they become inoperative. The Regulator is calibrated in such a manner during manufacturing that overhaul operations are impractical. However, one adjustment may be made to the Regulator to correct speed drop or increase at the time of engagement.

BRAKE RELEASE SWITCHES

ELECTRIC

Service – An inoperative switch must be replaced. Switch replacement is identical to standard brake lamp switch replacement.

Adjustment– The brake switch plunger must clear the pedal arm when the arm is moved 1/4 inch measured at the switch (Figure 7).

VACUUM

Service – An inoperative (sticking, plugged, or leaking) switch must be replaced. Switch replacement is similar to brake switch replacement. Be certain that the hose to the switch is connected firmly and is not cracked or deteriorated.

Adjustment– The brake switch plunger must clear the pedal arm when the arm is moved 5/16 inch measured at the switch (Figure 7).

ENGAGEMENT SWITCH

Service The engagement is serviced only by replacement.

Removal

1. Pry the engagement button out of the turn signal knob with a small thin bladed screwdriver (Figure 2).
2. With a small hook or long nosed pliers, remove the switch retaining ring.
3. Pull switch outward utilizing the slack in the wiring harness.
4. With a small soldering iron, unsolder the wires and resolder them to the correct terminals of the replacement switch.

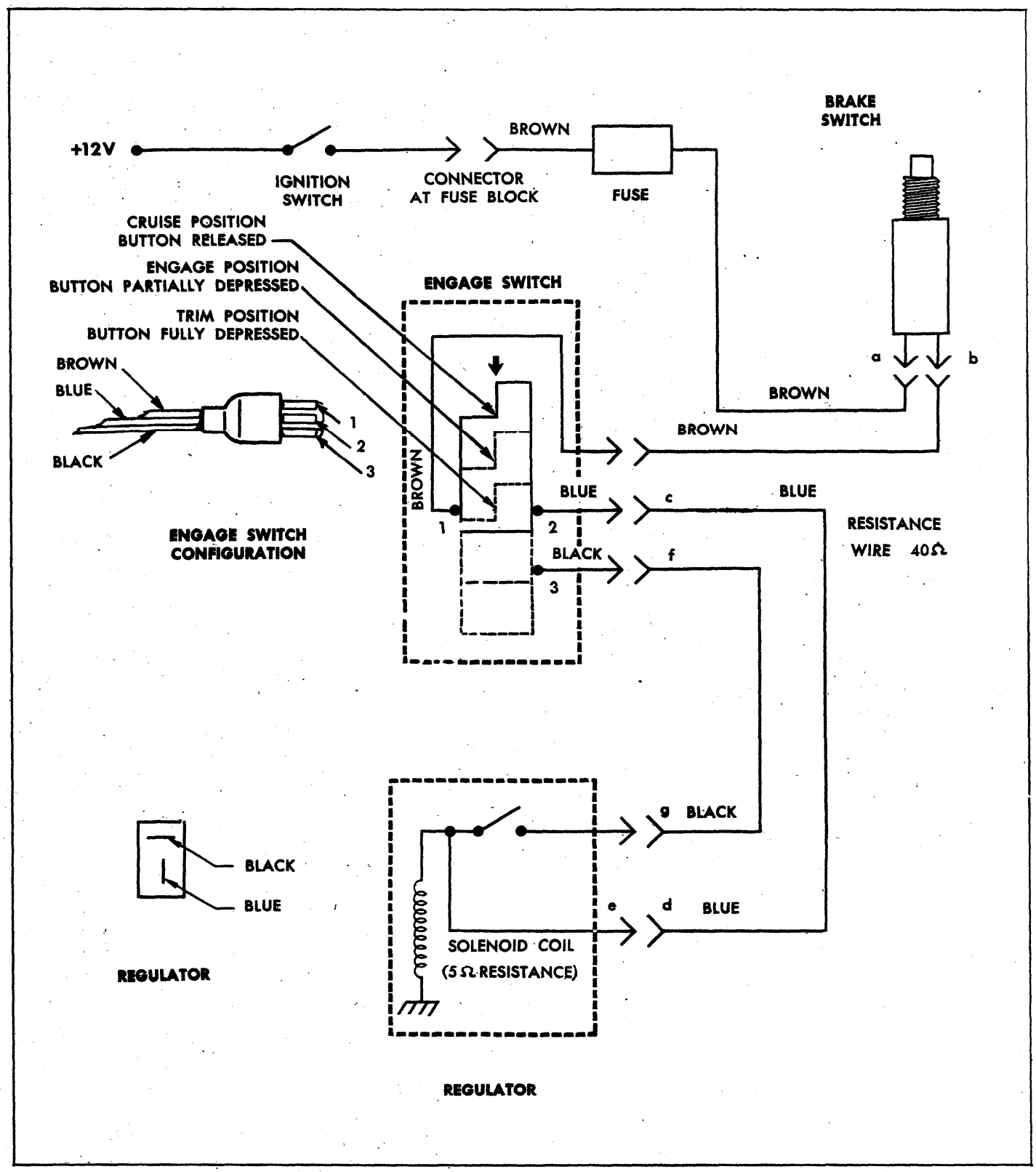


Fig. 10 - Wiring Diagram

Replacement

1. Insert the switch into the turn signal knob, push the retaining ring firmly against the switch, and push the operating button onto the switch plunger.

SERVO

Service – If the Servo unit is found to be defective, replacement is required. Note the condition of the hoses and replace any which are cracked or deteriorated.

Adjustment - Adjust the bead chain so that it is as tight as possible without holding the throttle open when the carburetor is set at its lowest idle throttle position. When connecting the bead chain (engine stopped) manually set the fast idle cam at its lowest step and connect the chain so that it does not hold the idle screw off the cam. If the chain needs to be cut, cut it three beads beyond the bead which pulls the linkage.

REGULATOR

Service - A defective regulator, that is one which is not simply out of adjustment, must be replaced. During replacement, check the hoses which connect to the regulator and replace any which are cracked or deteriorated.

Air Filter

The air filter located in the solenoid cover should be cleaned and re-oiled at engine oil change intervals.

1. Snap the solenoid cover off.
2. Remove the filter and wash it in kerosene or mineral spirits. Squeeze it dry and wet with SAE 10 engine oil. Squeeze out excess oil and reinstall into the cover.
3. Attach the cover with neoprene seal to the solenoid housing. Be certain that the cover fits tightly to the housing.

One regulator adjustment is possible: Engagement-Cruising Speed Zeroing (to remove any difference between engagement and cruising speed).

NOTE: No regulator adjustment should be made, however, until the following items have been checked or serviced:

1. Bead chain properly adjusted.
2. All hoses in good condition, properly attached, not leaking, not pinched or kinked.
3. Regulator air filter clean and properly oiled.
4. Electric and vacuum release switches properly adjusted.

Engagement—Cruising Speed Zeroing

If the cruising speed is lower than the engagement speed, loosen the orifice tube locknut and turn the tube outward; if higher, turn the tube inward. Each 1/8 turn will alter the engagement-cruising speed difference one mph. Tighten the locknut after adjustment and check the system operation at 50 mph.

ELECTRICAL SYSTEM CHECK OUT

1. Check fuse and connector.
2. Check electric brake switch as follows: Unplug connector at brake switch. Connect ohmmeter at points A and B on brake switch. The ohmmeter must indicate infinity when the brake pedal is depressed and continuity when pedal is released. The cruise release brake switch (electric) is adjusted as is the standard stop light brake switch. Replace electric brake switch if needed.
3. Check engagement switch and connecting wiring as follows: Unplug push button control connector (brown, blue, black) at electrical wiring harness connector and perform the following tests. (See Figure 10)

Test #1 — Connect ohmmeter between terminal #1 (brown wire) and terminal #2 (blue wire). Continuity shall be maintained until switch is depressed all the way in.

Test #2 — Connect ohmmeter between terminal #1 (brown wire) and terminal #3 (black). No continuity shall be shown; however, when the button is depressed halfway, continuity shall be indicated. When the button is pressed all the way down, no continuity shall be shown.

Test #3 — Connect ohmmeter between terminal #2 (blue wire) and terminal #3 (black). Button released, no continuity; however, when the button is depressed partially and fully, continuity shall be shown.

4. Check regulator solenoid coil, low-speed switch, and wiring harness as follows:
   a. Disconnect engagement switch wire harness connector from the main wire harness connector (brown, blue, and black wires). Connect ohmmeter between point C (blue wire in main wire harness) and ground. (Make sure the regulator is well grounded to chassis.) The ohmmeter should read 45 ohms ± 2 ohms. If a resistance of greater value is shown, then disconnect the connector from the regulator and measure the resistance of the blue wire from point C to D. It should measure 40 ohms. Check the resistance from point E (vertical bar of terminal forming T) to ground. It should measure 5 ohms ± 1/4 ohm. Replace either the wiring harness or solenoid as needed if greater values are indicated. The black harness wiring from point F to G should also be checked for continuity.

ENGAGEMENT SWITCH TEST

BUTTON POSITION	TERMINALS		
	1 TO 2	1 TO 3	2 TO 3
Cruise (released)	closed	open	open
Engage (partially depressed)	closed	closed	closed
Trim (fully depressed)	open	open	closed

SERVO AND VACUUM SYSTEM CHECK OUT

To determine the condition of the diaphragm, remove hoses from power unit and apply 14 inches of vacuum to either vacuum tube opening (seal the other opening) and hold in for one minute. The vacuum shall not leak down more than 5 inches of vacuum in one minute. If leakage is detected, replace servo. To utilize engine as a vacuum source, proceed as follows:

1. DISCONNECT SERVO BEAD CHAIN and hoses from servo and connect engine vacuum directly to vacuum servo fitting (fitting in middle of servo). Seal the servo unit opening.
2. Note position of servo diaphragm.
3. Start engine - the diaphragm should pull in.
4. Clamp off engine vacuum supply line and check for leakage.

The cruise release brake switch (vacuum) and connecting hoses can likewise be checked using a vacuum pump.

CRUISE MASTER SYSTEM CHECKS

	Cause	Correction
Will not engage	Brake Switch Circuit Open	Check connections - adjust or replace switch. Refer to Electrical Check Out.
	Fuse blown	Replace fuse - if it blows again, check for: 1. Engage Switch stuck in the center of travel - Refer to Electrical Check Out. 2. Incorrect wiring - Refer to Electrical Check Out. 3. Short to ground - Refer to Electrical Check Out. Make necessary corrections.
	Defective Engage Switch	Replace as needed - Refer to Electrical Check Out.
	Vacuum leak in Servo and/or Brake Switch and connecting lines.	Vacuum test and repair or replace as needed. Refer to Servo and Vacuum System Check Out.
	Open in wiring harness	Repair or replace as needed.
	Defective Regulator	Replace Regulator.
Does not cruise at engagement speed	Orifice Tube misadjusted	Adjust as required.
System hunts or pulses	Bead Chain loose	Tighten Bead Chain.
	Kinked or deteriorated hoses	Repair or replace.
	Dirty Air Filter	Service as required.
	Defective and/or improperly positioned Drive Cables and/or Casing Assemblies	Repair or replace as needed.
	Defective Regulator	Replace Regulator.
System does not disengage - with brake pedal	Brake and/or Vacuum Switch misadjusted or defective	Adjust or replace as required. Refer to Servo and Vacuum System Check Out and Electrical Check Out.
System applies full throttle when engaged	Hoses interchanged at Servo	Correct as needed.
	Defective Regulator	Replace Regulator.
Cannot adjust speed downward with Engage Button	Defective Engagement Switch or Wiring	Replace as needed. Refer to Electrical Check Out.
Does not engage or engages lower than limits referred to in "Driver Operation"	Internally Misadjusted Regulator	Replace Regulator