

- 
- ✓ OPERATION
 - ✓ INSTALLATION
 - ✓ ADJUSTMENT
 - ✓ SERVICE

PS SERIES CARBURETOR MANUAL

THE BENDIX CORPORATION
ENERGY CONTROLS DIVISION

717 N. BENDIX DRIVE
SOUTH BEND, INDIANA 46620



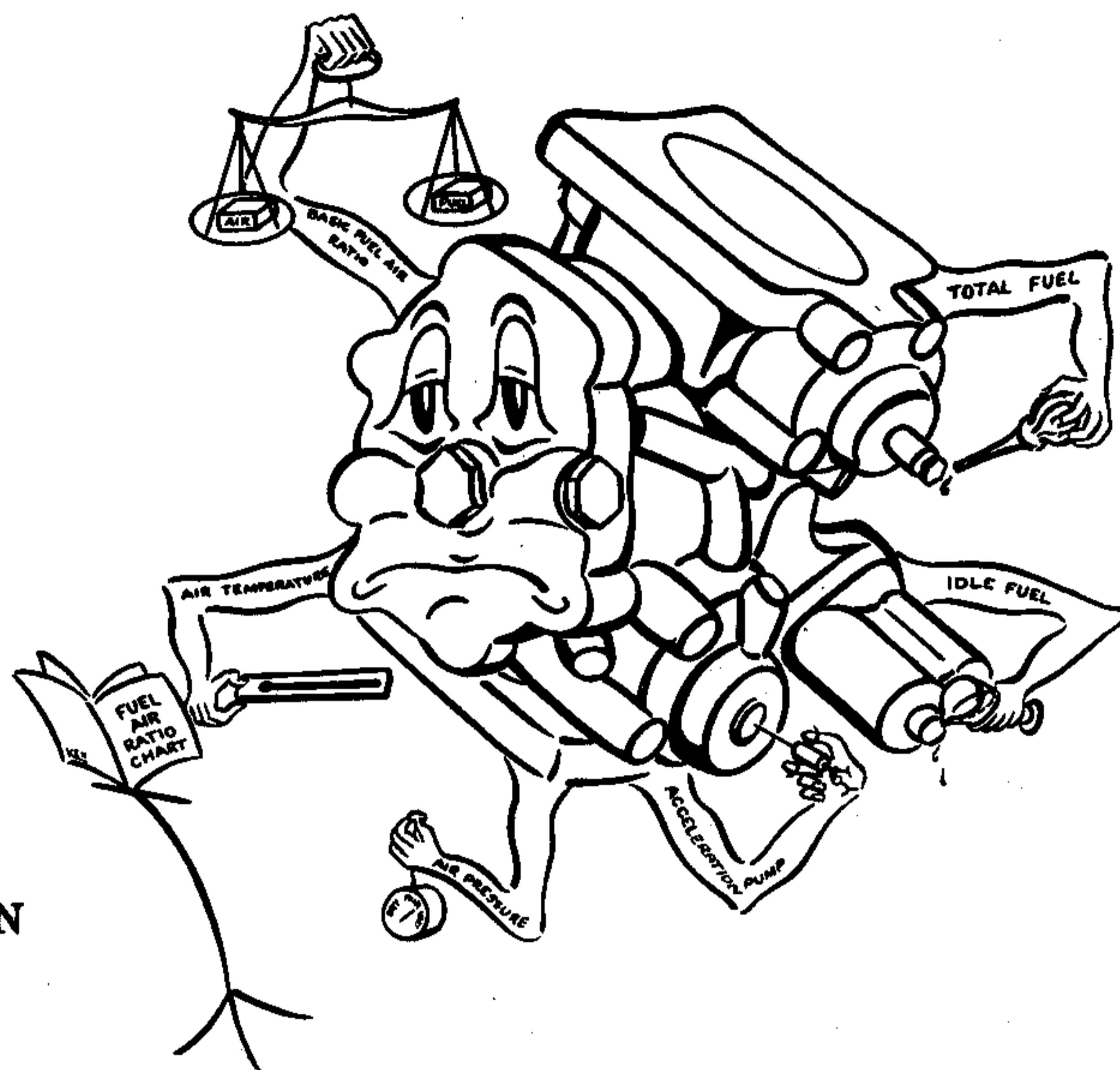
FOREWORD

This service manual has been prepared and distributed by the Product Support Publications Department of the Energy Controls Division of The Bendix Corporation and is intended for use by service personnel responsible for the installation, adjustment, and maintenance of the PS Series Carburetors. Every effort has been made to include specific carburetor instructions for each current model aircraft and engine incorporating a PS type carburetor. If any manufacturer, certain model aircraft or specific engine has been omitted, it is because the necessary information was not available at the time of printing.

This manual is to be revised periodically so that maintenance personnel will be informed of the latest service procedures and modifications. If, in the opinion of any reader, certain information or procedures have been omitted, an endeavor will be made to include such information in future revisions by directing your comments and suggestions to the above office.

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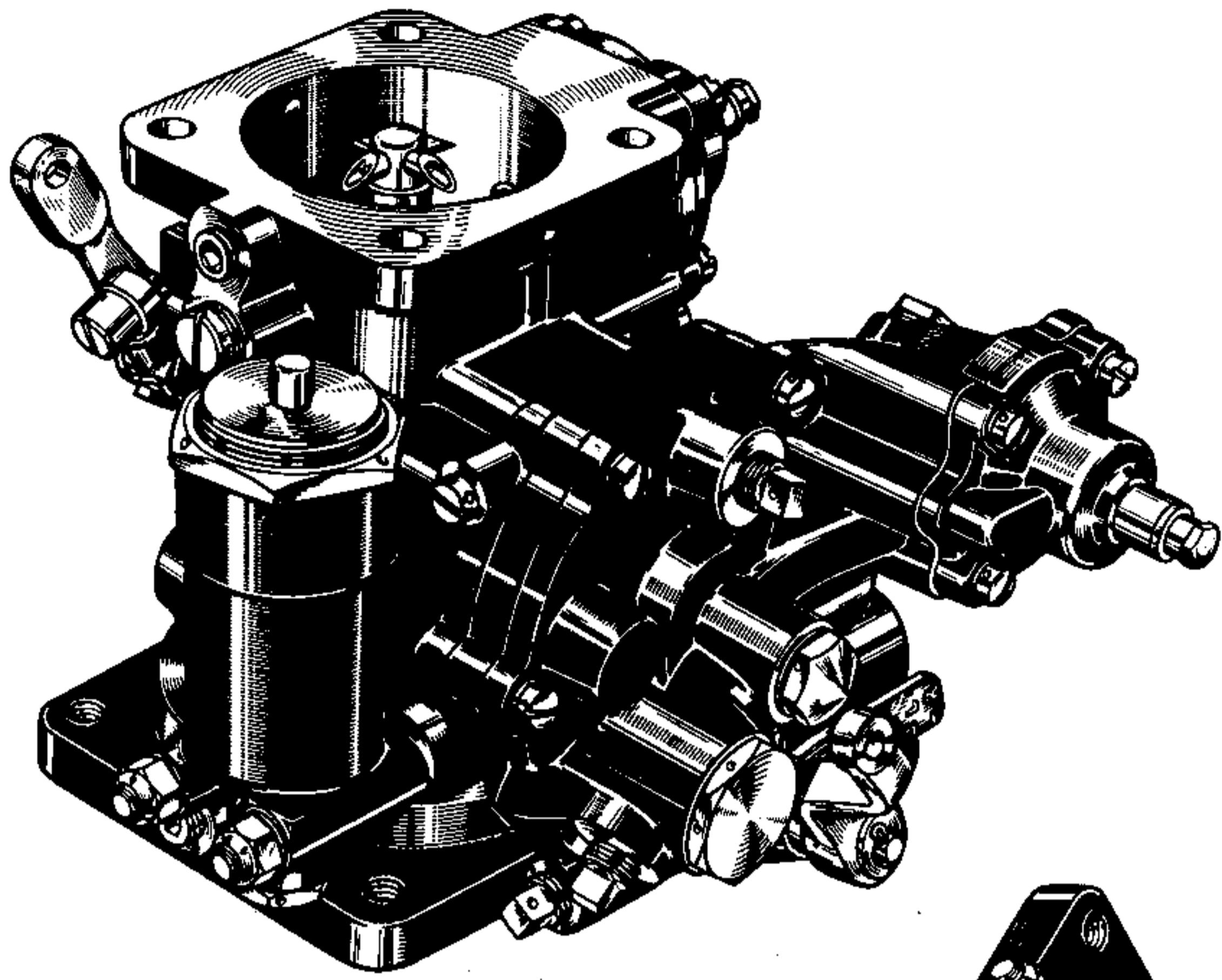
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INTRODUCTION

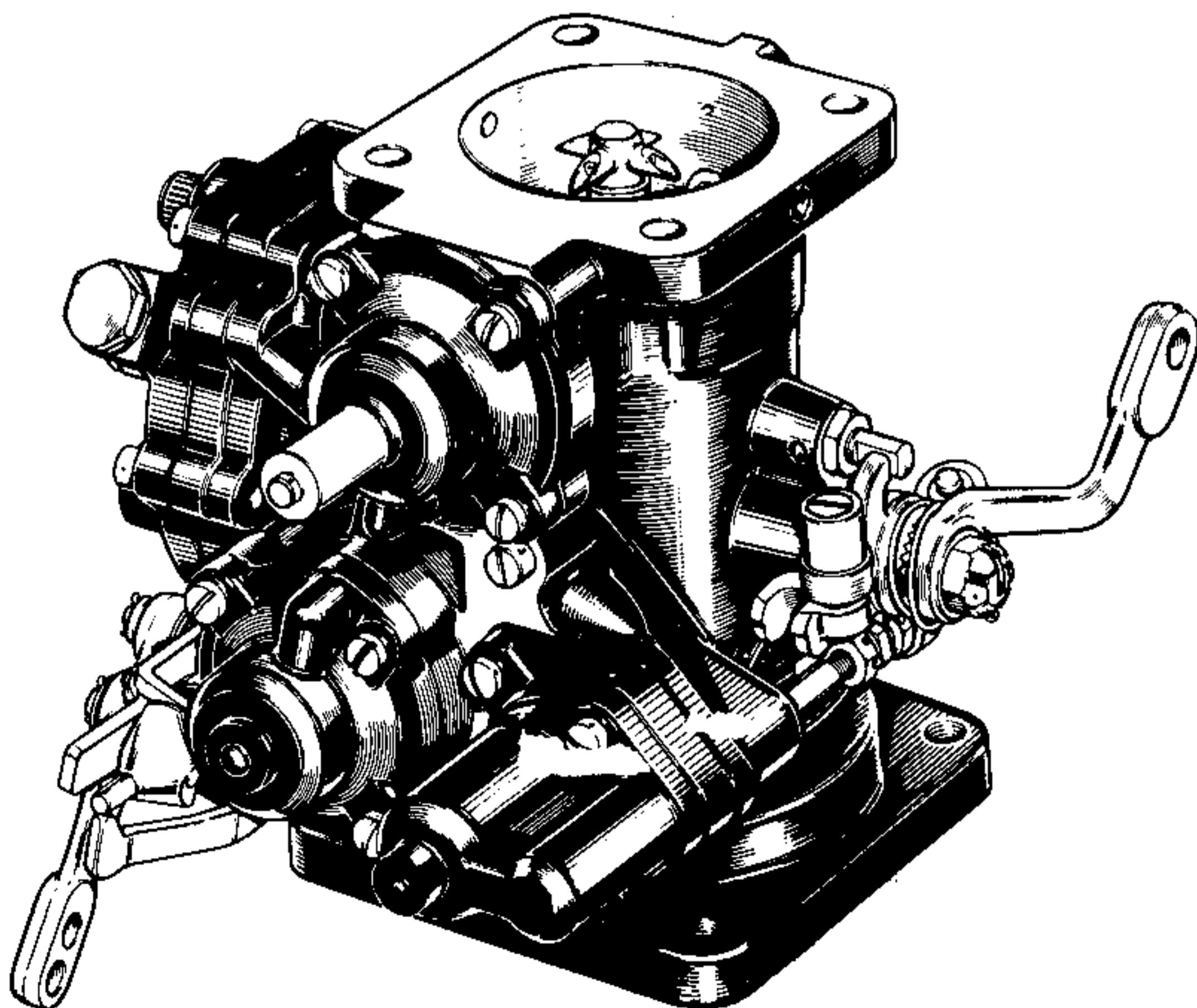
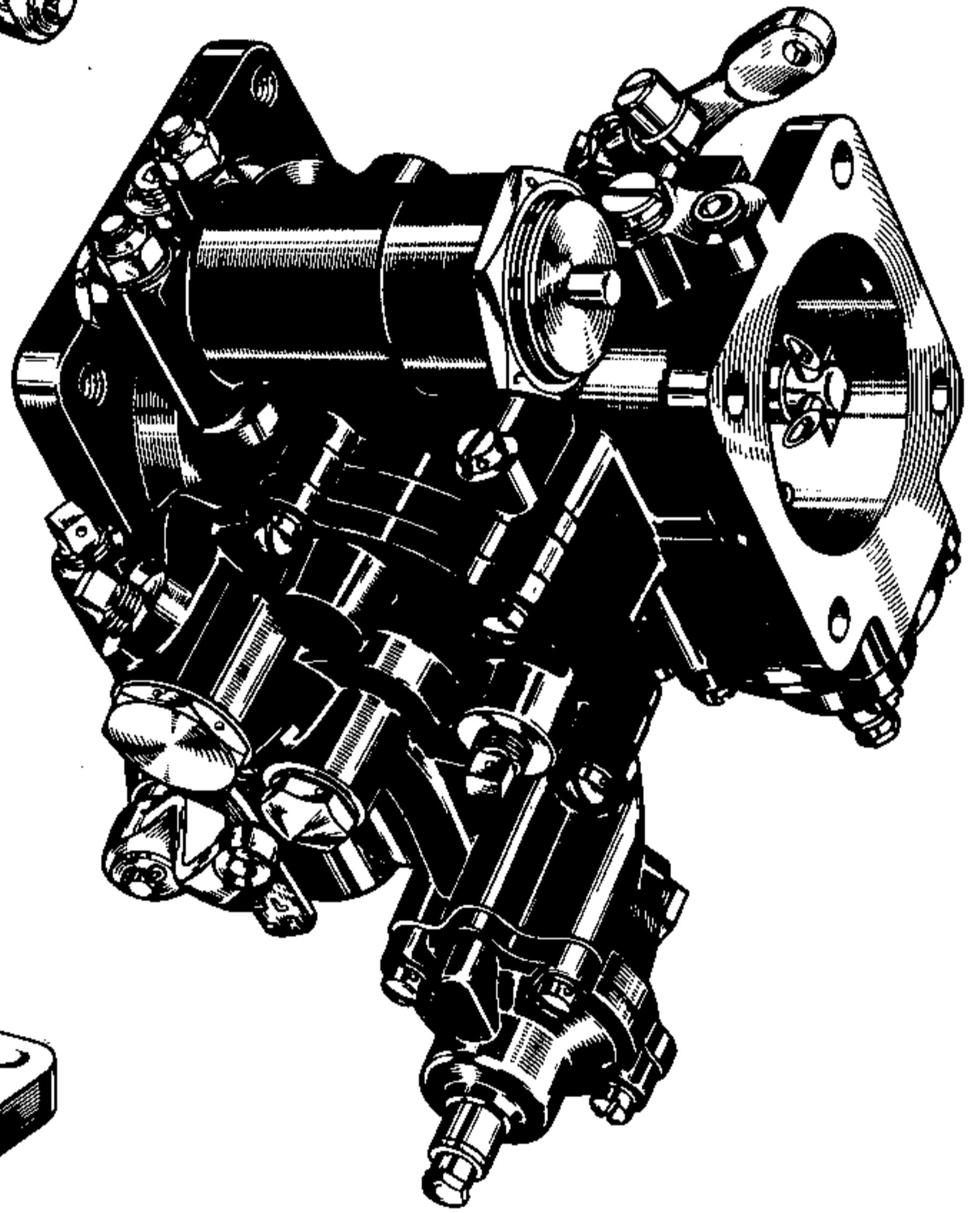
Carburetion as applied to the modern aircraft reciprocating engine presents one of the most complex and difficult problems of engine development and operation. If the engine is not supplied with just the right fuel-air ratio under all conditions of flight, the performance will of course, be affected, and in some cases severe damage to the engine may result. The modern aircraft carburetor must maintain the proper fuel-air ratio for the engine at all conditions of air pressure and temperature, throttle opening, engine speed, flight attitude, acceleration and maneuvers. It must supply a mixture in the idle range that is rich enough to give smooth idling, yet lean enough to prevent the engine from loading up. In the cruise range the mixture is usually held as lean as possible to afford good fuel economy. In the high power range a rich mixture is necessary to both inhibit detonation and to decrease the amount of air cooling necessary.

As a result, the aircraft carburetor has become a highly developed and complicated mechanism which is very accurate. It should be considered a precision instrument and treated as such, for it is manufactured with extreme care. To obtain the maximum in performance and service, the carburetor must be installed and adjusted in accordance with the manufacturer's recommendations.



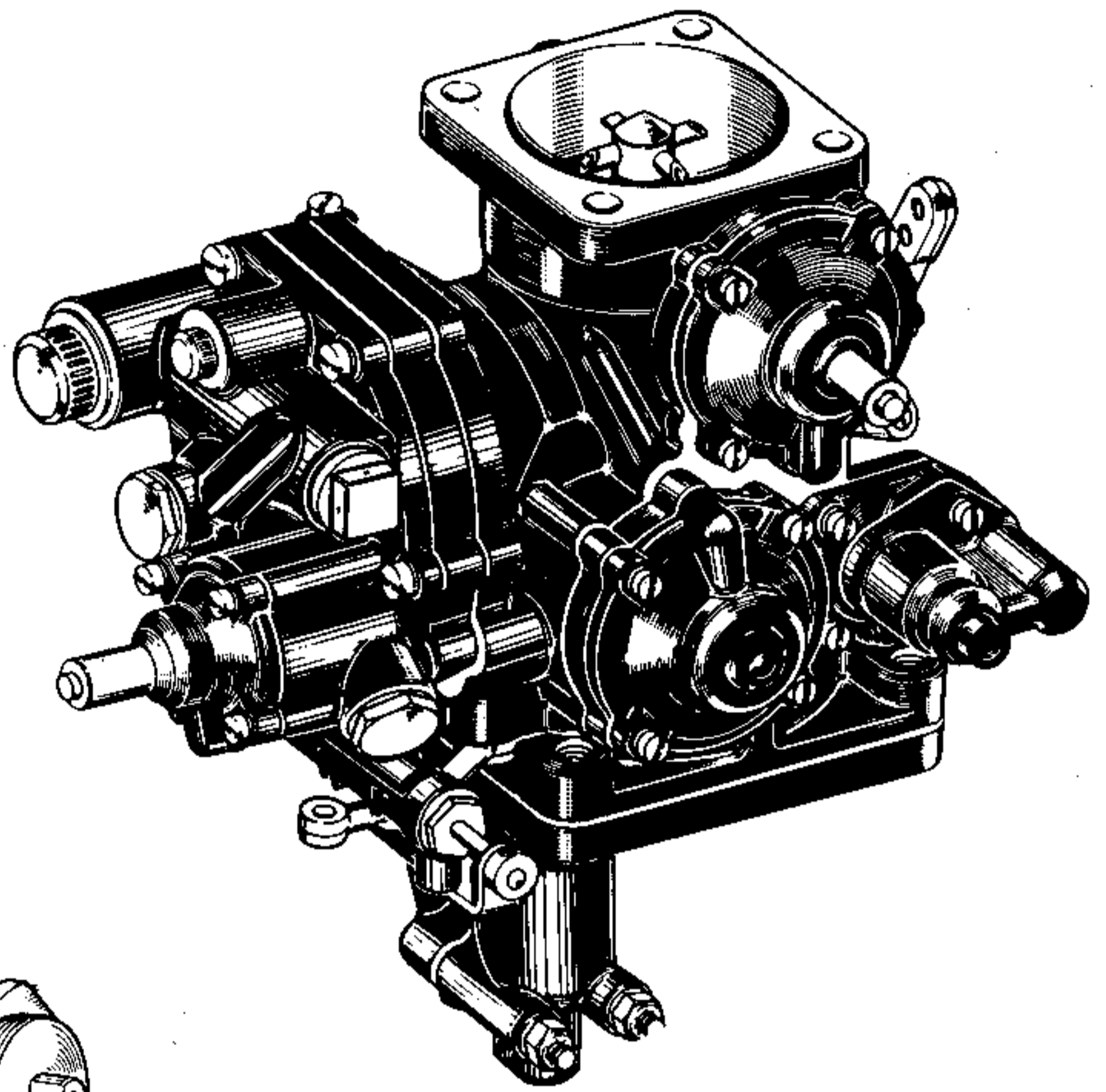
PS - 5BD

PSH - 5BD

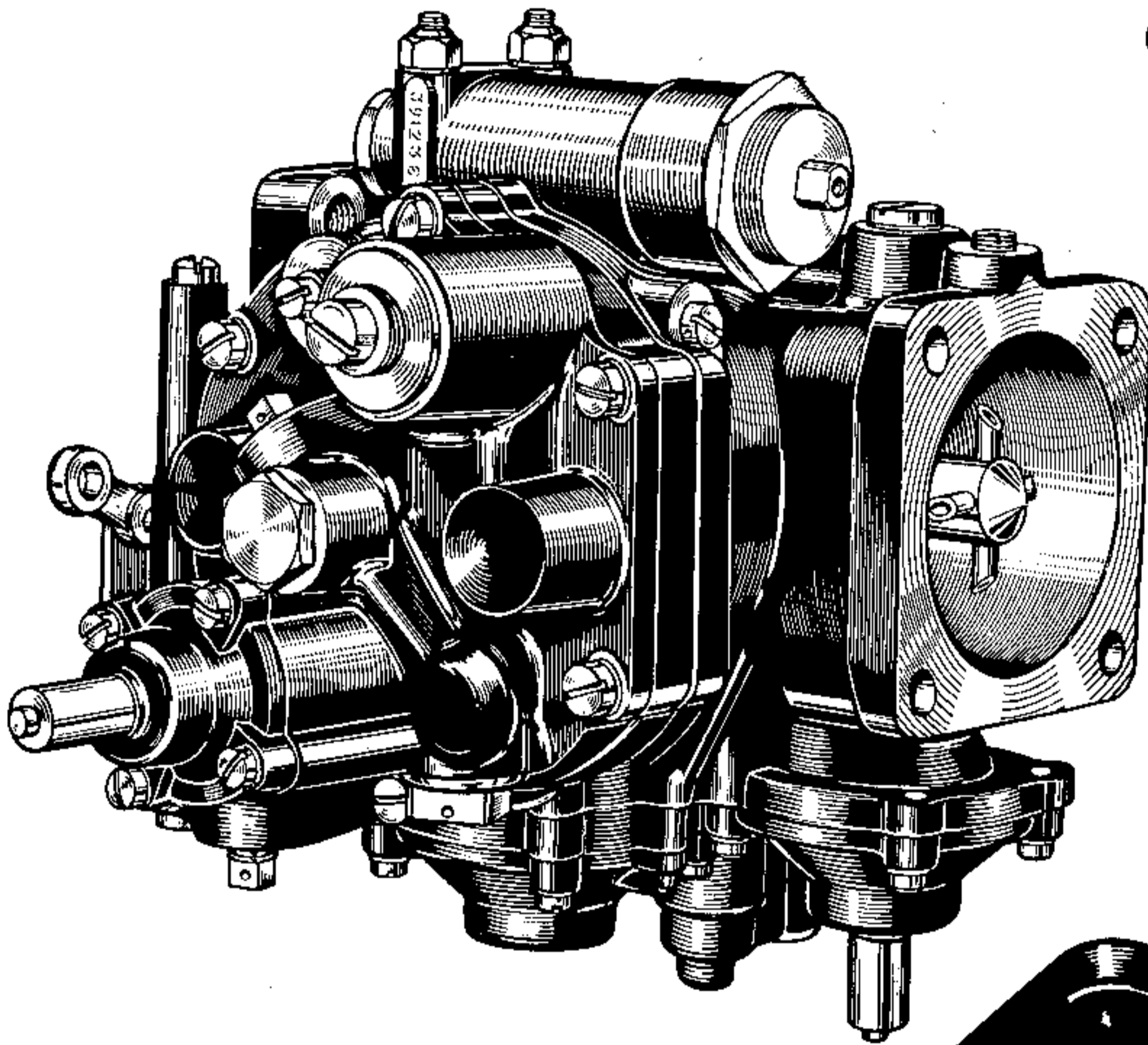


PS - 5C

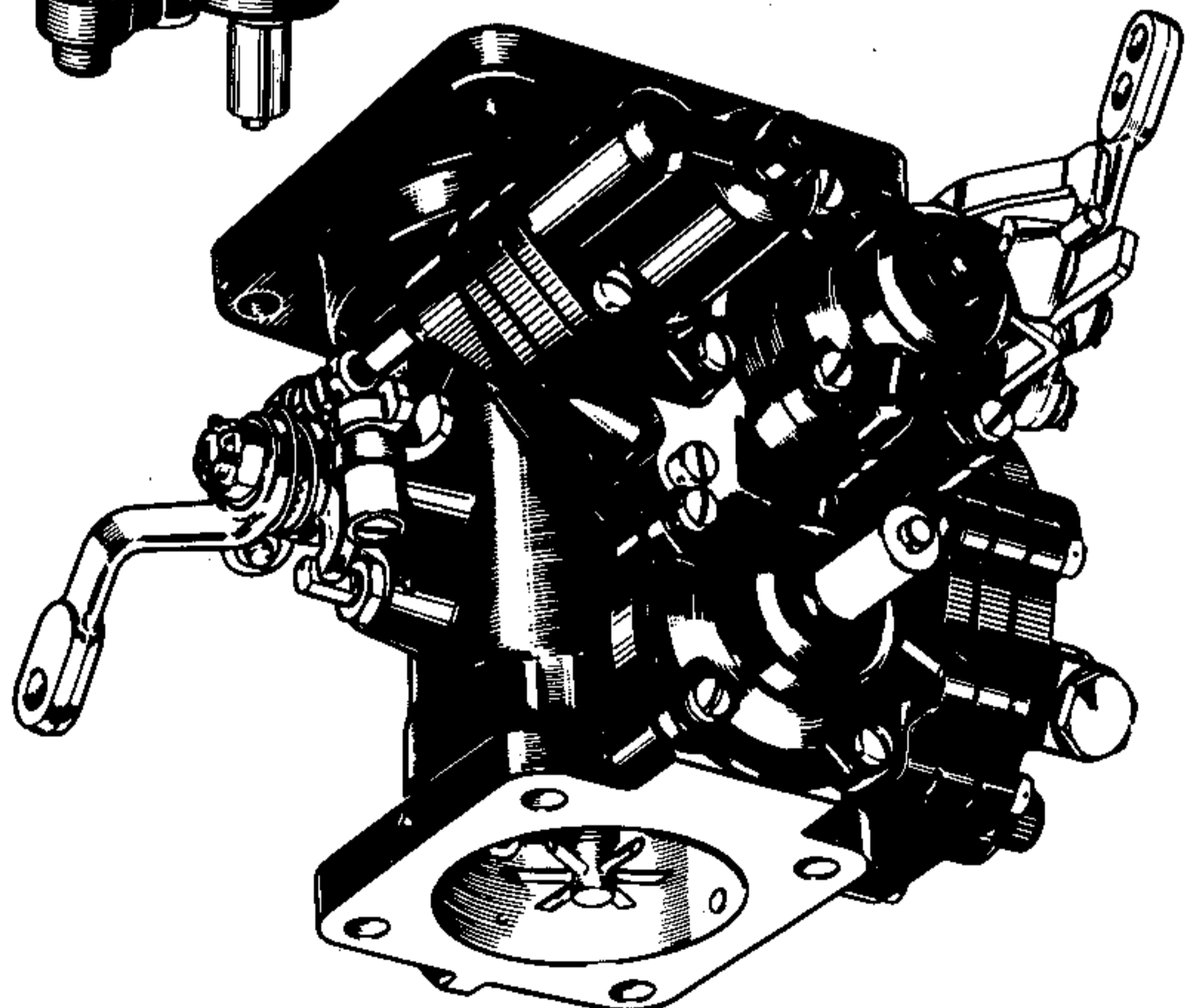
PS - 7BD



PSH - 7BD



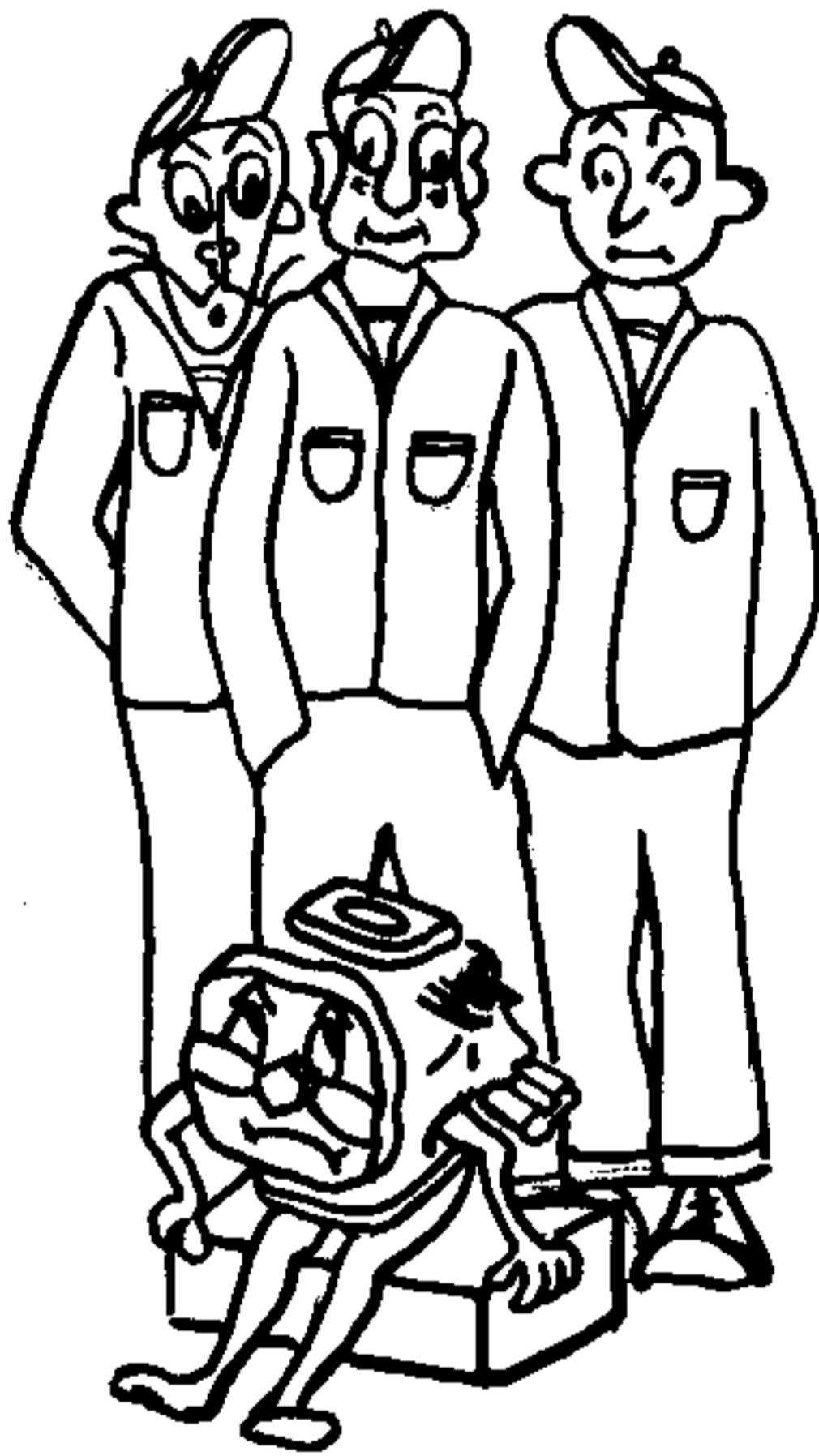
PSD - 5C



SECTION I

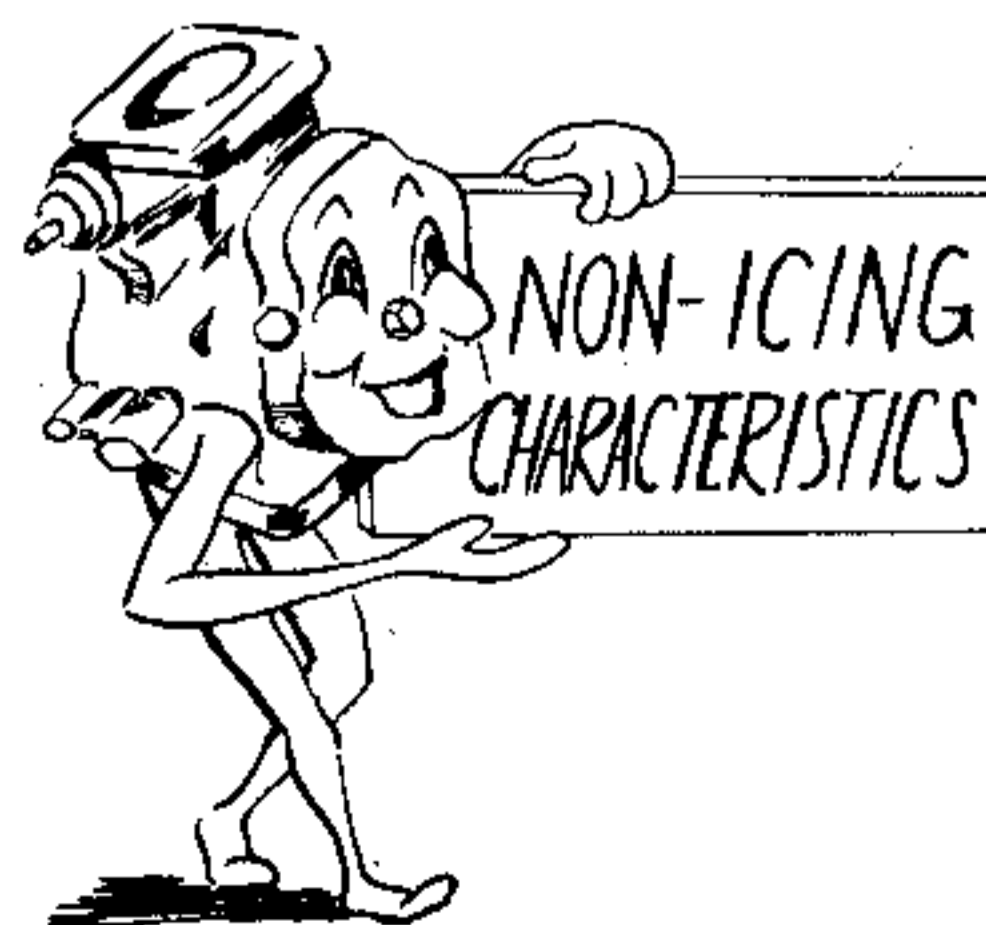
DESCRIPTION

GENERAL

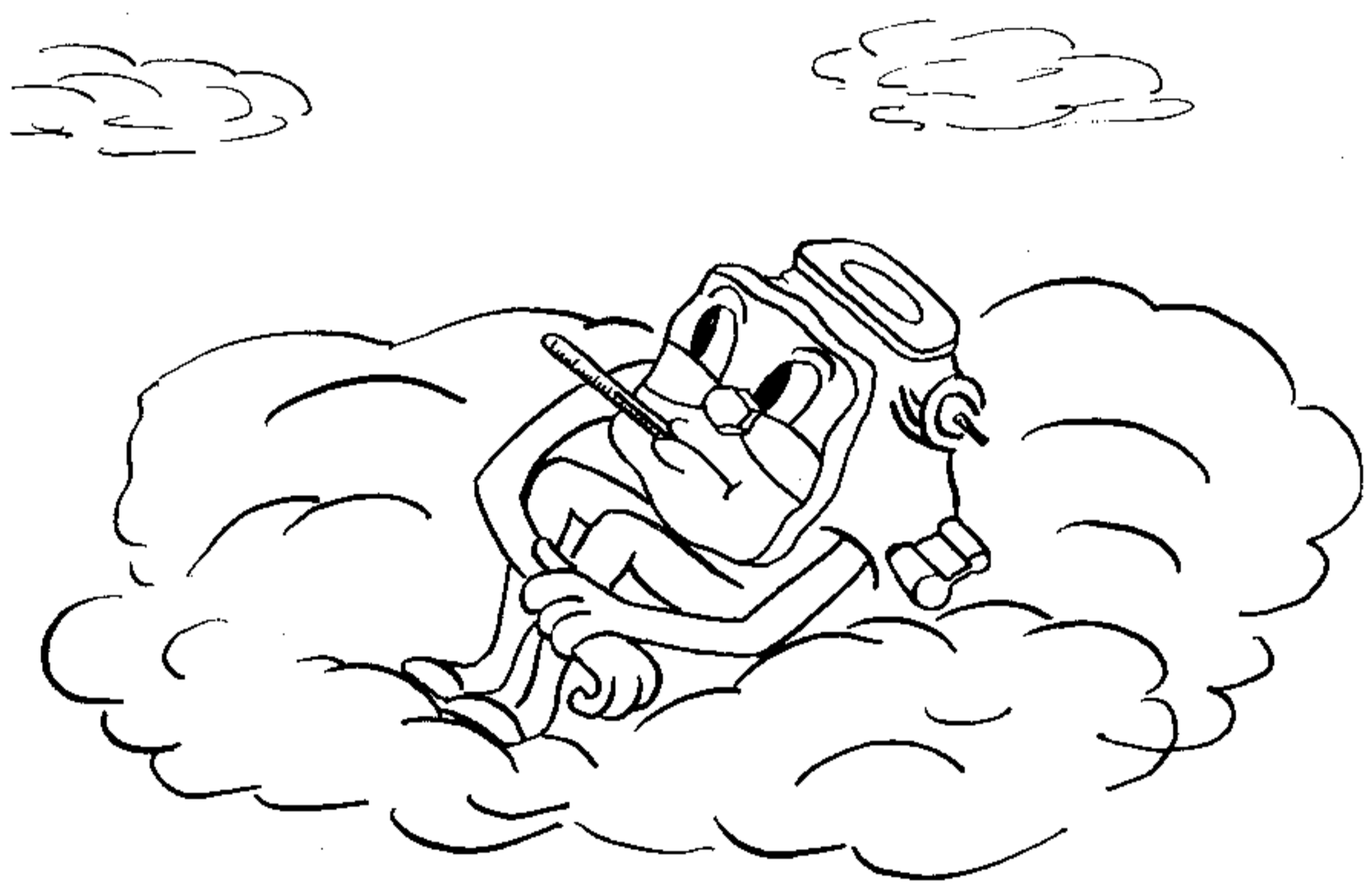
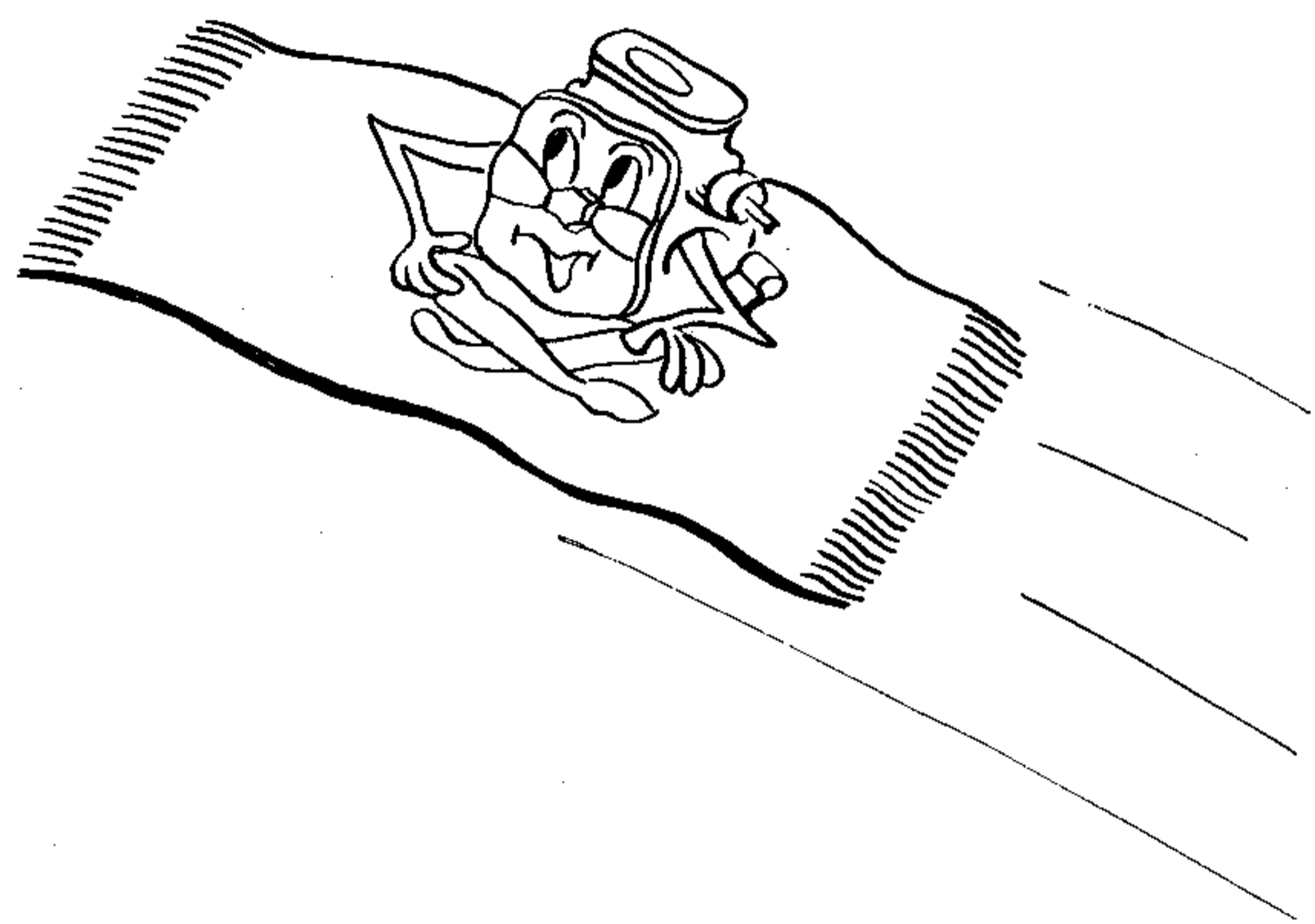


1-1. The Stromberg PS series injection carburetors are distinctly different from float type carburetors of the same size and power range, as they do not incorporate a vented float chamber or suction pickup from a discharge nozzle in the venturi tube. Instead they offer a pressure fed fuel system that is closed from the engine fuel pump to the discharge nozzle. The venturi serves only to create pressure differentials for controlling the quantity of fuel to the metering jet in proportion to air flow to the engine. This type of fuel system offers such advantages as:

a. The discharge nozzle is located downstream from the throttle valve, ice formation within the throttle body is eliminated.

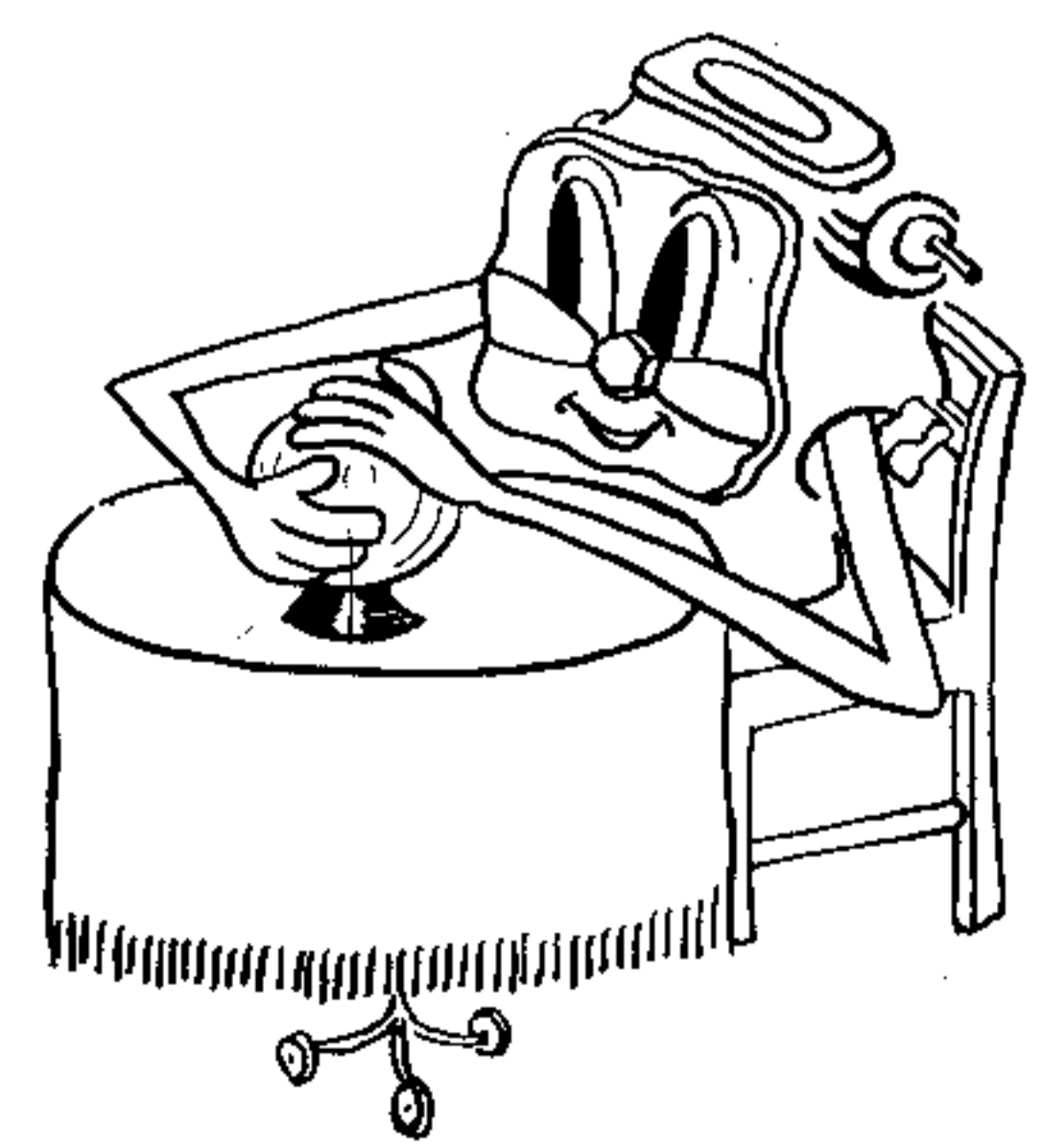


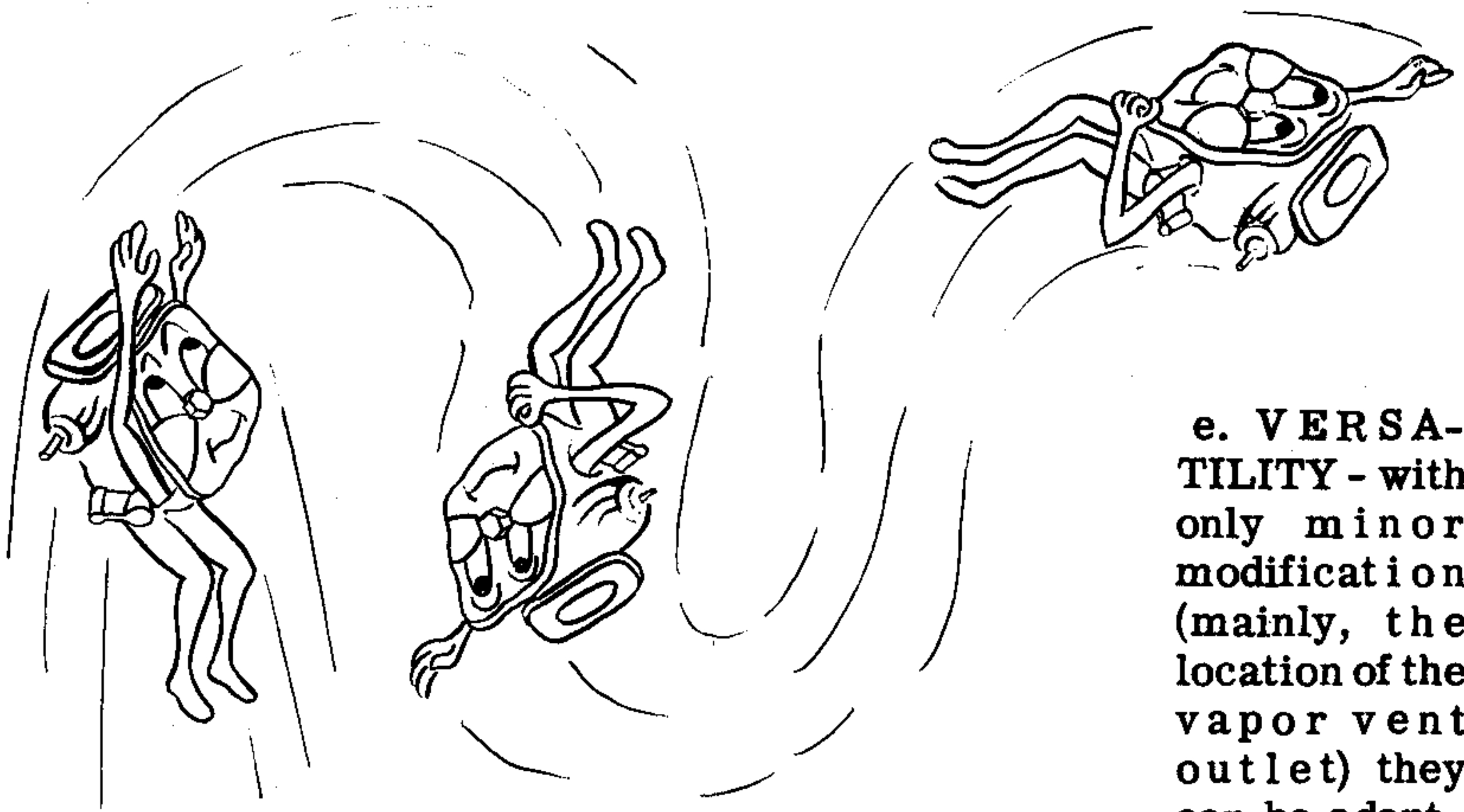
b. Freedom from gravity effects; maintains proper fuel/air ratios regardless of aircraft attitude.



c. Automatic compensation for temperature and altitude.

d. Accurate predictability of fuel consumption.





e. **VERSATILITY** - with only minor modification (mainly, the location of the vapor vent outlet) they can be adapt-

ed for either updraft, downdraft or horizontal operation.

1-2. The standard PS carburetor features a regulated pressure discharge nozzle, vacuum operated acceleration pump, manual mixture and idle cut-off device, and either an airflow or manually operated power enrichment valve. Models are also available incorporating an Automatic Mixture Control Unit and an Electric Primer Assembly.

MODEL DESIGNATION

1-3. The model designation such as PS-5C, PS-5BD, etc., indicate the various features of that particular model carburetor. One should learn to recognize the various models by their proper prefix designations as follows:

a. **Prefix:**

- "P" - Pressure operated
- "S" - Single Barrel
- "D" - Downdraft
- "H" - Horizontal



b. The number following the dash, such as -5, -7, or -9 indicate the bore size of the carburetor and is used for engineering information only, as when matching a carburetor to a particular engine.

c. Sub-Model designation:

“B” - Airflow operated power enrichment valve

“C” - Manually controlled power enrichment valve

“D” - Automatic Mixture Control Unit

“E” - Electric Primer Assembly

“F” - Fuel Head Enrichment Valve

d. Examples:

PS-5C, Pressure operated, single barrel, updraft carburetor, incorporating a manually operated power enrichment valve.

PS-5BD, Pressure operated, single barrel, updraft carburetor, incorporating an airflow operated enrichment valve and an Automatic Mixture Control Unit.

PSH-5CD, Pressure operated, single barrel, horizontal carburetor, incorporating a manually operated power enrichment valve and an Automatic Mixture Control Unit.

PSD-5C, Pressure operated, single barrel, downdraft carburetor, incorporating a manually operated power enrichment valve.

PSH-7DF, Pressure operated, single barrel horizontal carburetor, incorporating an Automatic Mixture Control Unit, a fuel pressure operated enrichment valve and a two position mixture control.

1-4. Each new carburetor is identified with a specification plate (figure 1), attached to the throttle body. It identifies the carburetor manufacturer, unit serial number, model designation and parts list and issue number to which the carburetor was manufactured. Always refer to the specification plate for the proper model and

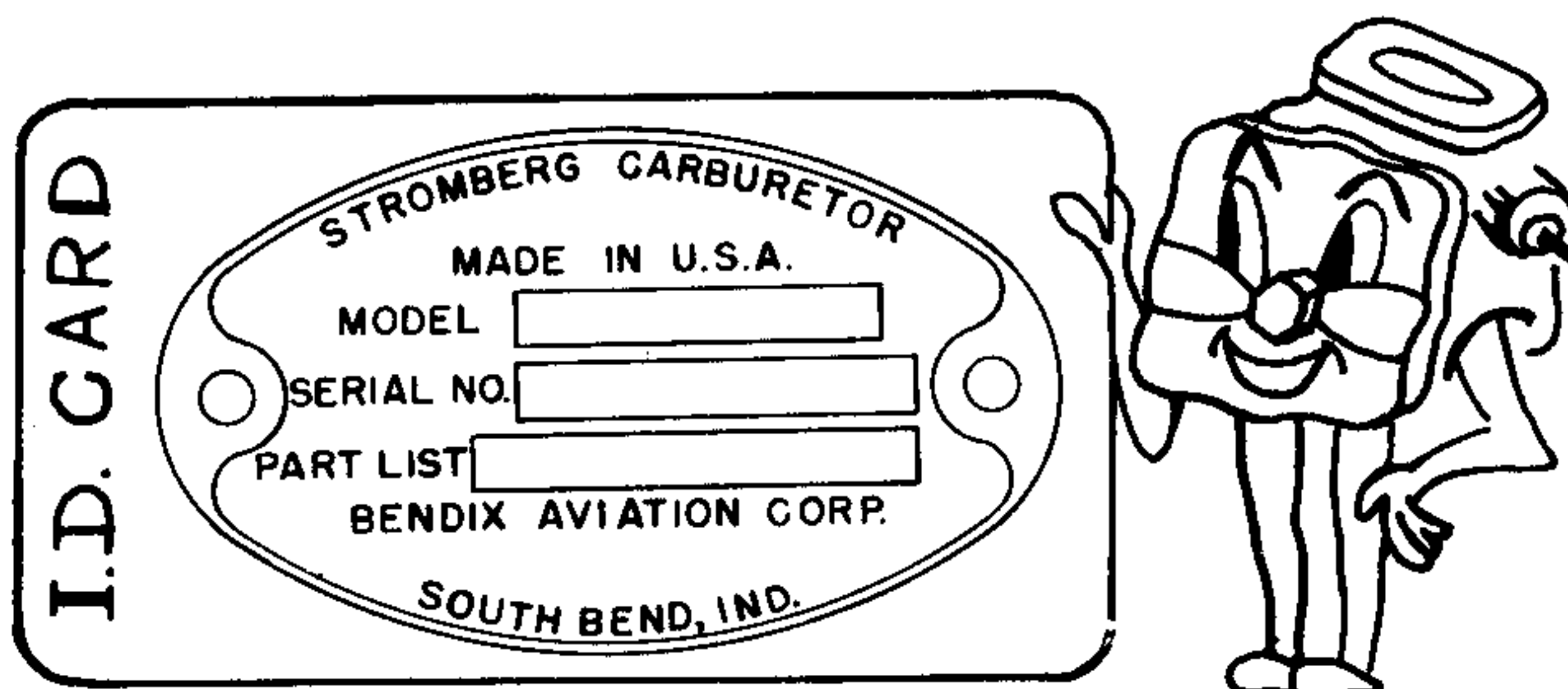


Figure 1. Specification Plate

parts list number to which the carburetor was built, before attempting any field adjustments. This information must then be matched with the correct manual enrichment adjusting gage, and adjustment instructions for that particular carburetor as outlined in the text.

SECTION II

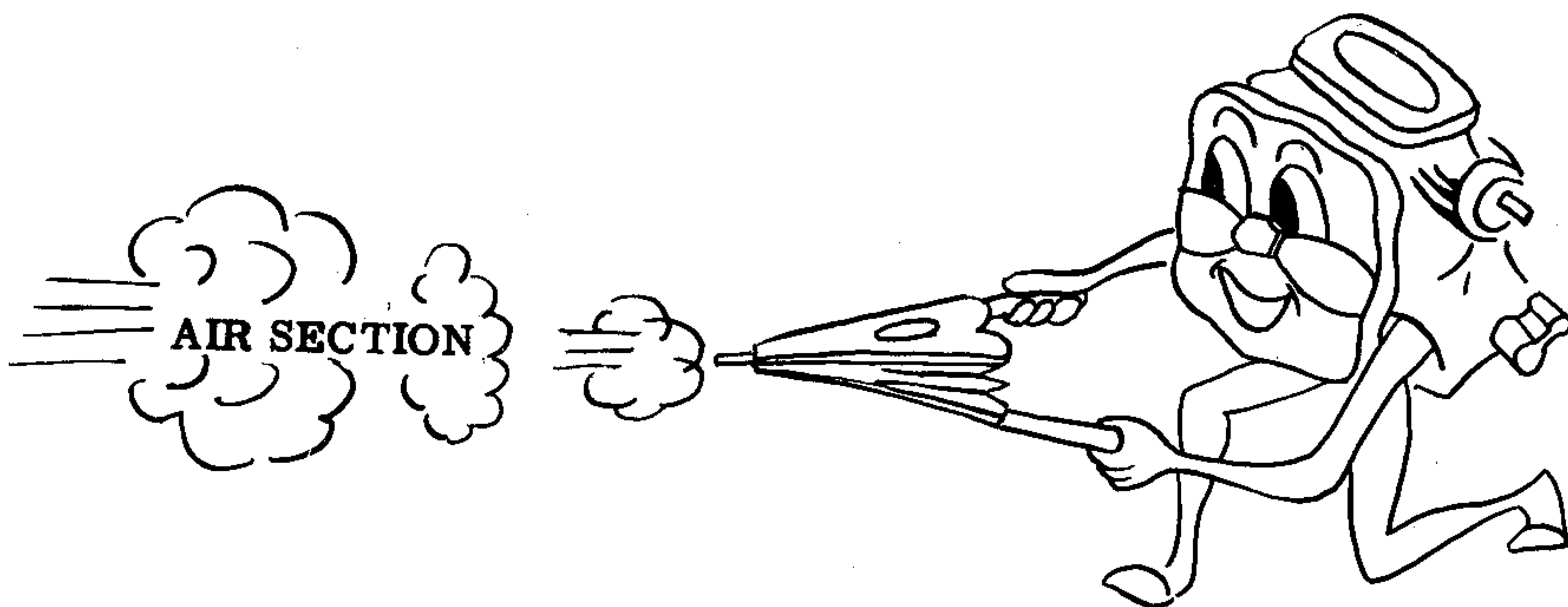
PRINCIPLES OF OPERATION

GENERAL

2-1. This section is arranged to acquaint the reader with the basic principles of operation of the "PS" series carburetors. For clarity and ease of presentation, the air and fuel circuits are traced separately. For aid in tracing the various circuits, refer frequently to the schematic diagram of the PSH-7BD, located the center of the book. This is used as an example as it best represents the latest "PS" type carburetor.



2-2. Following the review of the complete carburetor is a description of the Air Flow Power Enrichment Valve and the Automatic Mixture Control.



2-3. Air enters the carburetor through the air intake, passes through the venturi tube, past the throttle valve, and into the intake manifolds. The flow of air is controlled by a conventional butterfly type throttle valve. Air flowing through the venturi creates a suction at the throat of the venturi tube. This suction is transmitted through internal channels to chamber "B" of the regulator, and to the low pressure side of the discharge nozzle diaphragm. This suction is termed "venturi suction".

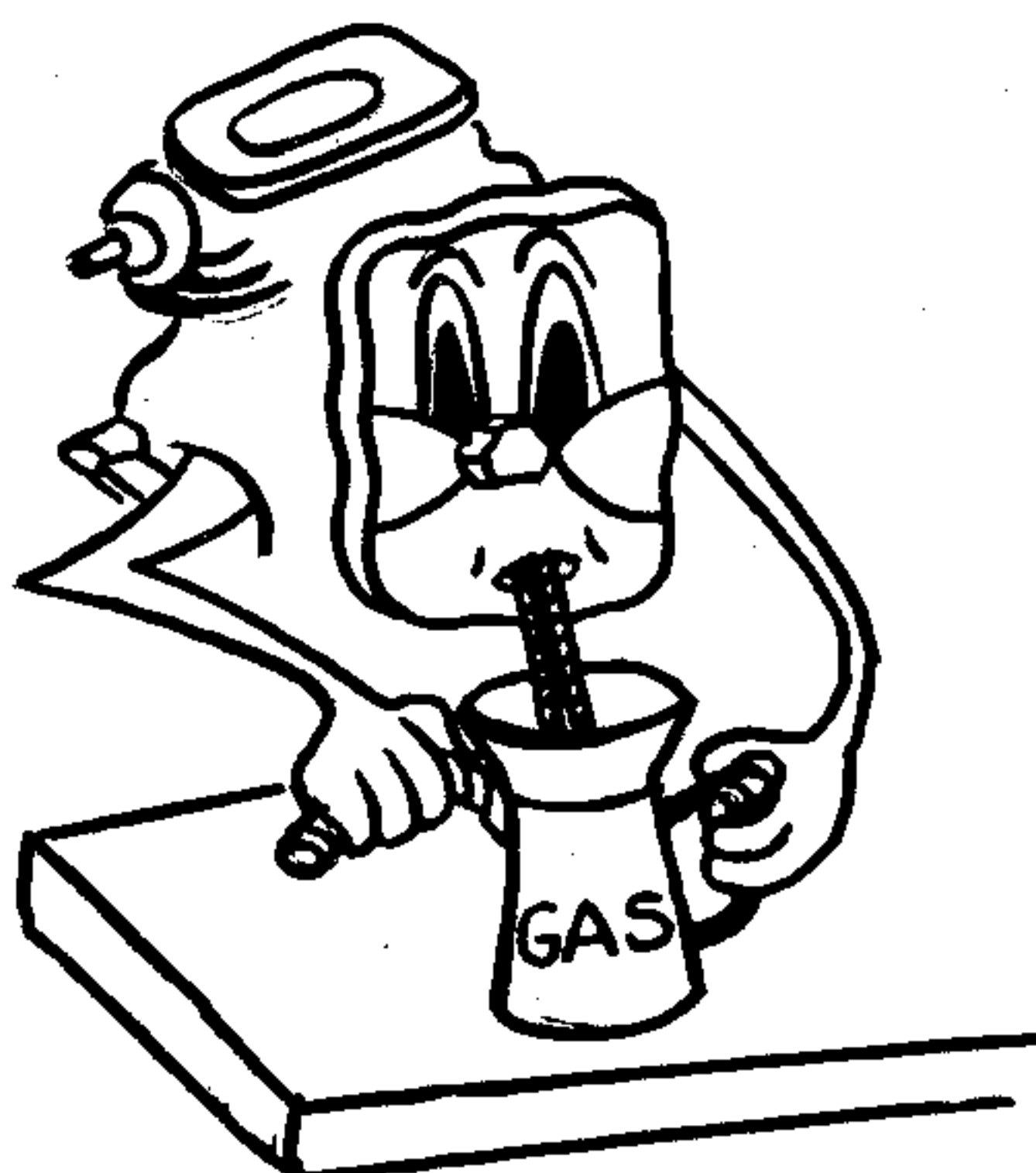
a. Intake air also enters the annular space between the outside diameter of the venturi tube and the flange of the carburetor main body and flows through internal channels to chamber "A" of the regulator and to the discharge nozzle air bleeder. This pressure is termed "impact pressure".

b. As the "impact pressure" in chamber "A" is greater than the "venturi suction" in chamber "B", a pressure differential is created acting upon the air diaphragm separating the two chambers. This differential force acting on the air diaphragm is termed "metering suction", which increases and decreases with the air flow through the carburetor.

c. Movement of the air diaphragm in response to "metering suction", is applied to the regulator needle (poppet) valve through a stem arrangement. The degree of opening of this valve determines the pressure of unmetered fuel that is applied to the metering jet.

FUEL SECTION

2-4. Fuel at engine pump pressure, flows through the fuel strainer in chamber "E" and past the poppet valve into chamber "D" of the regulator. The pressure of the fuel in chamber "D" is lower than that in chamber "E" due to the pressure drop across the poppet valve. Fuel at this pressure is termed "unmetered fuel". The pressure of the fuel in chamber "D" is regulated by the opening of the poppet valve..



a. In the idle range, at low air flows, there is little or no "venturi suction" available, so the regulator spring force in chamber "A" acting on the poppet valve will be opposed by the unmetered fuel pressure in chamber "D". These two opposing forces are so balanced as to hold the poppet valve open sufficiently to allow an ample amount of fuel to pass for idling purposes.

b. After passing through the main metering jet, fuel is next exposed to the idle needle valve and its respective diaphragm. This fuel pressure acting on the diaphragm will force the idle needle valve away from its seat. This movement, however, is restricted and controlled by a fork on the throttle lever. At this point in the operating range the actual metering of fuel is accomplished by the idle needle valve, as the orifice created by this valve and its seat is smaller than the orifice in the main metering jet.

c. On carburetors equipped with the manually controlled power enrichment valve the idle needle is of the "step design" having two major diameters, the larger controls fuel flows to approximately 25% power, the smaller diameter controls fuel flows from the 25% power range to about 65% power, (cruise range). See figures 2 and 3 for details of typical idle needles used in the "PS" type carburetors.

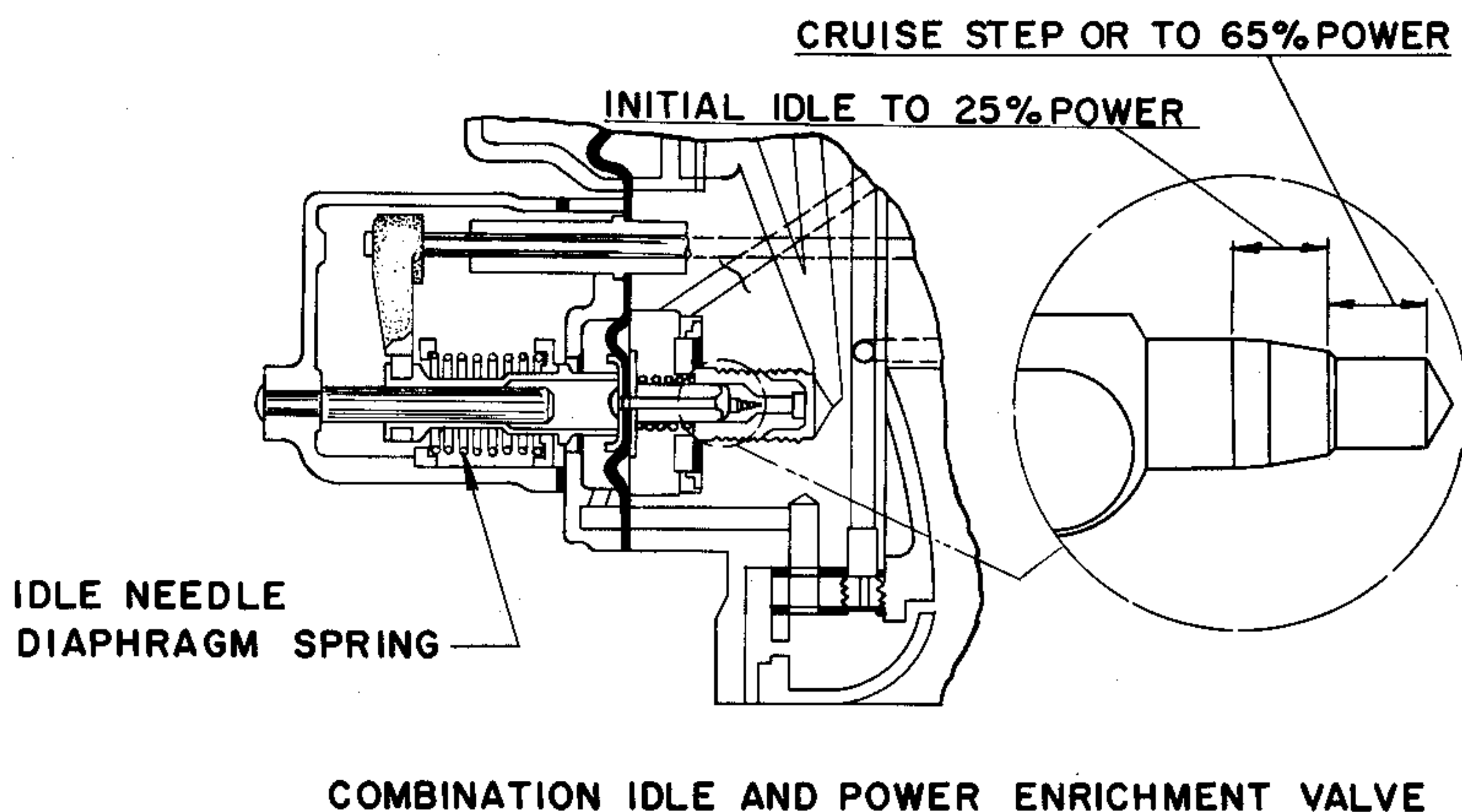
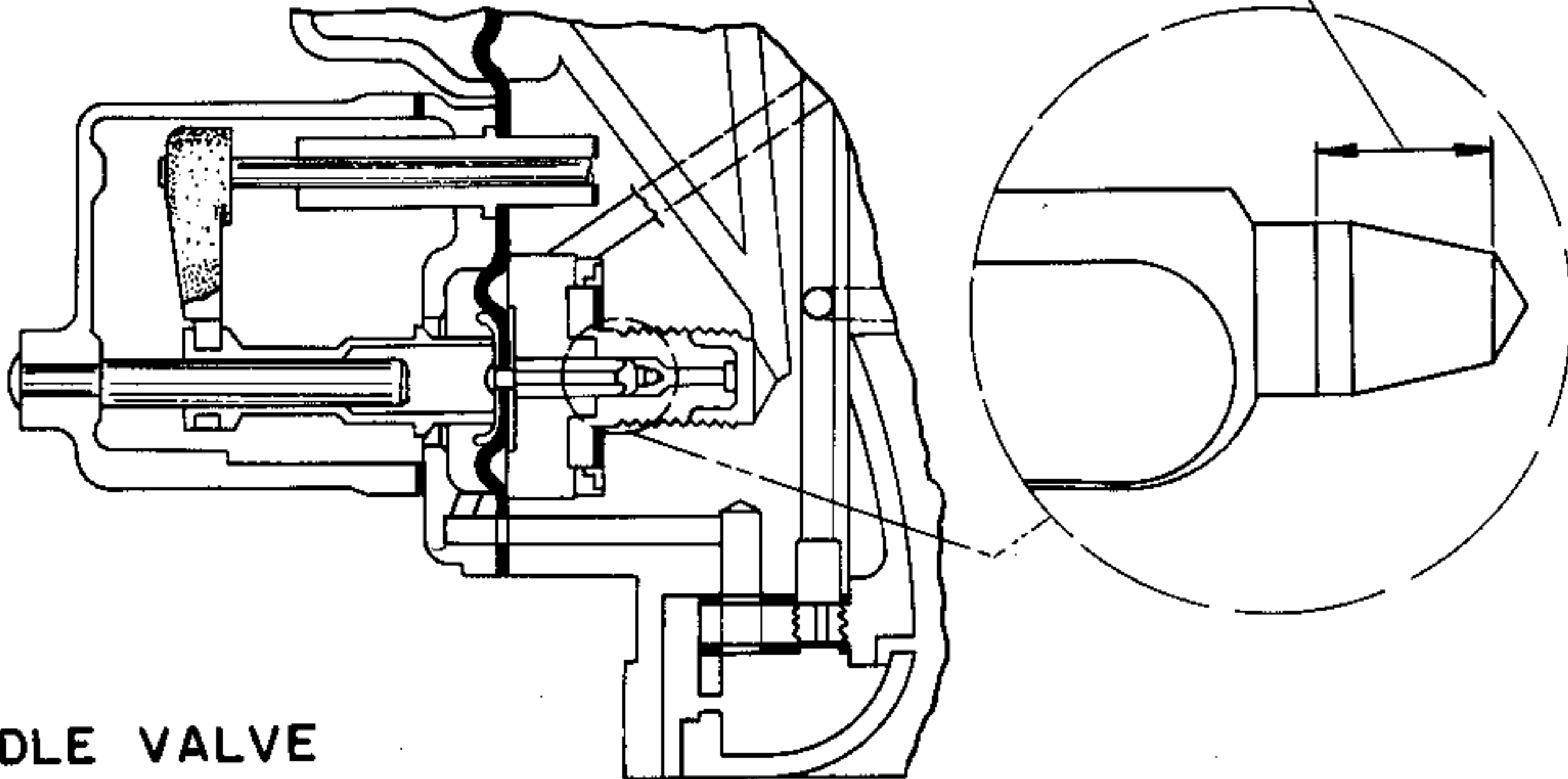


Figure 2. Typical "C" Idle Needle and Power Enrichment Needle

INITIAL IDLE TO
25% POWER



IDLE NEEDLE VALVE
USED ON CARBURETORS EQUIPPED WITH AN AIRFLOW POWER
ENRICHMENT VALVE

Figure 3. Typical "BD" Idle Needle

d. As the throttle lever is opened, the fork on the throttle lever will move out of contact with the idle push rod and allow the spring pressure acting on the diaphragm to hold the idle needle valve on the cruise step during the cruise range. As the throttle lever approaches a predetermined position (approximately 1/2 throttle), the enrichment needle actuating screw (on the loose lever) contacts the idle push rod so any further movement of the throttle lever will cause the idle push rod to move in a direction that will release the diaphragm spring pressure. This will allow the metered fuel pressure acting on the idle needle valve diaphragm to move the cruise step portion of the needle out of the idle seat, thereby mechanically furnishing the necessary enrichment for maximum cruise powers, climb and full throttle operation.

e. After passing through the idle needle and power enrichment valve seat, metered fuel pressure flows to the fuel side of the discharge nozzle diaphragm, see figure 4. This diaphragm controls the discharge nozzle needle valve position. The opposite side of the diaphragm is exposed to venturi suction, and an adjustable spring. When metered fuel pressure on the fuel side of the diaphragm overcomes this spring pressure the needle valve will open and allow fuel to discharge through the nozzle seat and out the discharge nozzle under positive pressure.

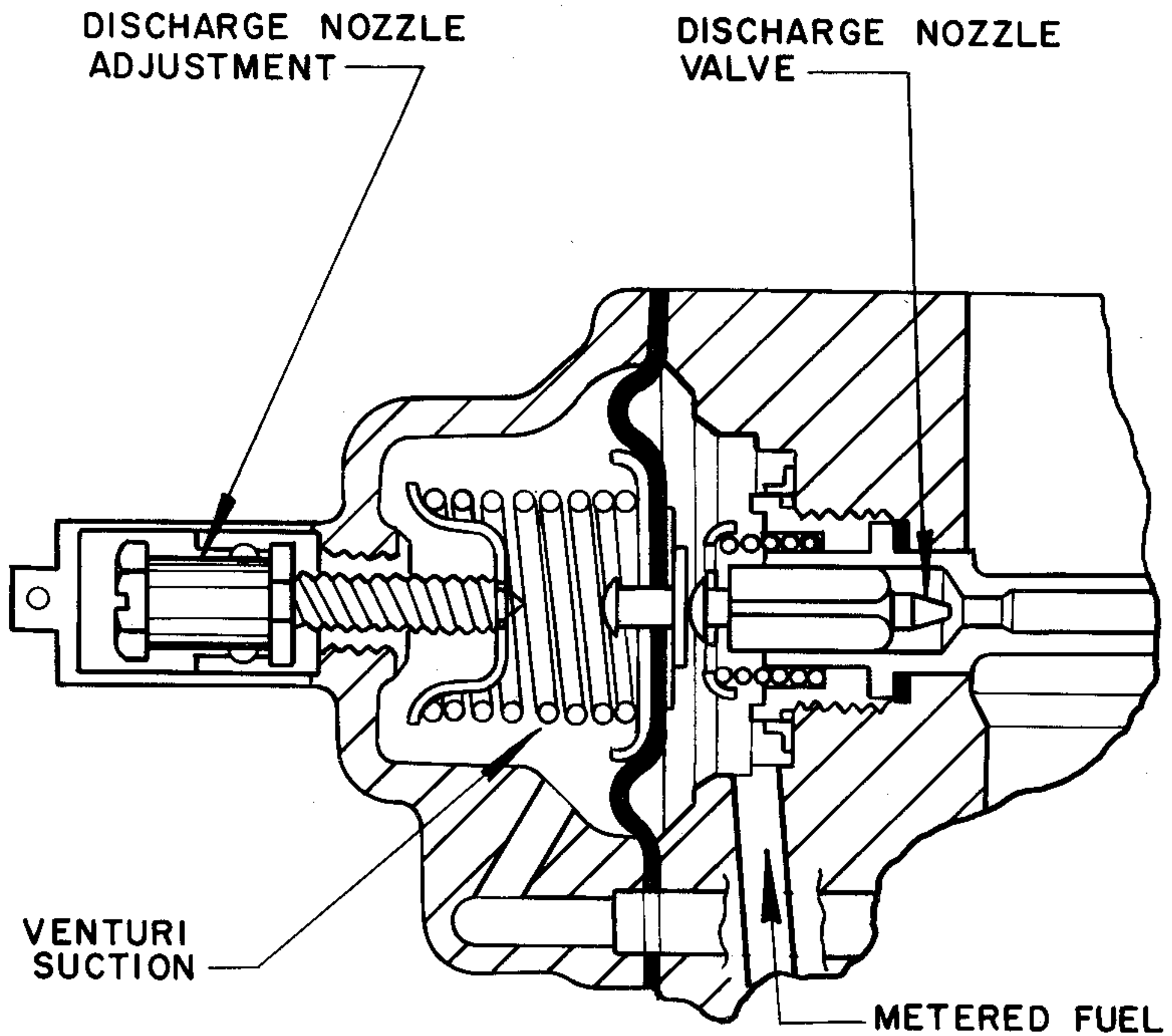
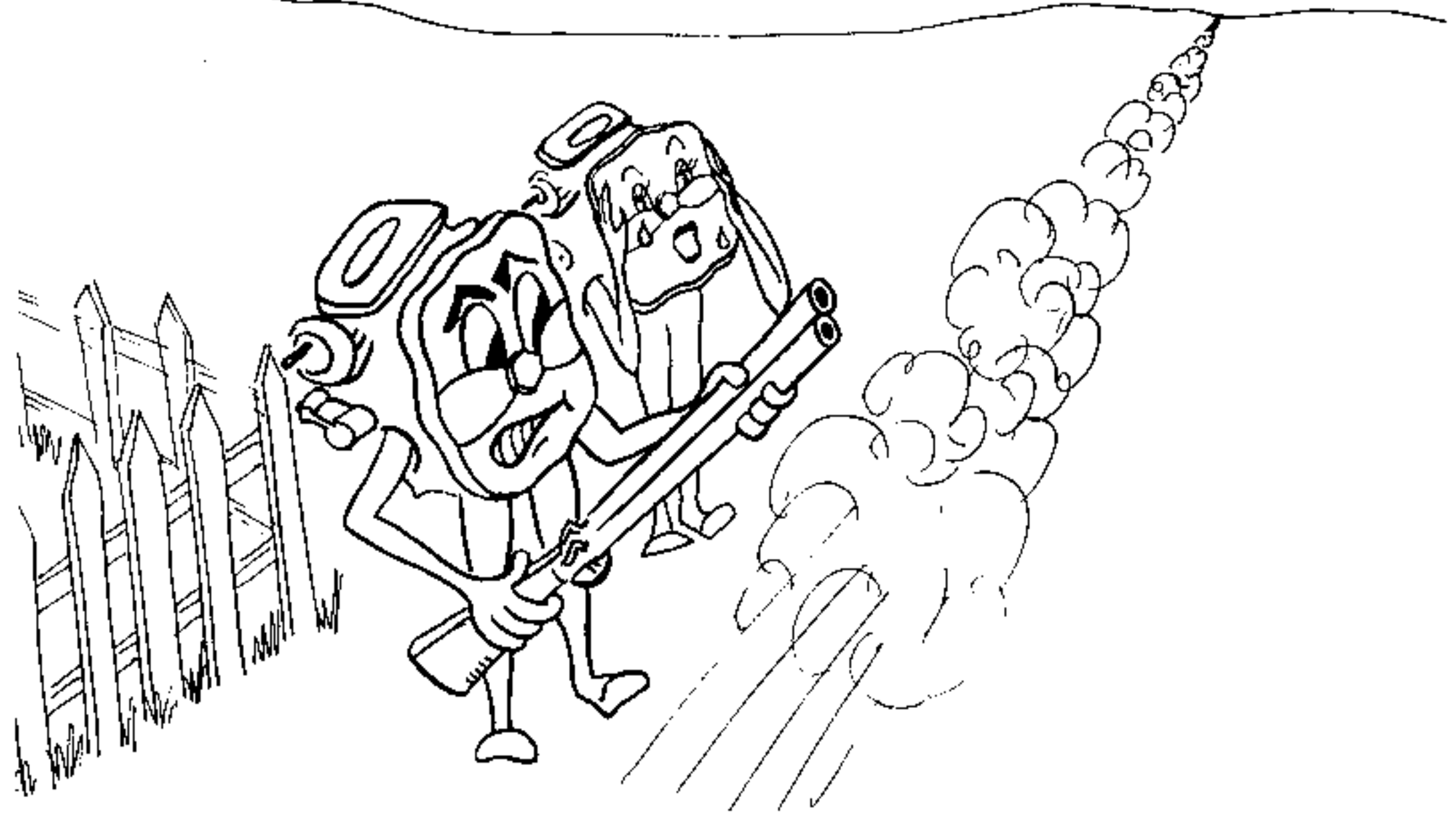


Figure 4. Details of the Discharge Nozzle Assembly

ACCELERATION PUMP

2-5. The "PS" series carburetors are equipped with a single diaphragm, vacuum operated, acceleration pump that compensates for the lag in fuel flows that occur

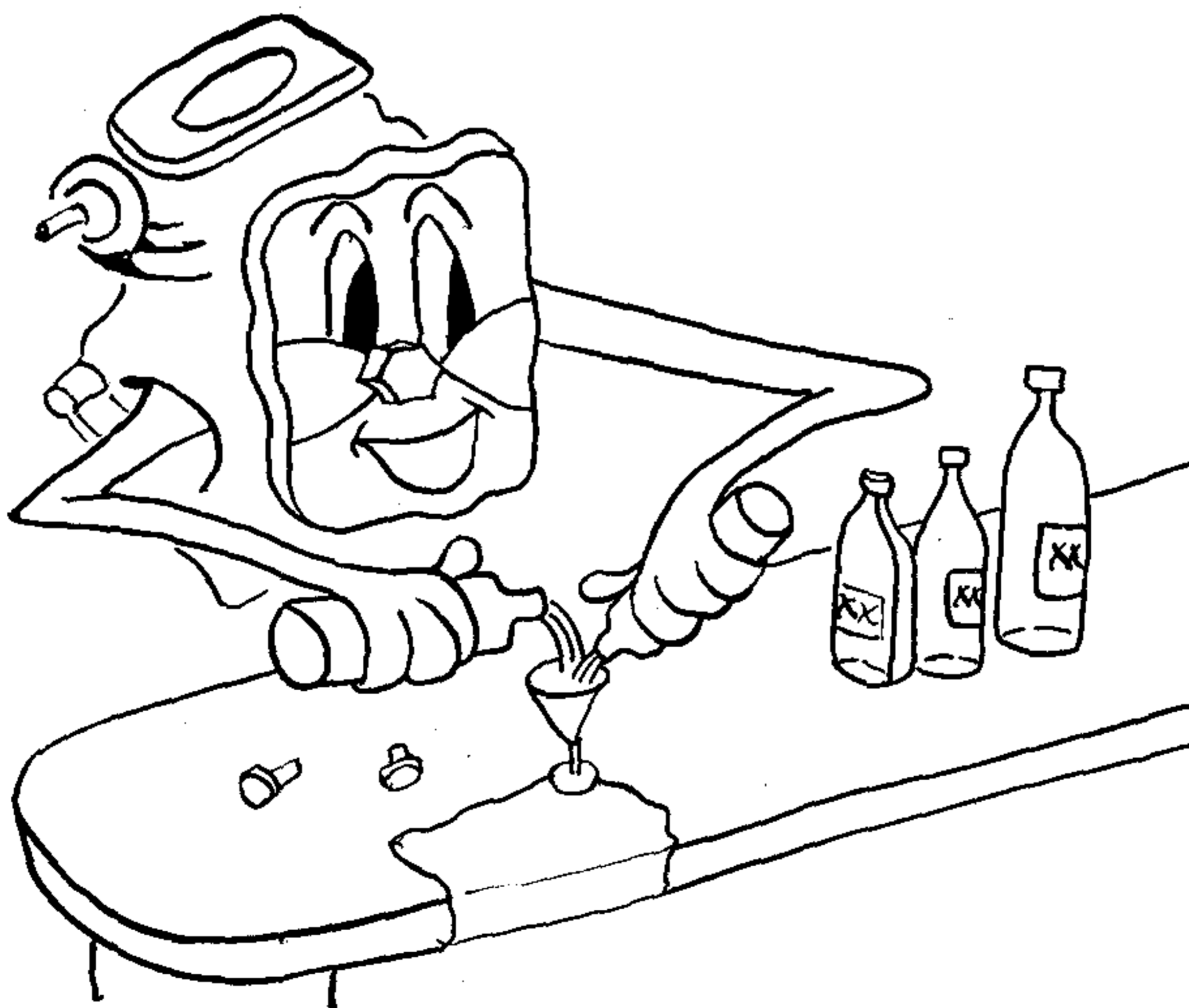


when the throttle is opened rapidly. The pump is composed of a vacuum chamber, diaphragm and fuel well. (On some models a spacer is installed between the fuel well and the metered fuel channel. The spacer will contain an inlet passage or bleed and a discharge relief valve to give a time delay action to the acceleration

pump discharge.) The vacuum side of the diaphragm contains a spring and is exposed to pressure above the throttle (approximately equal to intake manifold suction), while the fuel well on the opposite side of the diaphragm is open to "metered fuel pressure". The pressure differential will cause the diaphragm to move in a direction that will compress the spring and at the same time fill the now enlarged pump well with fuel. When the throttle is opened quickly, pressure above the throttle will increase as will the pressure on the air side of the diaphragm. This increase in pressure plus the spring force will move the diaphragm toward the pump well, displacing the fuel in the pump well. This discharged fuel will increase the pressure on the discharge nozzle diaphragm, causing the nozzle needle valve to open farther and provide a momentary rich mixture.

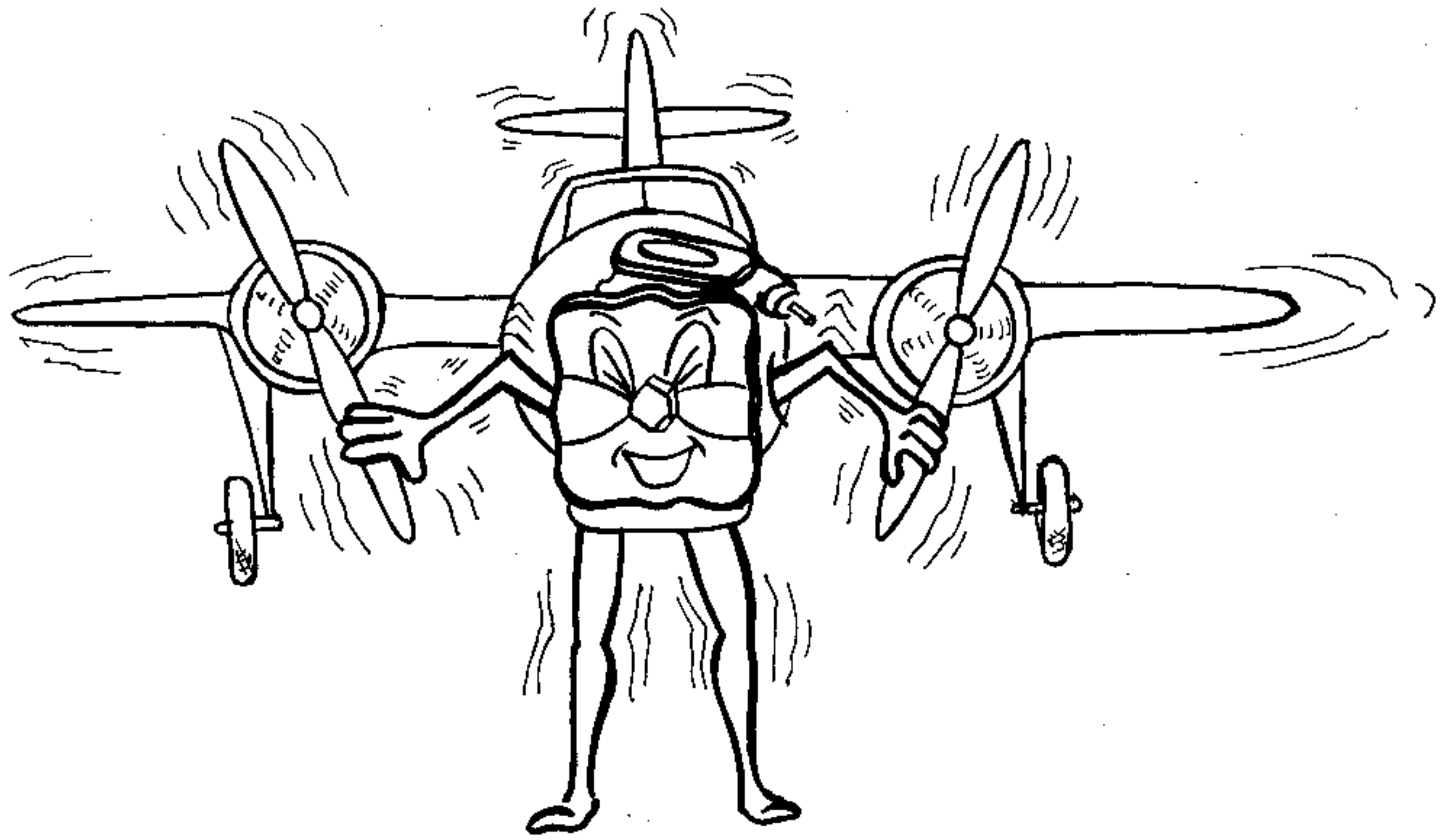
MANUAL MIXTURE CONTROL

2-6. A manual mixture control valve is provided as a means of correcting for natural enrichment at altitude on carburetors without Automatic Mixture Control Unit. It consists of a needle valve and seat that form an adjustable bleed between chamber A and chamber B. In operation, as the aircraft gains altitude, a wider throttle opening will be necessary to maintain ground level power. But as venturi suction increases with throttle opening, a rich mixture will result. The pilot can then adjust the manual mixture control valve to bleed off the excess venturi suction and maintain the correct fuel-air ratio.



IDLE CUT-OFF

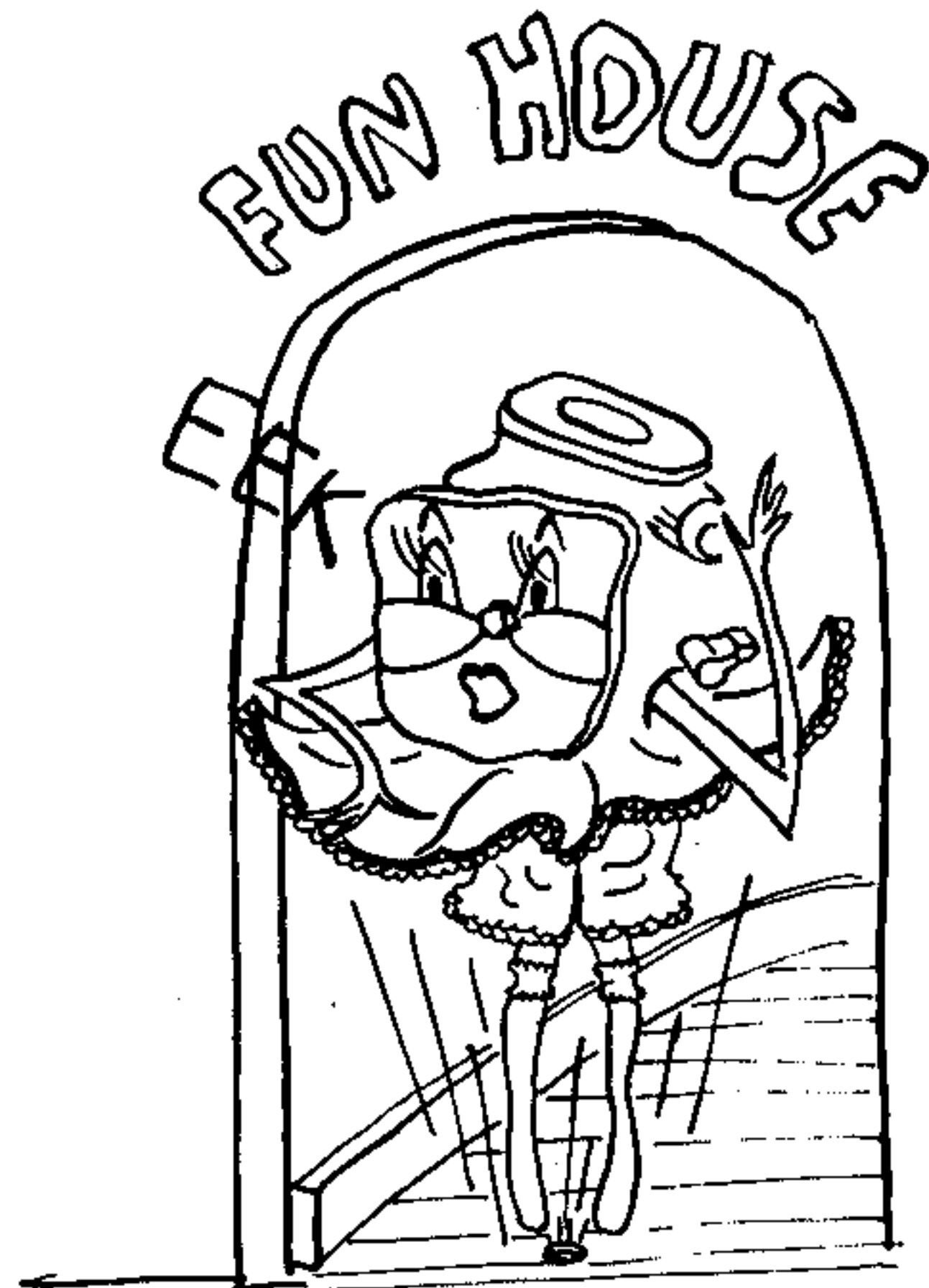
2-7. When the manual mixture control lever is moved to the idle cut-off position, a cam on the linkage actuates a rocker arm which



causes the idle cut-off plunger to move inward against the release lever in chamber "A". The lever compresses the regulator diaphragm spring to release all tension on the diaphragm between chambers "A" and "B". This permits fuel pressure plus regulator needle (poppet) valve spring force to close the poppet valve and stop the fuel flow through the carburetor. It should also be noted that placing the mixture control lever in idle cut-off will position the mixture control needle off of its seat and allow metering suction within the carburetor to bleed off.

AIRFLOW POWER ENRICHMENT VALVE

2-8. The airflow power enrichment valve, when used, consists of a spring loaded, diaphragm operated, metering valve. One side of the diaphragm is exposed to unmetered fuel pressure, and the other side to "venturi suction" plus an adjustable spring. When the pressure differential across the diaphragm establishes a force strong enough to compress the spring, the valve will open and supply an additional amount of fuel to the metered



fuel circuit in addition to the fuel supplied by the main metering jet. On the carburetors equipped with the airflow enrichment valve the idle needle valve will be of a slightly different design, (without cruise step) as shown in figure 3. Also the idle needle diaphragm spring will be removed as well as the enrichment valve actuating screw

from the loose lever assembly. Refer to figure 5, for a detailed schematic view of the airflow power enrichment valve.

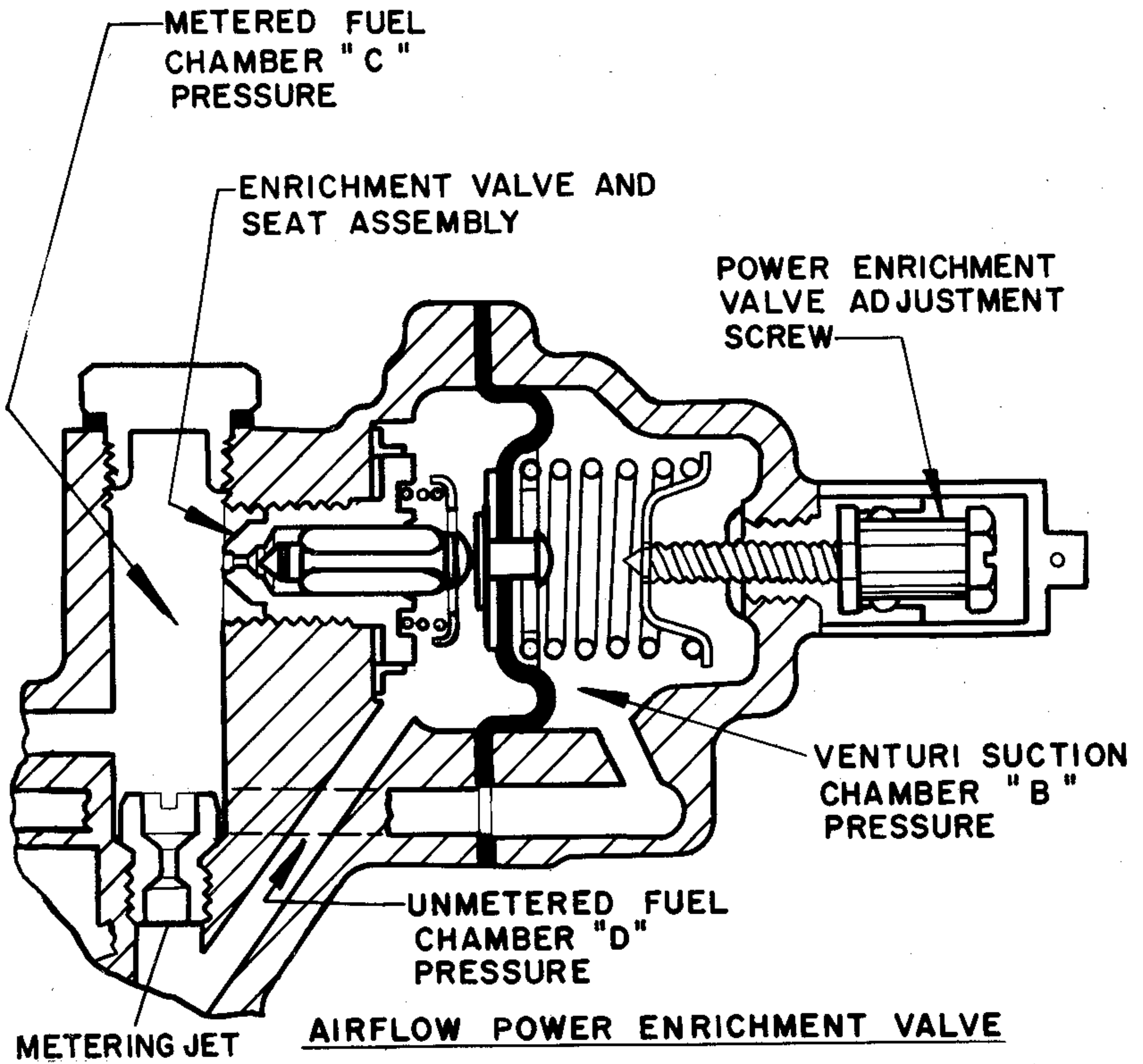
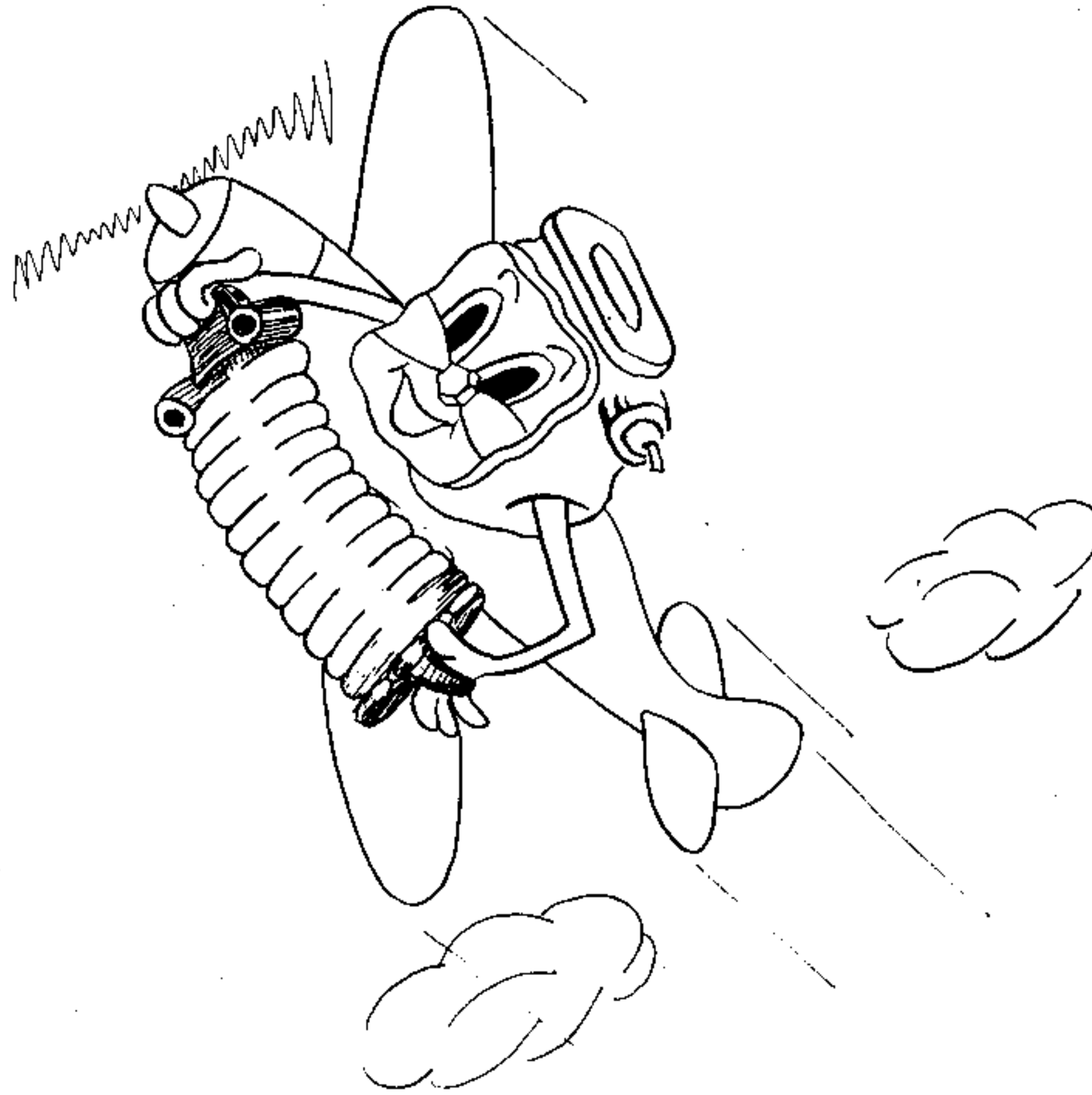


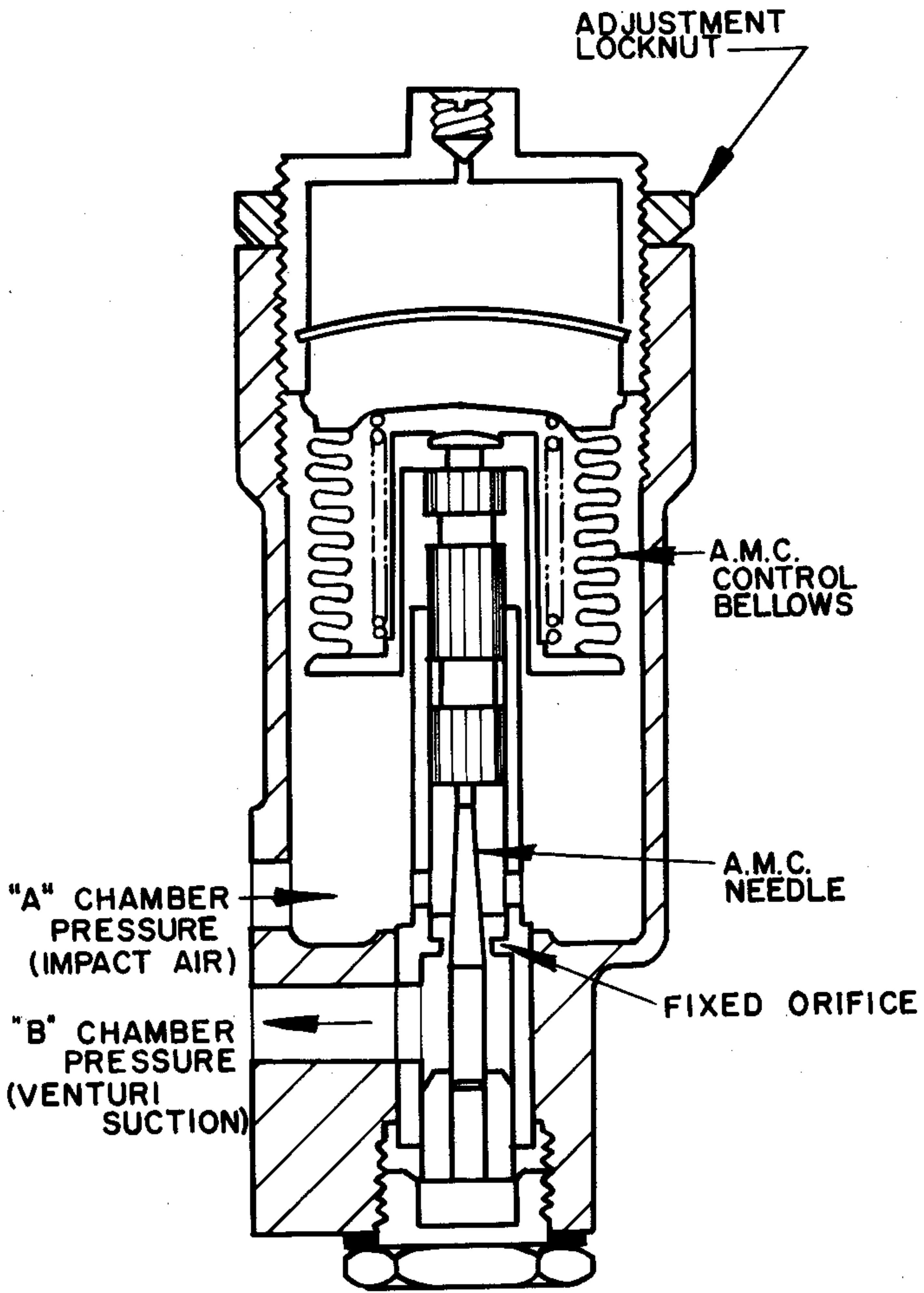
Figure 5.

AUTOMATIC MIXTURE CONTROL ASSEMBLY

2-9. The automatic mixture control assembly is a device that works independently of, and in parallel with the manual mixture control to automatically correct for natural enrichment at altitude. In effect, it provides a variable bleed between chambers "A" and "B" of the carburetor to regulate metering suction.



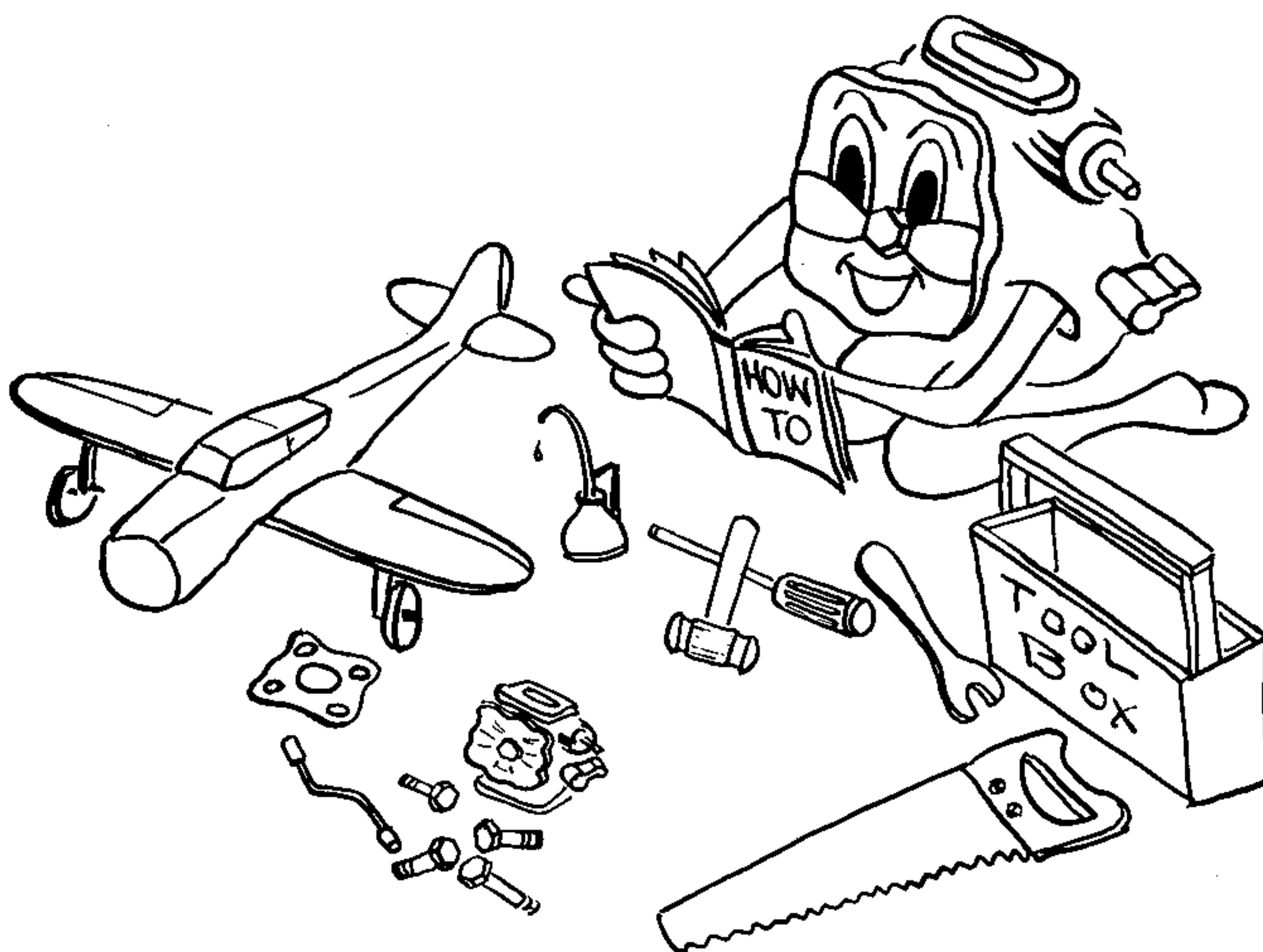
2-10. By reference to figure 6, you will see that the automatic mixture control consists of a contoured needle that is moved in or out of an orifice by a bellows assembly. This bellows assembly is similar to a barometer in that it is sensitive to both air pressure and temperature. Generally speaking, at ground level the bellows is contracted and holds the needle in the orifice in such a position that the flow of "impact pressure" into "venturi suction" is at a minimum and "metering suction" is therefore at a maximum. As altitude increases the bellows elongates and repositions the needle in the orifice allowing more "impact pressure" to flow into the "venturi suction" chamber maintaining the ground level metering suction.



AUTOMATIC MIXTURE CONTROL ASS'Y

Figure 6.

SECTION III



INSTALLATION

ENGINE

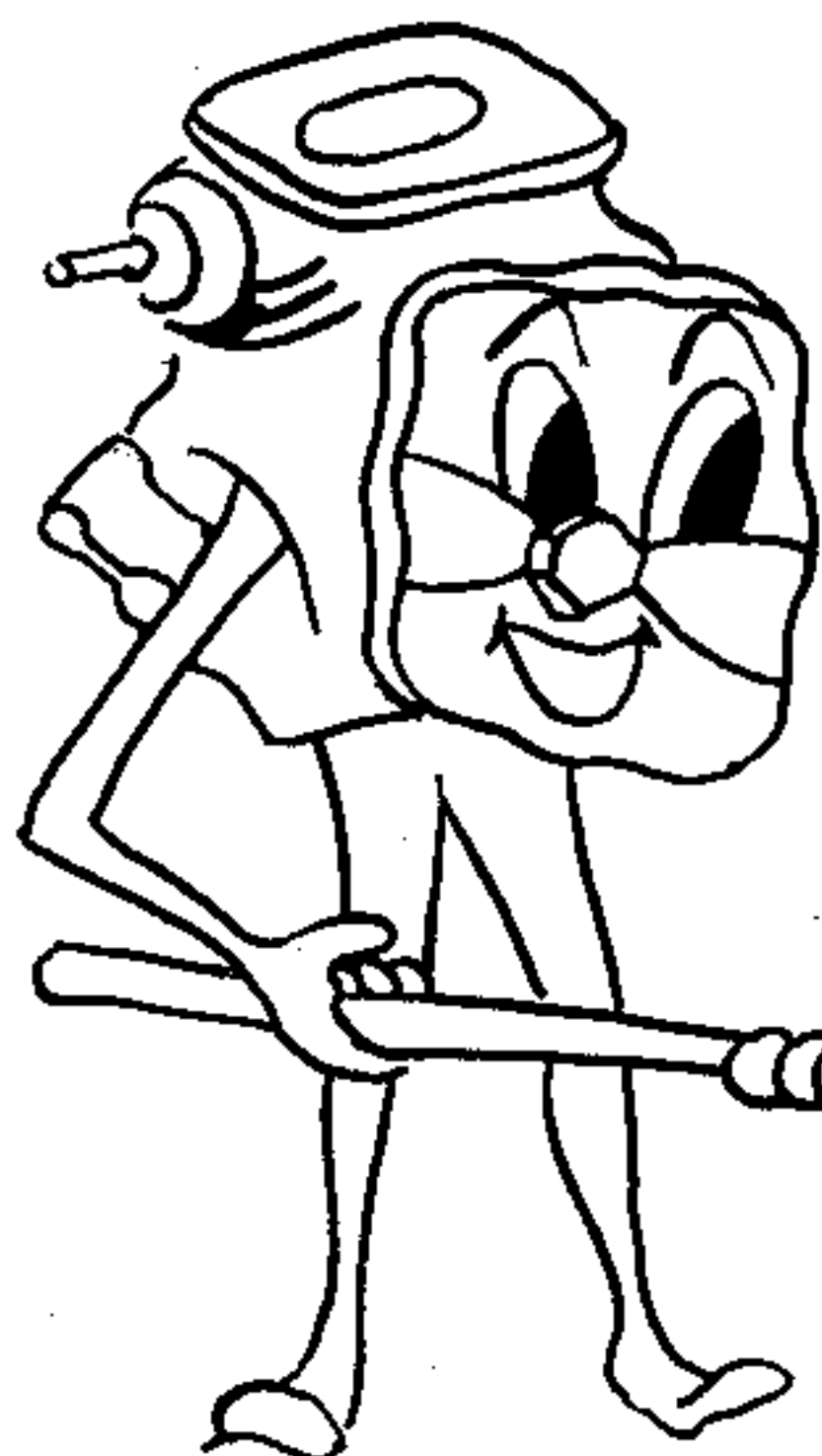
3-1. Install the carburetor on the mounting pad of the engine using the proper gasket and torque the four attaching nuts to the specified torque. Refer to the engine manufacturer's instructions and bill of material for applicable torque specifications and correct attaching parts, i.e., gaskets, fittings, etc.

a. All "PS" type carburetors should be installed so the fuel will discharge directly into the intake manifold or blower throat, whichever the case may be.

b. Carburetors installed for horizontal operation should be installed with the discharge diaphragm adjusting screw pointing down.

c. When installing the carburetor extreme care should be taken against sliding the flange of the carburetor over the attaching studs of the manifold as the face of the carburetor flange can become scratched and allow an air leak at this point.

AIR SCOOP

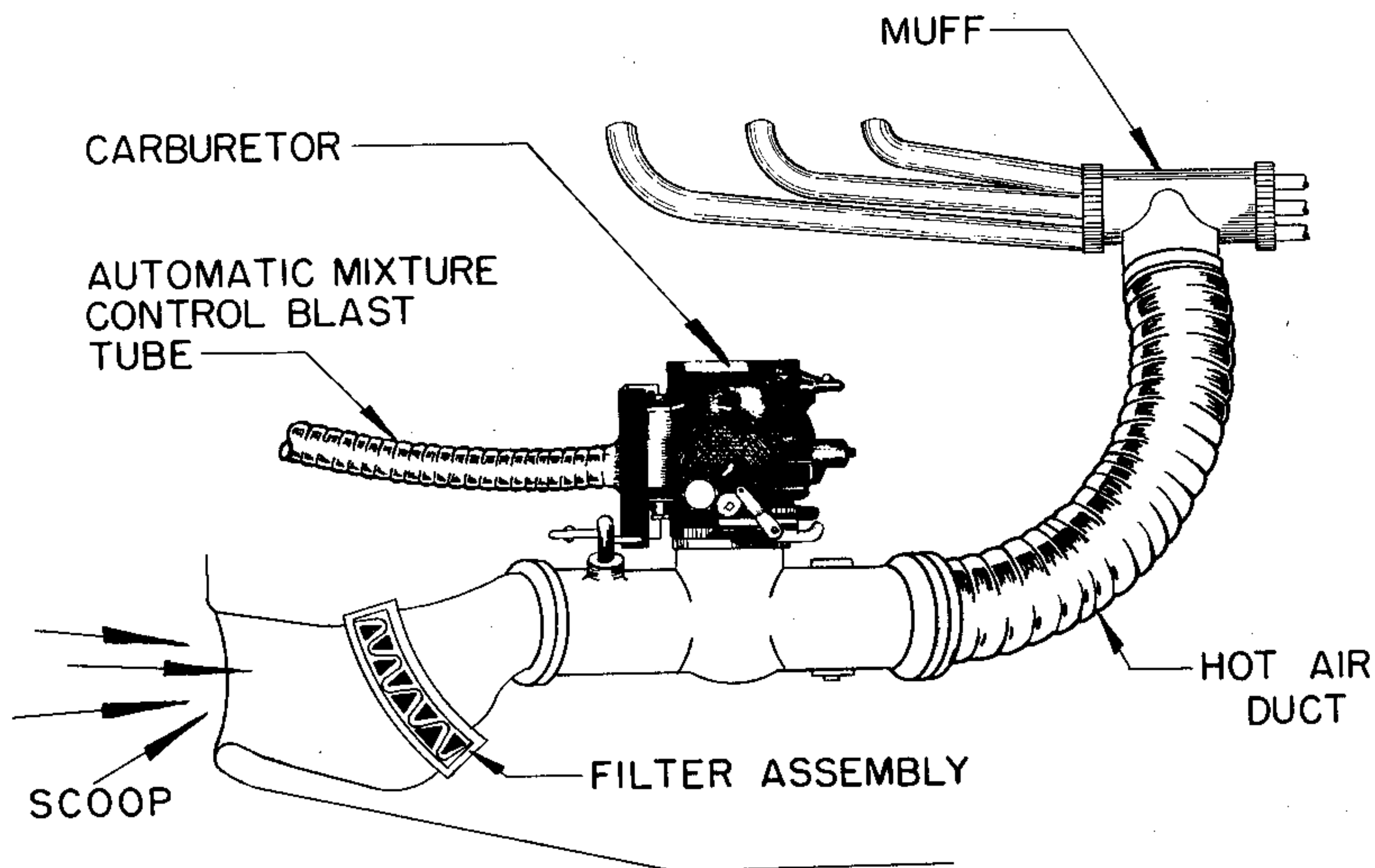


3-2. Attach the air scoop adapter to the mounting flange of the carburetor with the proper gasket installed and torque the cap screws evenly.



a. On all PS-5 carburetors equipped with an Automatic Mixture Control mounted on the main body an auxiliary air blast tube should be provided. Follow the aircraft manufacturer's instructions for installing this tube.

b. On some PS-5 and all PS-7 and PS-9 carburetors equipped with an Automatic Mixture Control the Automatic Mixture Control Assembly is mounted on a special adapter that is part of the carburetor.



TYPICAL SCOOP INSTALLATION USING A
PS-5BD CARBURETOR

Figure 7.

The air scoop attaches to this adapter, so that when assembled, the Automatic Mixture Control is located within the air scoop. Refer to figures 7 and 8 for examples of typical scoop installations.

c. Either of the above two arrangements is necessary as the Automatic Mixture Control must sense carburetor inlet air temperature only and not engine compartment air temperature.

d. Follow the aircraft manufacturer's instructions for cleaning and oiling the air filter element. Be sure the recommended grade of oil is used for re-oiling the element and that an ample amount of time is allowed for draining. A filter element replaced with an excess amount of oil clinging to it can cause fuel metering difficulties as the excess oil will be drawn into the scoop and will settle on the venturi tube of the carburetor. This can greatly affect the metering characteristics of the carburetor.

3-3. When necessary to remove the scoop adapter from the carburetor, it should be broken loose by light tapping with a soft faced mallet, do not remove by prying, as the scoop flange of the carburetor can become scratched or otherwise distorted.

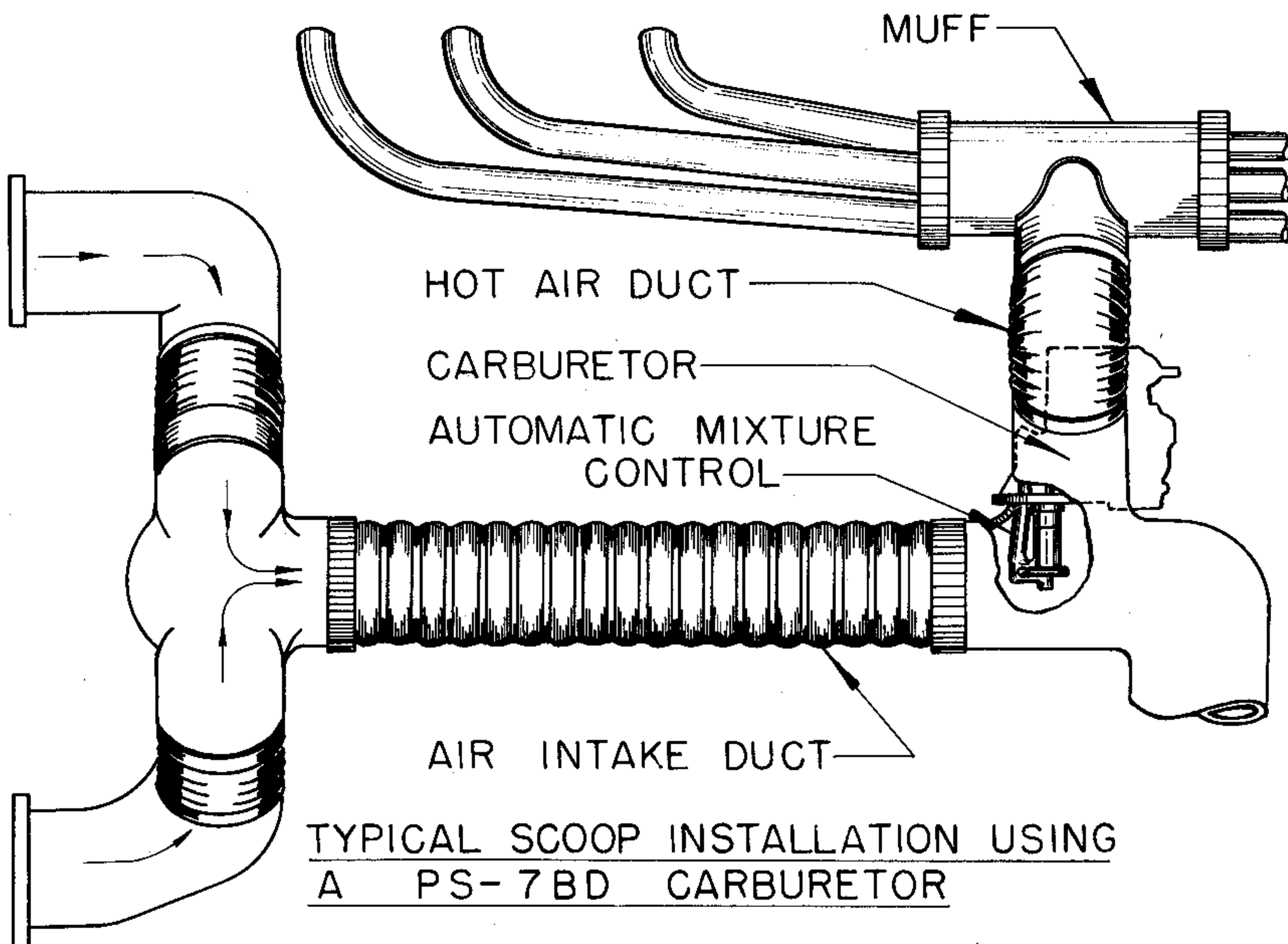
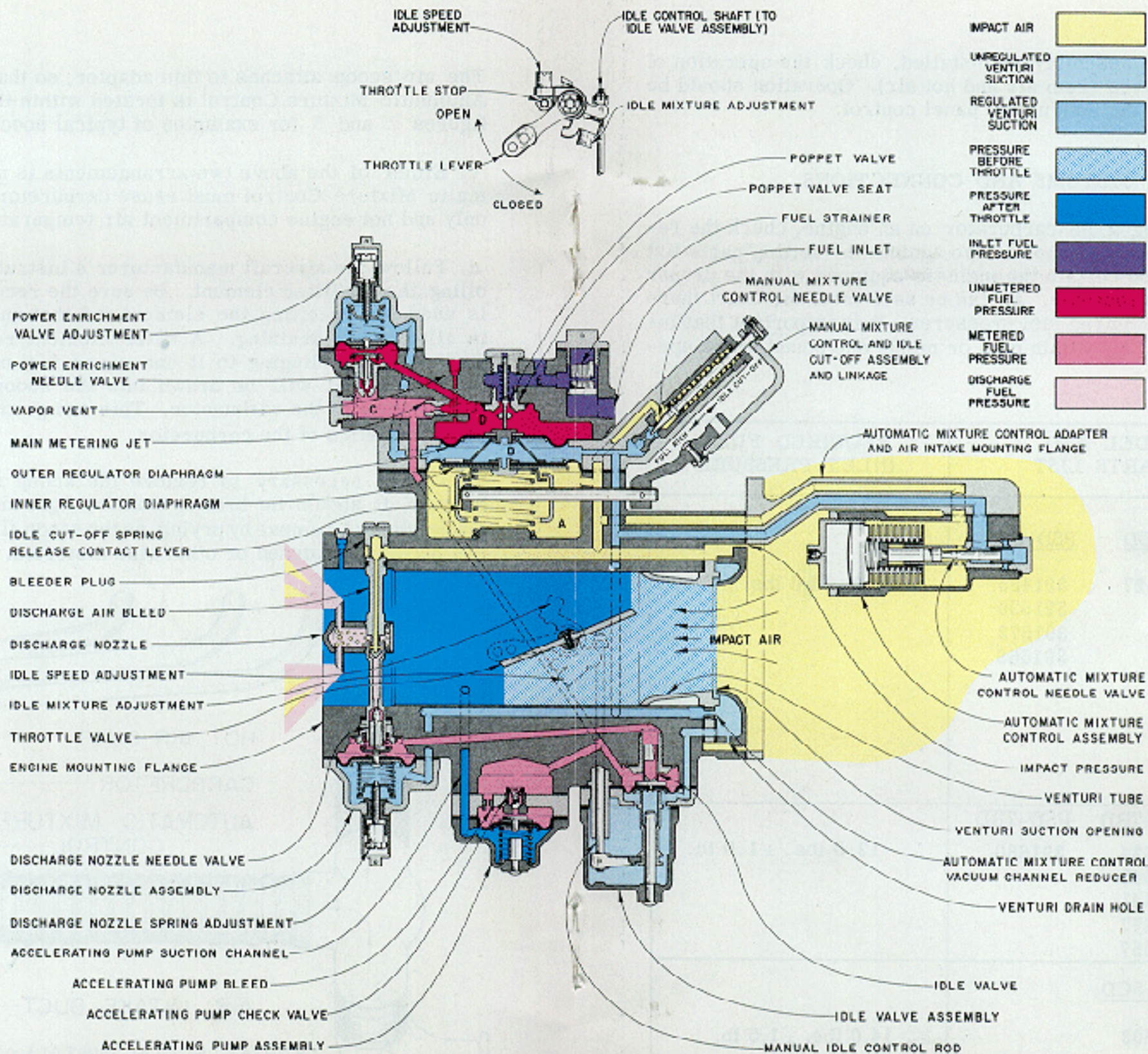


Figure 8.



Schematic Diagram of the Stromberg PSH-7BD Injection Carburetor

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3-4. After the scoop assembly is installed, check the operation of the alternate air valves (ram air and hot air). Operation should be checked by operating the instrument panel control.

FUEL SYSTEMS AND CONNECTIONS

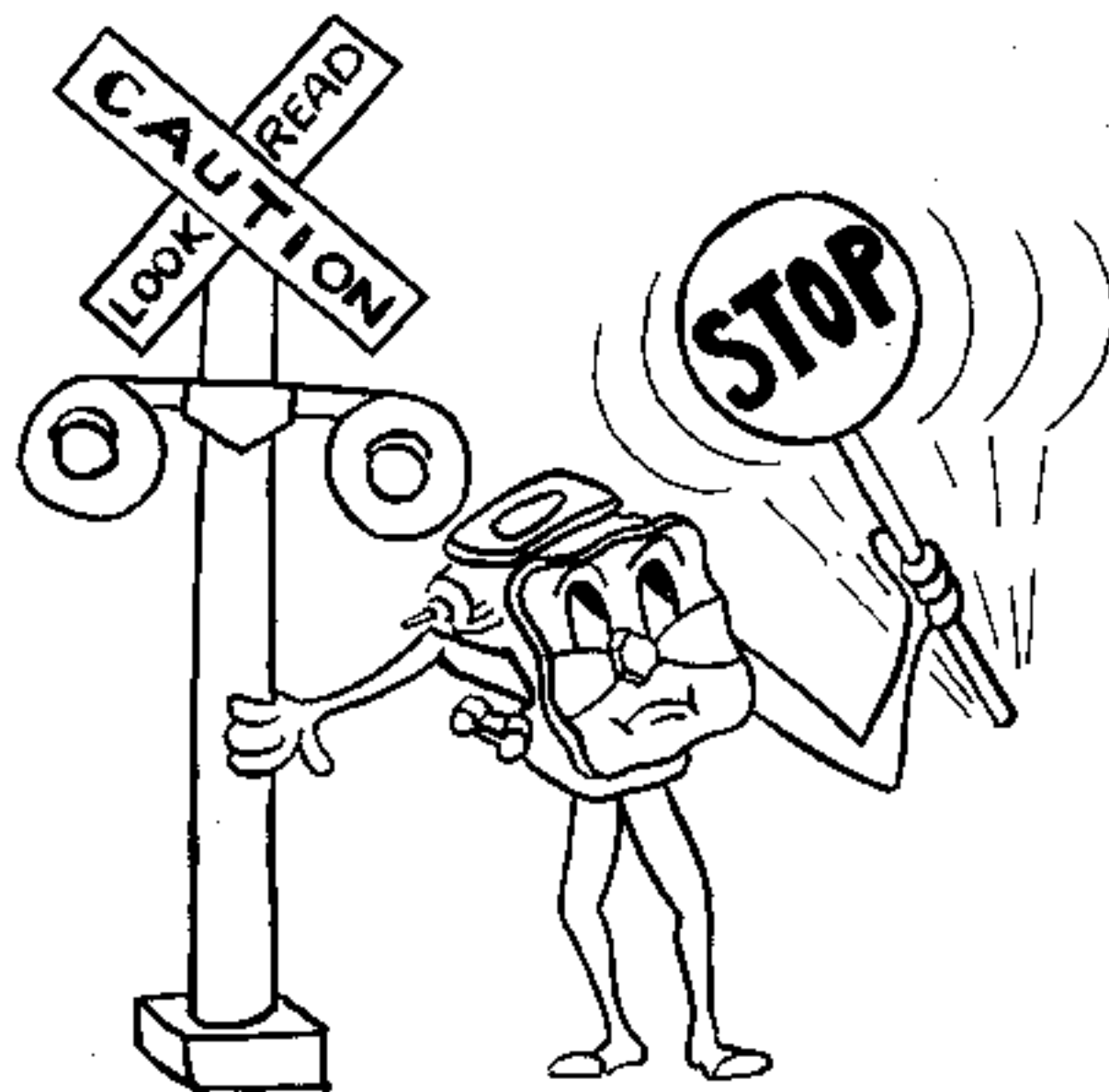
3-5. Before installing a PS carburetor on an engine, check the required fuel pressure chart shown here against the setting parts list of the carburetor to be certain the engine is equipped with the proper fuel pump for that carburetor. As can be seen from the chart there are three different required fuel pressures. It is important that inlet fuel pressure be held within plus or minus one pound of the specified pressure.

CARB. MODEL AND SETTING PARTS LIST			REQUIRED FUEL INLET PRESSURE
<u>PS-5C</u> 380179 380208 380212 380223 380229 380230 391318 391330 391583 391629	<u>PS-5CD</u> 391527	<u>PSD-5C</u> 391435 391529 391572 391668	9.0 -14.0 lbs.
PS-7BD 391264 391454 391635	PSH-7BD 391624 391640 391641 391677 391657	PSD-7BD 391660	12.0 lbs. ± 1.0 lb.
<u>PS-5BD</u> 391279 391486 391561 391569 391621	<u>PSH-5CD</u> 391603		14.0 lbs. ± 1.0 lb.

3-6. The fuel inlet connection is a 1/4 inch N.S.P.T. on all "PS" series carburetors. The fuel pressure and vapor vent openings are 1/8 inch N.S.P.T. Caution must be exercised in insuring that the threaded area of all connecting fittings to the carburetor are free from nicks, burrs or other thread damage which might cut or shave off aluminum cuttings from the regulator cover and force them into the unprotected cavity around the poppet valve.

CAUTION

Extreme care should also be exercised when applying Seal Lube or other thread compounds to the above connections. **USE SPARINGLY.** A large number of carburetor difficulties have been traced to the presence of thread compound and thread shavings in the metered fuel channels and poppet valve cavity of the carburetor causing erratic engine operation or complete engine stoppage.



3-7. If a check valve is installed in the vapor vent line be sure it is free and operating. The check valve should operate on 1.5 pounds **MAXIMUM** pressure.

THROTTLE AND MIXTURE CONTROL LEVERS

3-8. The control linkage from the cockpit control panel to the carburetor throttle and mixture controls must be supported in such a manner as to insulate the linkage from vibration as much as possible. The operation of the controls should be checked from the cockpit control panel. Enough slack should be available in the control linkage to prevent engine torque (on ground or in flight) from lifting the mixture control needle from its seat, causing unpredictable leaning.

a. The throttle lever on the carburetor is adjustable radially in 15 degree increments to conform to the control system of the aircraft. With the cockpit control in the **CLOSED** position, and the throttle lever on the carburetor in the **CLOSED** position, adjust the linkage as necessary.

b. The manual mixture and idle cut-off lever is not adjustable at the carburetor, all adjustments must be made on the cockpit control linkage. With the cockpit control in FULL RICH and the carburetor lever in FULL RICH, adjust the control linkage as necessary so ICO and FULL RICH can be obtained.

PREPARATION FOR USE

3-9. To eliminate corrosion and abnormal drying of the various diaphragms the carburetor is filled with a preservative oil before shipment. The carburetor must be drained, flushed and filled with fuel and allowed to soak in clean fuel to condition the fuel diaphragms.



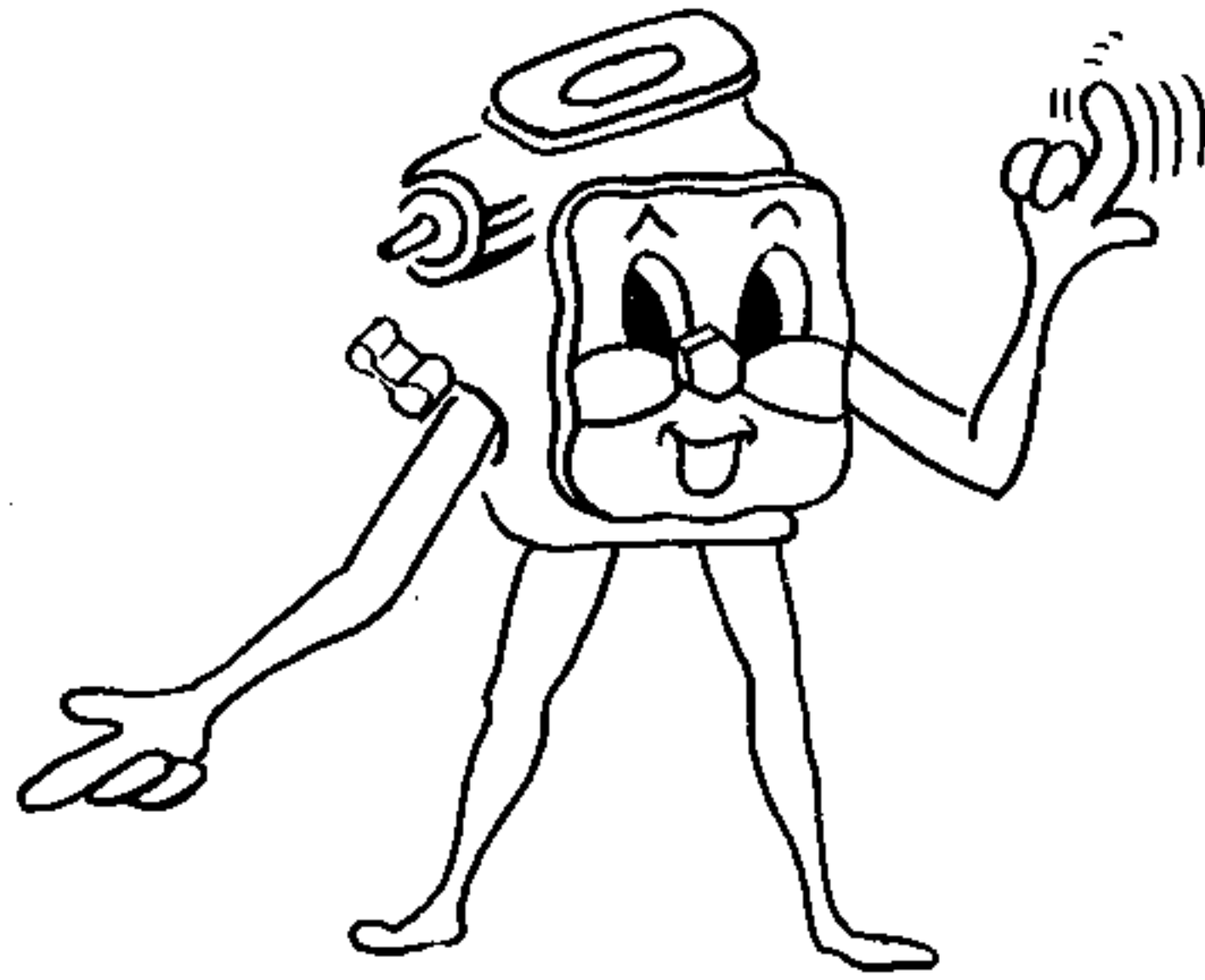
a. Before installing the carburetor on an engine, remove the various shipping plugs, inlet screen, and the 1/8 inch pipe plug from the regulator cover, and allow the preservative oil to drain off. Wash the inlet screen in clean fuel and reinstall using a new 365533 strainer plug gasket.

b. After installing the carburetor on an engine, connect the fuel lines to the carburetor as soon as possible and use the following procedure to complete the flushing operation.

- (1) Open the fuel supply valve.
- (2) Place the mixture control in "RICH" and the throttle in the "WIDE OPEN" position.
- (3) Remove the 1/8 inch pipe plug from the bottom of the regulator cover.
- (4) Operate the boost pump until clean, oil-free fuel flows from the pipe plug opening.
- (5) Replace the 1/8 inch plug, and continue pumping fuel to the carburetor until oil-free fuel flows from the discharge nozzle.
- (6) Place the mixture control in "IDLE CUT-OFF" and shut off the fuel supply. Leave the carburetor soak for as long a period as practical before operating the engine.

NOTE

Because the carburetor is a closed fuel system it will remain full of fuel as long as the mixture control lever is in 'IDLE CUT-OFF'.

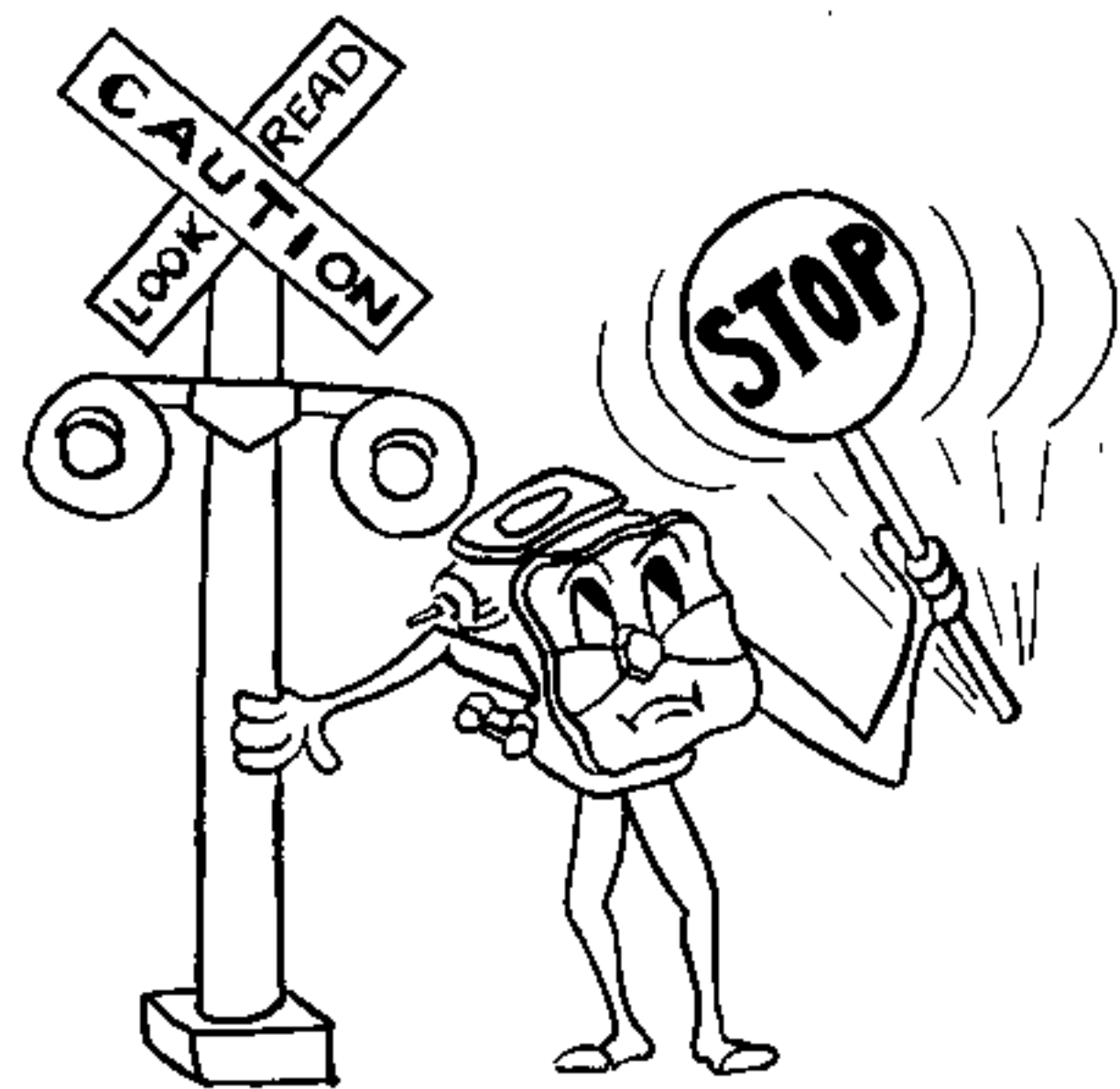


(7) An eight hour soak period is desired to condition the fuel diaphragms, that is, restore them to the pliable condition they were in when the carburetor was calibrated. This is particularly important in regard to making a final idle adjustment. If it is necessary to operate the aircraft without the full eight hour carburetor soak period the desired cruise metering may be erratic and the initial idle adjustment should be considered temporary and an idle readjustment will be necessary.

c. The soaking operation may be performed prior to installation on the engine if a portable pump and supply tank is available. Apply fuel to the carburetor inlet at 6.0 to 10.0 psi.

CAUTION

The above procedure is the only recommended method of soaking a new carburetor. The practice of soaking the carburetor by submersion in a pail of gasoline is definitely injurious to the air diaphragms as it allows fuel to come into direct contact with the air diaphragms, removing the vinyl coating from the diaphragms and causing them to become stiff after drying out, upsetting the metering qualities of the carburetor, and premature diaphragm service life.



SECTION IV

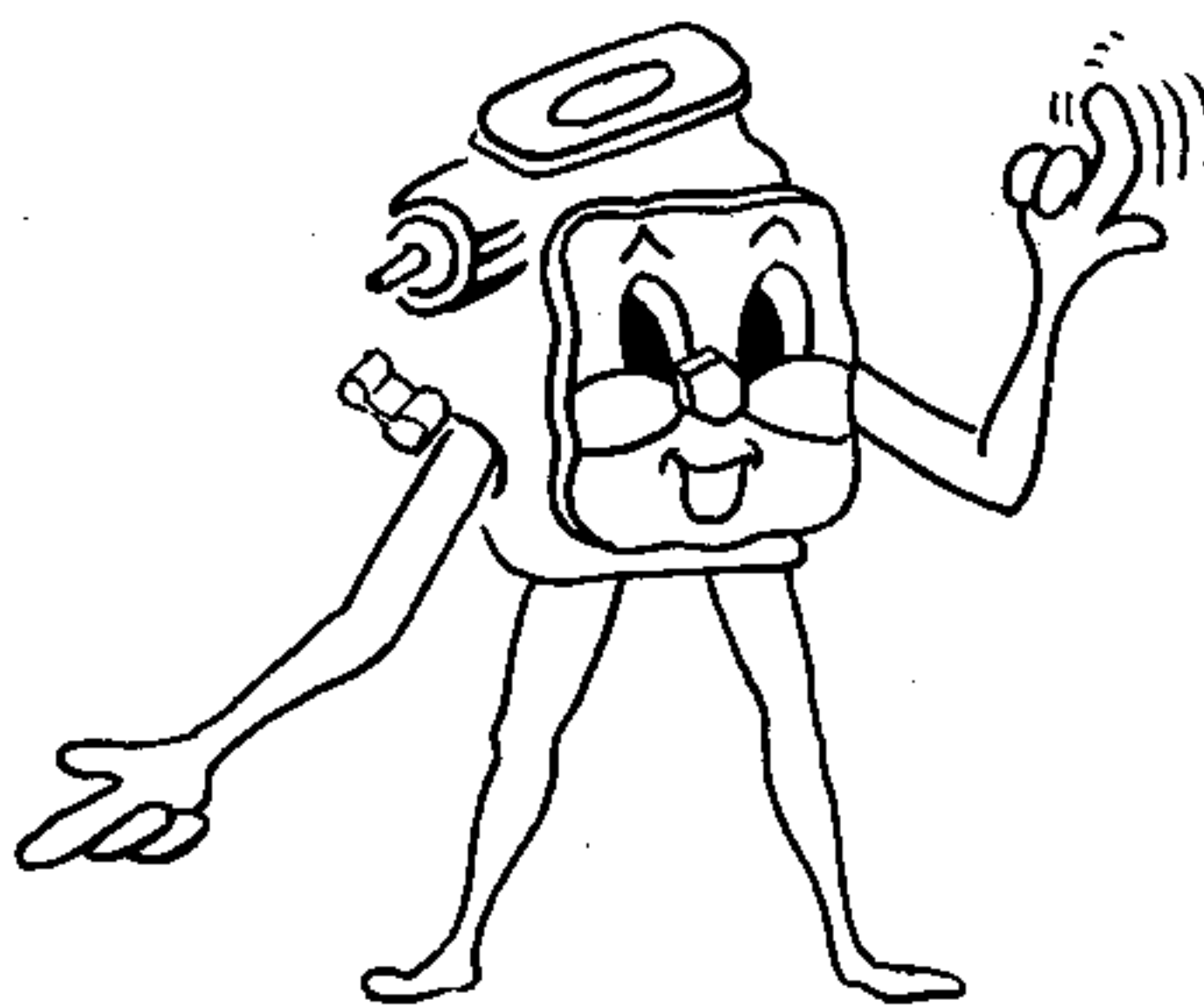
FIELD ADJUSTMENTS

4-1. IDLE SPEED AND MIXTURE ADJUSTMENT.

- a. Start the engine and warm up in the usual manner until oil and cylinder head temperatures are normal.
- b. Check magnetos in accordance with instructions furnished in the airplane operational handbook. If the "mag-drop" is normal, proceed with idle adjustment.
- c. Close the throttle to idle (approximately 600 rpm). If the rpm increases appreciably after changing the idle mixture adjustment during the succeeding steps, readjust the idle speed to the desired rpm.

NOTE

If the airplane has variable pitch propeller, the idle mixture should be set with the propeller in full low fixed pitch. Also aircraft that employ fuel boost pump pressure for ground, take-off and landing operations, the idle mixture must be adjusted with the fuel boost pump "ON".



- d. When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull, into the "IDLE CUT-OFF" position and observe the tachometer for any change during the "leaning" process. Caution must be exercised to return the mixture control to the "FULL-RICH" position before the rpm can drop to a point where the engine cuts out. An increase of more than 10 rpm while "leaning out" indicates a rich idle mixture. An immediate decrease in rpm (if not preceded by a momentary increase) indicates the idle mixture is too lean. The same indication of idle mixture is obtained by watching the manifold pressure gage. If the manifold pressure holds steady momentarily, then rises as engine

speed decreases, the idle mixture is correct. If the manifold pressure drops then rises as the manual mixture control is moved to idle cut-off, the mixture is too rich. If the manifold pressure increases immediately as the mixture control is moved toward idle cut-off, the mixture is too lean.

e. If steps (c) and (d) indicate that the idle adjustment is too rich or too lean, turn the idle mixture adjustment one or two notches in the direction required for correction, and check this new position by repeating steps (c) and (d). Make additional adjustments as necessary until a check with steps (c) and (d) results in a momentary pick-up of approximately five (never more than ten) rpm.

f. Each time an adjustment is changed, clear the engine by running it up to approximately 2000 rpm before making mixture check (steps c and d).

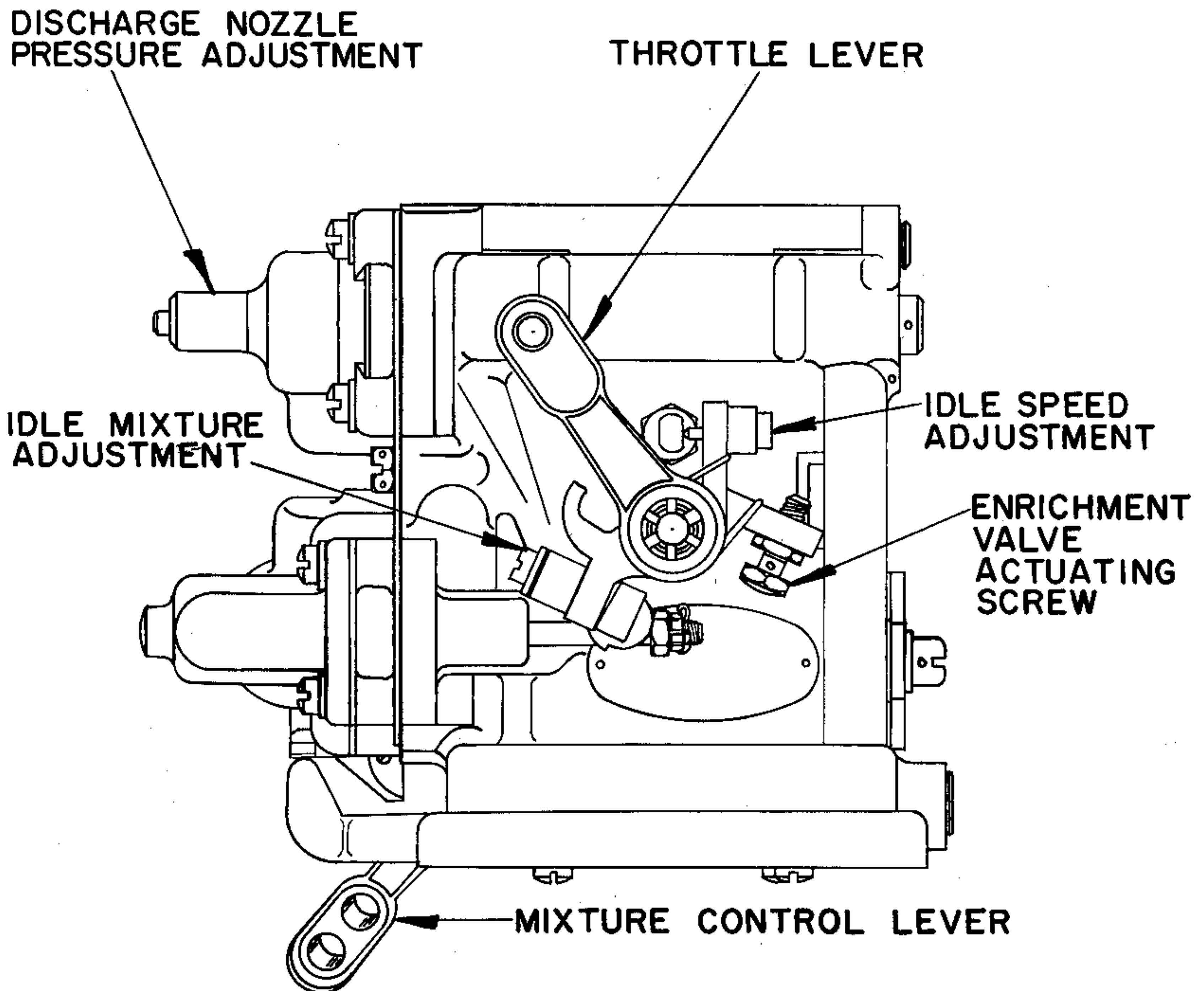


Figure 9. Idle Speed and Mixture Adjustments

g. Make the final adjustment of the idle speed adjustment to obtain the desired idling rpm with closed throttle.

h. This method of setting idle mixture strives to obtain the desired idle rpm with the lowest manifold pressure. In case the setting does not remain stable, check the idle linkage; any looseness in this linkage would cause erratic idling. In all cases, allowance should be made for the effect of weather conditions upon idling adjustment. The relation of the airplane to the direction of the prevailing wind will have an effect on the propeller load and thus on its rpm; hence it is advisable to make the idle setting with the airplane cross-wind.

4-2. Carburetor idle speed and mixture adjustments made according to the above method should require very little further attention except for extreme variations in temperature and altitude.

ENRICHMENT VALVE ADJUSTMENT

4-3. When the desired idle mixture and idle speed adjustments have been made, it is necessary to check and if necessary, readjust the mechanical enrichment valve opening point on the following model "PS" carburetors: PS-5C, PS-5CD, PSD-5C and PSH-5CD.

a. Refer to the chart (Figure 10) for the correct setting of the enrichment valve for the parts list of the carburetor effected. With the correct gage inserted square over the throttle stop (Figure 11), open the throttle valve until the lever contacts the angle on the gage. At this point, the enrichment valve actuating screw "A" must just contact the idle and enrichment valve control rod.

b. With the enrichment valve actuating screw set, tighten the lock-nut and safety wire.

4-4. It is important that on the above listed carburetors the enrichment valve setting be made AFTER the idle speed and mixture adjustment has been made as a change in idle adjustment can effect fuel flow in the cruise range. It can be seen by referring back to figure 2, that the idle needle on these carburetors not only controls idle flow, but also has a cruise step. The relation of the idle needle to the needle seat determines the point at which power enrichment fuel is available (when the cruise step moves out of the seat). The enrichment valve actuating screw on the throttle lever (a, Figure 11), allows for positive manual control of the power enrichment range.

4-5. The preceding instructions did not apply to carburetors equipped with an airflow power enrichment valve, such as PS-5BD, or PS-7BD. The "BD" series enrichment valve is actuated by the airflow through

Carburetor Model	Parts List	Enrichment Valve Screw Setting	Gage Part No.
PS-5C	380179	35° from WO	T25939
	380208	35° from WO	T25939
	380212	35° from WO	T25939
	380223	35° from WO	T25939
	380229	35° from WO	T25939
	380230	35° from WO	T25939
	391318	28° from WO	T25941
	391330	26-1/2° from WO	T25942
	391583	28° from WO	T25941
	391629	28° from WO	T25941
PS-5CD	391527	32° from WO	T25940
PSD-5C	391435	39° from WO	T25938
	391529	31° from WO	T25952
	391572	31° from WO	T25952
PSH-5C	391603	37° from WO	T25997
	391668	31° from WO	T25952
<p>Note: The enrichment valve setting gages are available separately under the above part number, or as a complete set under part number T25937 from your local Bendix distributor.</p>			

Figure 10.

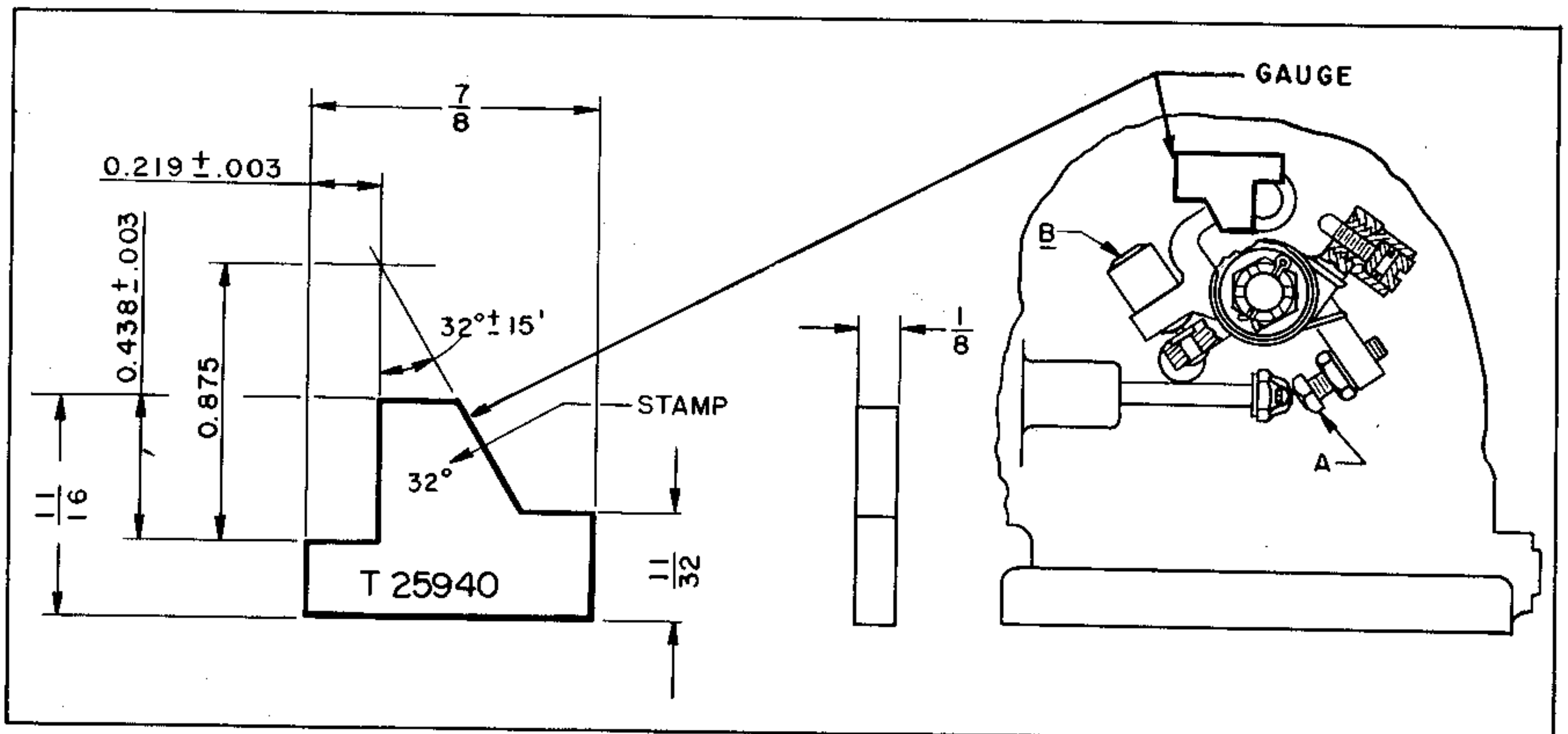


Figure 11. Correct position of adjusting gage when setting the enrichment valve

EFFECT OF IDLE MIXTURE ADJUSTMENT

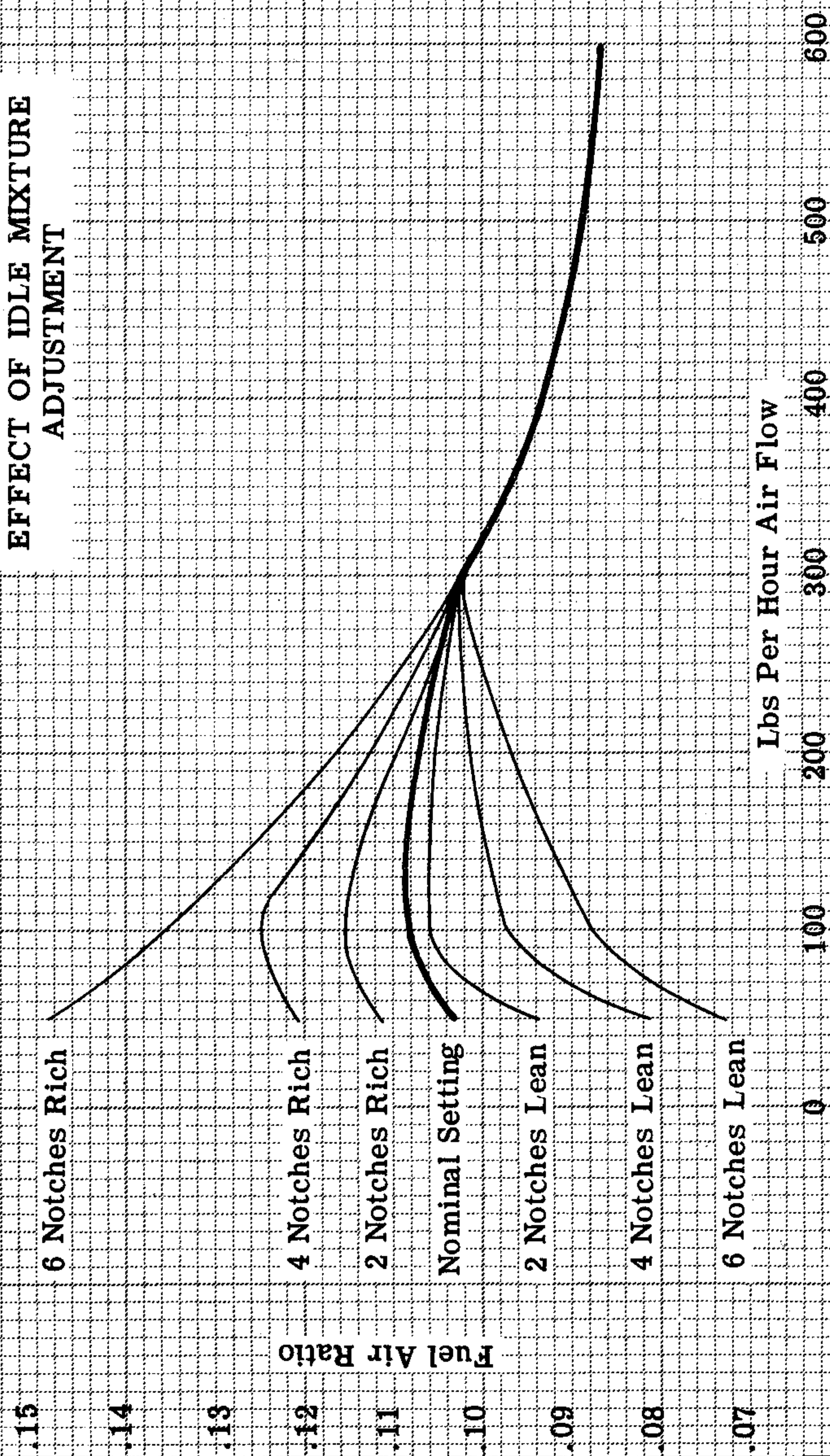


Figure 12.

the carburetor and is adjusted on the flow bench. It is not affected by idle adjustments.

DISCHARGE NOZZLE (Metered Fuel Pressure) ADJUSTMENT

4-6. The discharge nozzle adjustment is made on the flow bench during testing and calibration of the carburetor. However, in an early Bendix publication, form 10-849 dated 1-7-49 titled Handbook of Instructions with parts catalog for Stromberg PS series injection carburetors, a procedure was outlined for adjusting the discharge nozzle with the carburetor installed on the aircraft. Since the publication of the above handbook, aircraft engine performance has changed considerably with regard to horsepower and compression ratio. This, in itself, has made field adjustments of the discharge nozzle more critical and dangerous from the standpoint of causing possible damage to the engine.

a. Adjustments made to the discharge nozzle have not been considered approved field adjustments. However, on recent production carburetors, a limiting device has been incorporated which permits safe adjustment of the discharge nozzle in the field (See figure 13). The discharge nozzle adjustment limiter may be installed on any PS carburetor at time of overhaul.

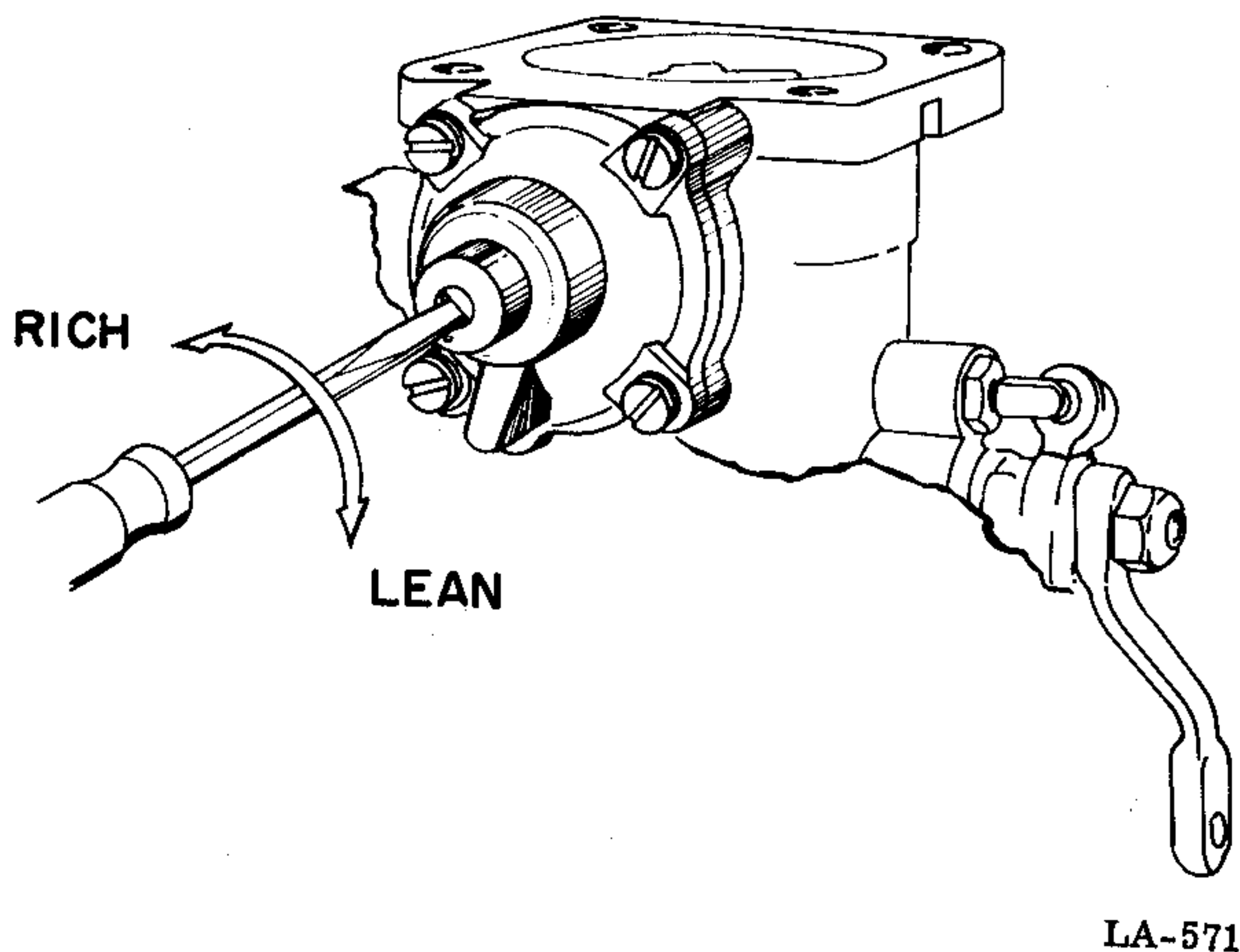


Figure 13.

b. One of the most frequent fuel metering complaints of operators has been engine roughness and RPM fluctuation in the off-idle range (between idle and cruise power). Variations in climatic conditions, particularly where severe changes in ambient air temperatures occur, contribute to this condition. Carburetors incorporating the limiter device may be safely adjusted to shift the off-idle fuel schedule in a rich or lean direction to compensate for variations in engine requirements.

4-7. If engine roughness occurs in the off-idle range and all other probable causes for roughness have been eliminated, the discharge nozzle may be adjusted on carburetors incorporating a discharge nozzle adjustment limiter, as follows:

a. Make normal idle speed and mixture adjustment as described in paragraph 4-1.

b. With engine oil temperature and cylinder head temperature still in normal, make mixture checks in the 1200 to 1500 RPM range and observe for maximum RPM rise.

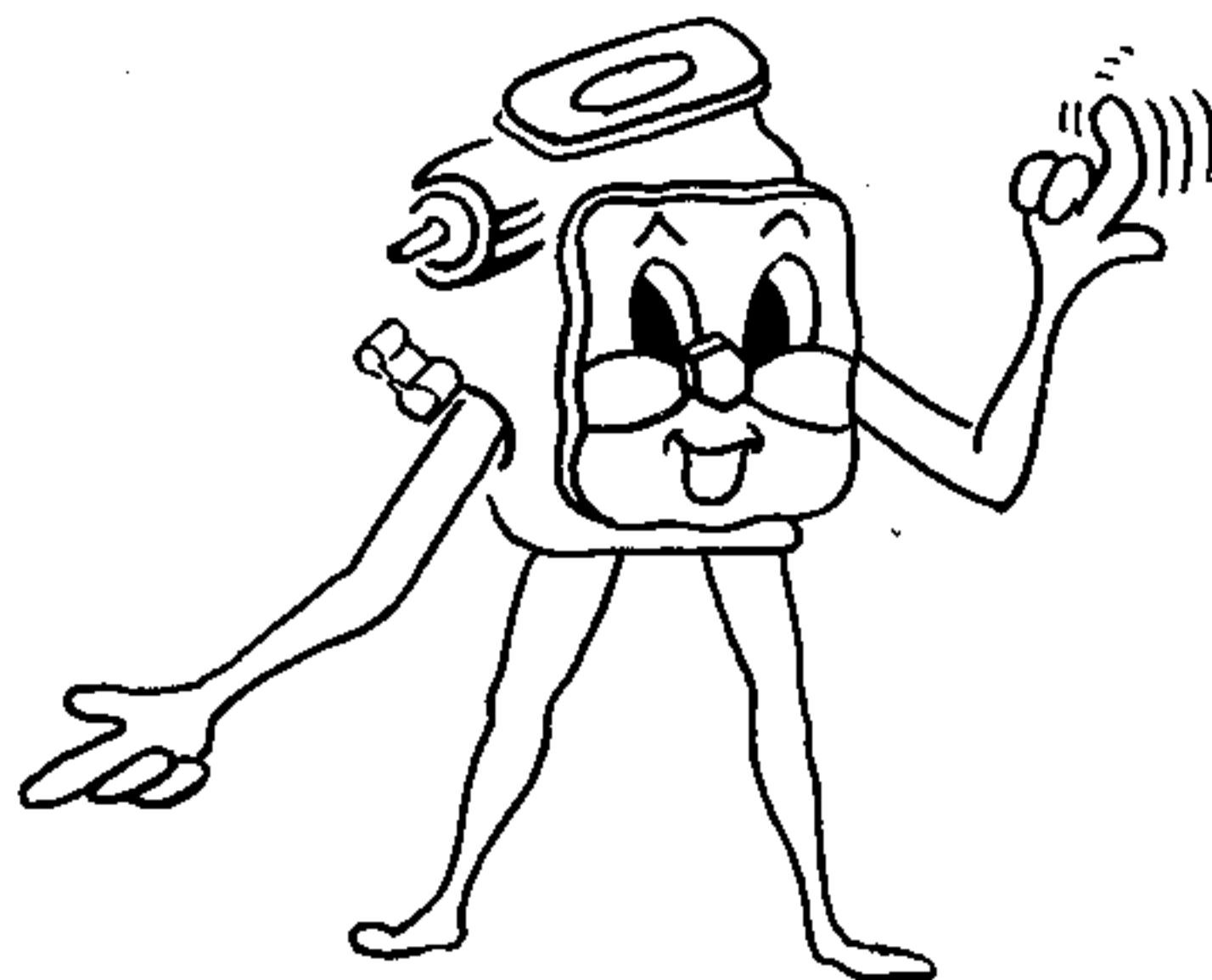
(1) The mixture check must be made with the propeller control in full low pitch (high RPM) and with the aircraft headed into the wind. Manually lean by pulling the mixture control slowly toward idle cut-off. As the fuel flow is being leaned, observe for the maximum momentary RPM rise which should occur just before the RPM starts to fall off. Immediately return the mixture control to full rich to prevent the engine from dying.

(2) If an RPM rise occurs, the carburetor setting is on the rich side of best power mixture.

(3) If there is no RPM rise, the carburetor setting is at or leaner than best power mixture.

NOTE

The adjusting screw contains a spring-loaded ball, and the sleeve has internal splines to provide a lock for the adjustment and a notch measurement of the amount of adjustment being made.



c. If mixture checks indicate a poor mixture setting, adjust the discharge nozzle to get a maximum rise not to exceed 50 RPM in the off-idle range, or until smooth engine operation is restored.

(1) To richen the off-idle range, insert a screwdriver through the end of the discharge nozzle adjustment locking cap and turn the adjusting screw in a counterclockwise direction one notch at a time until the desired engine operation is obtained.

(2) To lean the off-idle range, turn the adjusting screw in a clockwise direction one notch at a time until the desired engine operation is obtained.

(3) Clear the engine before each mixture check by running up to cruise power.

(4) Repeat the mixture check after each nozzle adjustment.

d. Make mixture check at 1700 RPM.

(1) Look for a 5 - 25 RPM rise.

e. After the off-idle mixture has been adjusted with the discharge nozzle adjustment, it will be necessary to readjust the idle.

(1) When resetting the initial idle, use only the normal idle speed and idle mixture adjustments.

(2) The idle should be adjusted to give the lowest possible manifold pressure at the desired engine speed (usually 600 RPM).

(3) A mixture check at the idle point should give approximately a 10 RPM rise.

4-8. The chart (Figure 14) illustrates the effect of a maximum rich and maximum lean adjustment of a discharge nozzle which incorporates a limiter device. The center line represents the normal fuel-air ratio schedule of a carburetor as set on an air box or flow bench. Assuming a lean or rich condition exists causing engine roughness in the off-idle range, the discharge nozzle could be adjusted accordingly. Notice that an adjustment will produce considerable change in the off-idle range, however, the cruise and power ranges are affected only slightly.

NOTE

It will be necessary to readjust the idle mixture after any adjustment of the discharge nozzle. With the PS-5C type carburetor (mechanical enrichment) it is necessary to reset the enrichment valve opening point following an idle mixture adjustment.

4-9. The air flow enrichment valve adjustment is made on the flow bench during testing and calibration of the carburetor. It is sealed at time of carburetor calibration and is not an approved field adjustment.

4-10. The nominal setting of the enrichment valve is to start to open at approximately 50% rated power. The approximate cruise power of aircraft using the "BD" type carburetor is from 60 to 65% of rated power which means that climb and cruise power settings are within the enrichment valve operating range and any adjustment made to the enrichment valve will affect these power settings. However, if rough engine operation occurs in the cruise range or during climb due to an excessive rich mixture, the enrichment valve may be adjusted one click at a time in a clockwise direction to lean or delay the enrichment valve opening point until the desired operation is acquired.

a. If roughness and/or detonation occurs at cruise powers and/or high cylinder head temperatures at rated climb and take-off power settings, the enrichment valve adjustment may be reset to open quicker by turning the adjustment one click at a time in a counter-clockwise direction until the desired enrichment is obtained.

b. It should never be necessary to turn the enrichment valve adjustment more than one-half turn rich or lean to obtain the desired setting.

c. If frequent adjustments to the discharge nozzle pressure or enrichment valve are necessary to maintain operation, the carburetor should be removed and completely overhauled and recalibrated.

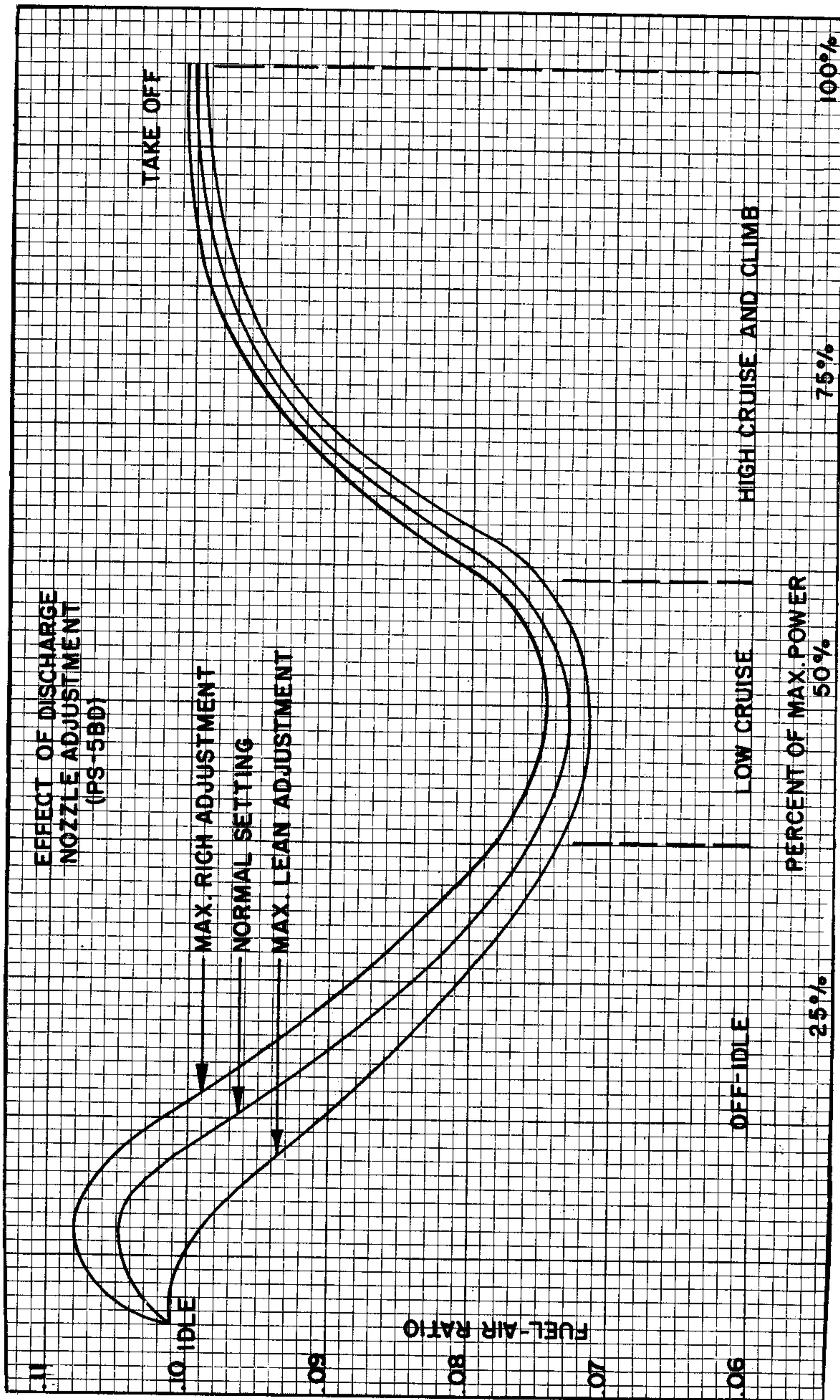


Figure 14.

SECTION V

MAINTENANCE, LUBRICATION & PREPARATION FOR STORAGE

MAINTENANCE

5-1. In general, little attention is required between carburetor overhauls. However, it is recommended that the following items be checked during periodic inspections of the engine.

a. Check tightness and lockwiring of all nuts, bolts and studs which fasten the carburetor to the engine and air scoop to the carburetor.

b. Check the fuel line, vapor vent line and pressure gage connection for fuel leakage.

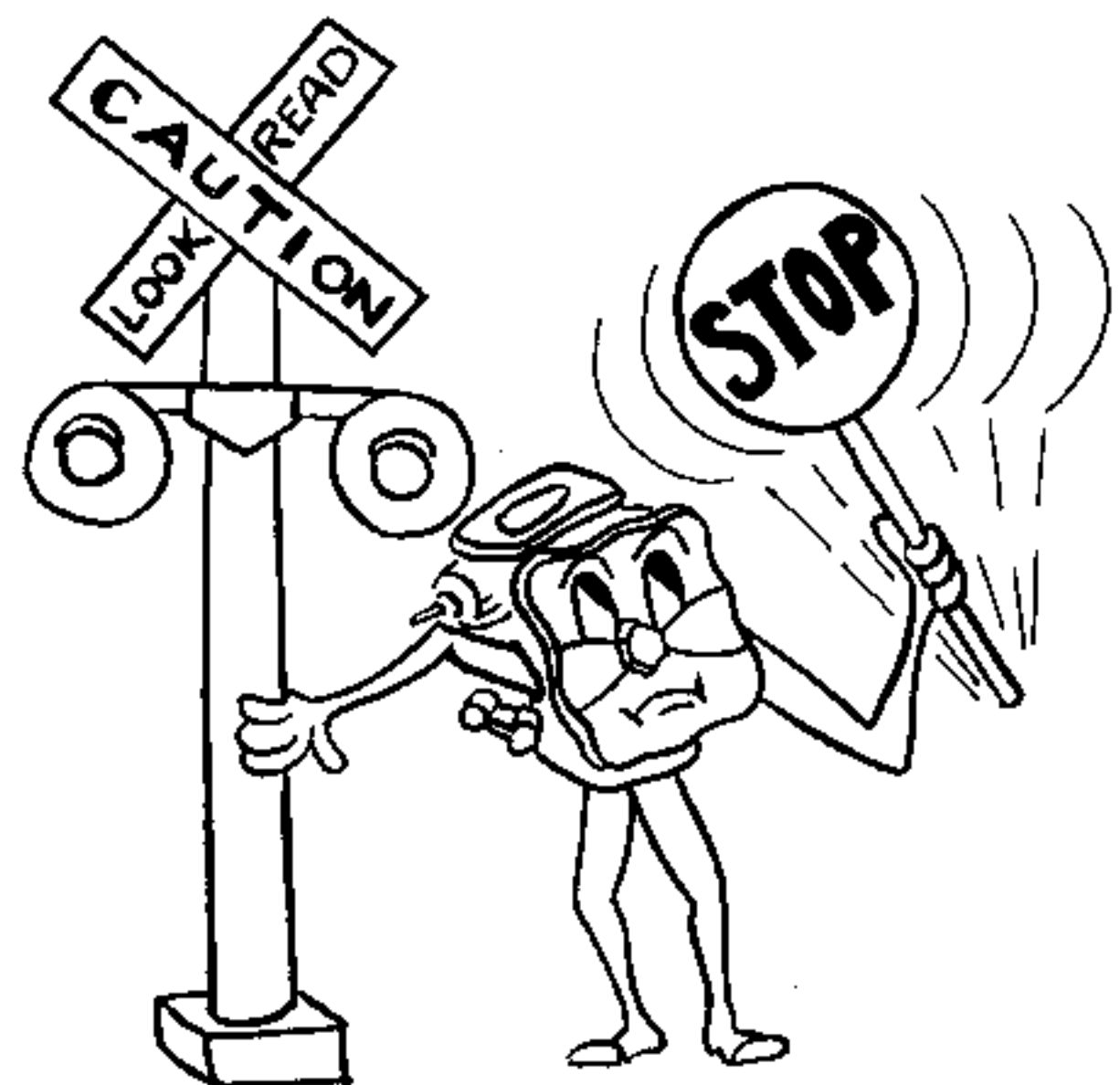
c. Check throttle and mixture control rods and levers for tightness and lockwiring.

d. Remove and clean the carburetor fuel inlet strainer at the first 25 hour inspection and each 50 hour inspection thereafter. Use a new 365533 strainer plug gasket each time the strainer is reinstalled.

5-2. Current production of some models of the "PS" series carburetors will incorporate a 200 mesh fuel inlet strainer and an 80 mesh fuel strainer around the poppet valve assembly. These carburetors will be identified with the letter "S" stamped on the face of the hex head poppet valve cover. If on inspection of the 200 mesh fuel strainer it is found to have more than 50% of the screen area plugged with dirt and lint, the poppet valve strainer should also be removed and cleaned.

CAUTION

Extreme care must be taken in the removal of the poppet valve strainer so as not to drop or lose the poppet valve and/or poppet valve return spring. Also, no attempt should be made to incorporate a poppet valve screen in a carburetor which has not had



the valve seat replaced or reworked during overhaul to include an annulus to receive the open end of the poppet valve strainer assembly.

5-3. The replacement of the 80 mesh fuel inlet strainer with a 200 mesh strainer can only be made when the airplane has been modified to incorporate a 200 mesh fuel strainer in the fuel system somewhere between the fuel tank and the carburetor. The finer mesh strainers are being incorporated to minimize the possibility of carburetor malfunction due to the induction of dirt, metal particles, lint and/or other contamination from the fuel and/or the fuel system such as lines, tanks and related fuel connections. The "PS" series carburetors will digest a considerable amount of dust and small particles of dirt. However, service experience has shown that metal particles, thread cuttings from fuel system fittings and small quantities of gas-tite or thread lube are getting into the carburetor poppet valve cavity and causing possible engine stoppage due to an over-rich mixture caused by the poppet valve being held open by this contamination.

a. It is advisable for maintenance personnel to include these additional fuel system screens as soon as possible and to use care in their periodic inspection of the fuel system.

5-4. Tests have proven that gasoline which has become stale due to prolonged storage, absorbs oxygen rapidly. This stale oxidized gasoline acquires a very distinctive odor similar to varnish and causes rapid deterioration to synthetic rubber parts and also forms a gummy deposit on the internal metal parts. This condition, however, does not occur during normal operation of the carburetor where fresh fuel is being constantly circulated.

5-5. If it is known that an airplane is going to be taken out of service, for a period of more than 10 days, it is recommended that the fuel section of the carburetor be completely drained of all fuel. (See Section III, Paragraph 9.) Install drain plugs and connect an oil supply line to the carburetor fuel inlet and inject oil into the carburetor at 5 psi. The oil must be Grade 1010 conforming to Aeronautical Specification No. MIL-O-6081. Continue pumping oil to the carburetor until oil flows from the discharge nozzle insuring that the carburetor is completely filled.

5-6. If practical, the following alternate method can be used for short storage periods. Instead of oil flushing the carburetor, the fuel system may be pressurized every 3 or 4 days on airplanes incorporating a fuel boost pump. This is accomplished by placing the mixture control in "Rich" and moving the throttle to half open position, then momentarily operating the boost pump until fuel starts

to flow from the manifold drain. Return mixture control to cut-off and close throttle valve. This will insure that the carburetor is completely filled with fuel.

LUBRICATION

5-7. There is very little need for lubrication of the carburetor in the field between regular overhauls. However, the clevis pins used in connection with the throttle and manual mixture control levers should be checked for freedom of movement and lubricated, if necessary, as directed in the airplane manufacturer's handbook.

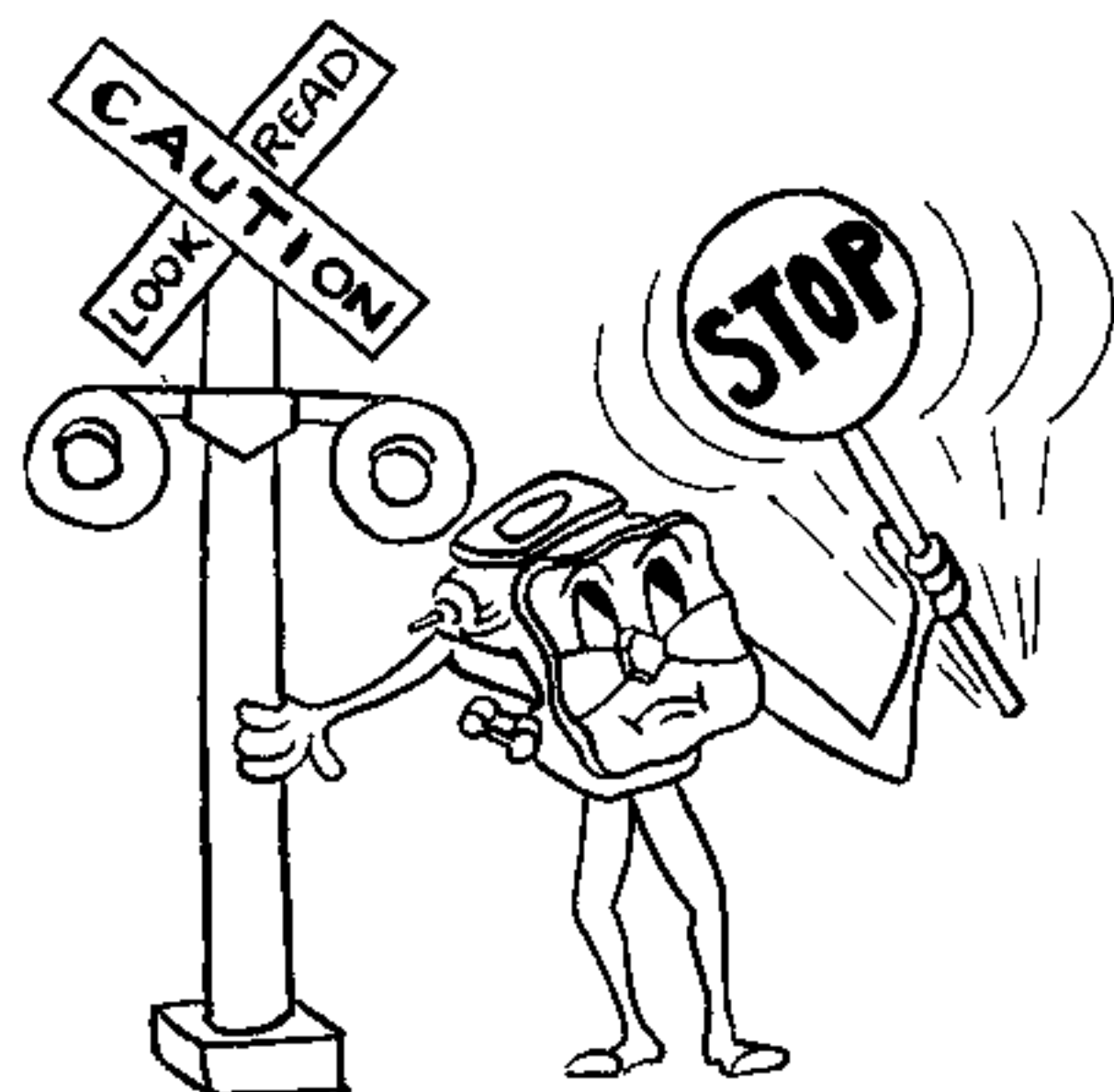
PREPARATION FOR STORAGE

5-8. Any unit taken out of service or units being returned for overhaul must be flushed with preserving oil (Specification MIL-O-6081, Grade 1010), using the following procedure:

- a. Remove plugs and drain all fuel from the carburetor, then apply 10 to 15 psi air pressure to the carburetor inlet, until all fuel is discharged from the discharge nozzle.
- b. Replace plugs and apply flushing oil filtered through a 10-micron filter at 13-15 psi to the carburetor fuel inlet until oil is discharged from the discharge nozzle.
- c. Replace fuel inlet shipping plug.



Do not exceed the above air pressures as internal damage to the carburetor may result.



d. After filling with preservative oil the carburetor should be protected from dust and dirt, and given such protection against moisture as climatic conditions at the point of storage require. In most cases, storing the unit in a dry area will be sufficient.

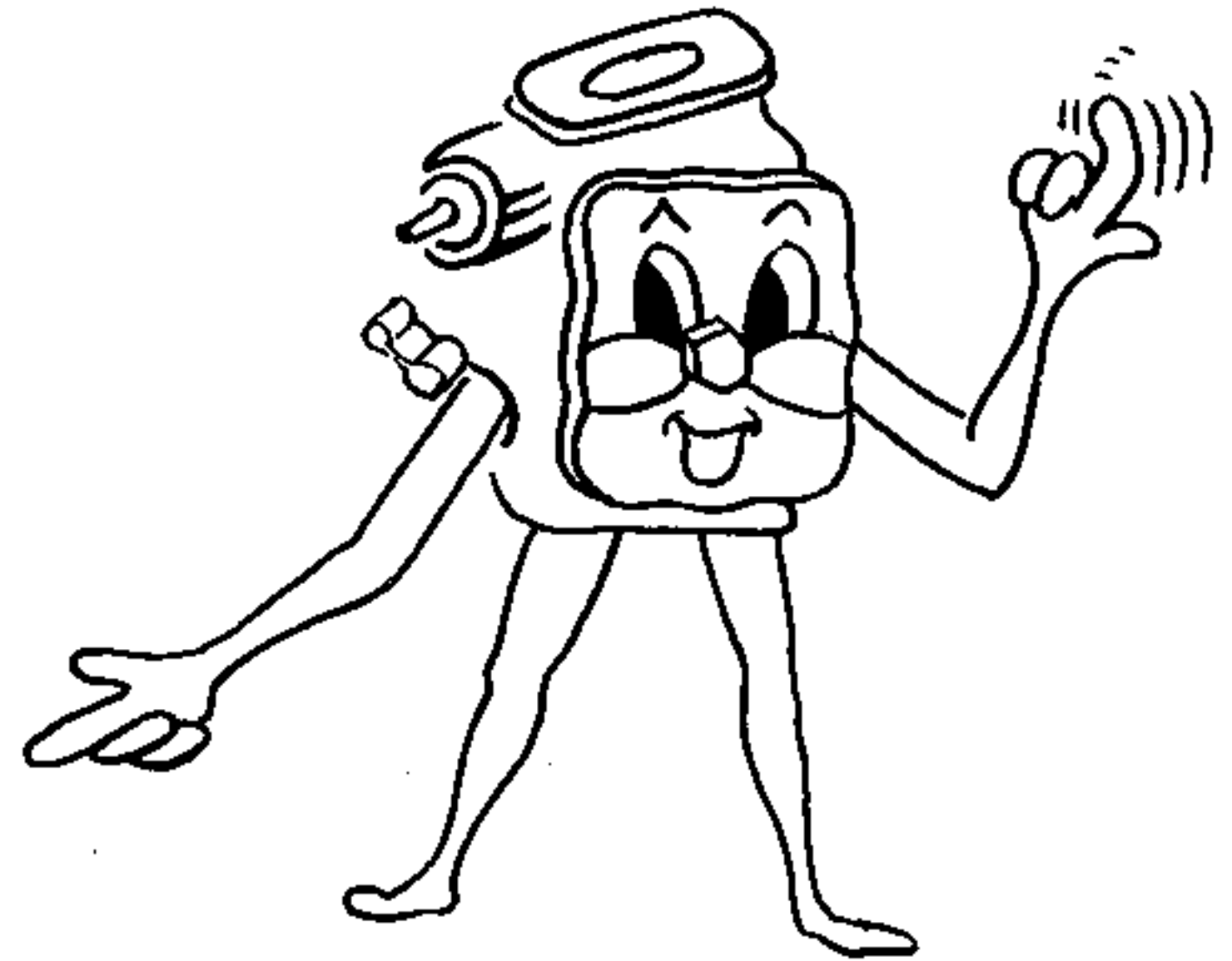
e. If the unit is to be stored near or shipped over salt water, the following precautions should be observed:

(1) Spray the exterior of the carburetor with an approved preservative oil.

(2) Pack in a sealed dustproof container, wrap the container with moisture and vaporproof material and seal. Pack the wrapped unit in a suitable shipping case.

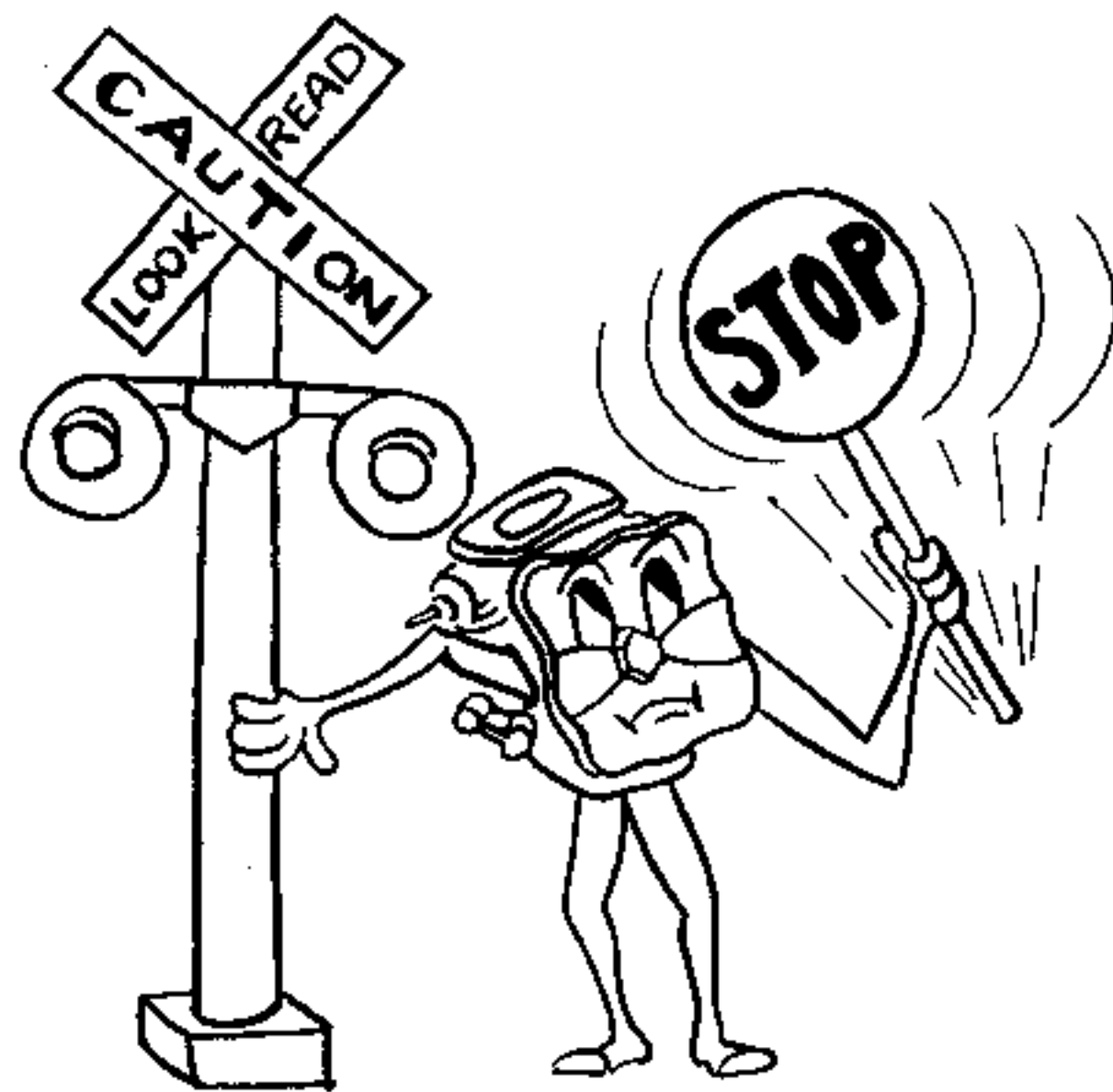
NOTE

Pack a one-half pound bag of silica gel crystals in the dustproof container with the carburetor. The bag must not touch the carburetor.



CAUTION

Extreme caution should be exercised when handling or working around the carburetor to prevent oil or fuel from entering the air sections of the carburetor. As explained previously, damage to the air diaphragm will result. Fluid can easily enter the air section of the carburetor through the annular groove around the venturi at the scoop mounting flange. For this reason some protection plate should be installed on the scoop mounting flange when performing routine maintenance on the engine, such as washing down the engine and air scoop, servicing the air filter (surplus oil on the element) or when injecting preservative into the engine prior to storing or shipping.



SECTION VI

CARBURETOR NOTES, GROUND & FLIGHT

6-1. INDUCTION SYSTEM ICING. There are two types of icing conditions which are of considerable concern to the operator of any airplane. The first is ice formation due to fuel vaporization and the second is rime or atmospheric icing. The conditions that bring about these two ice formations are considerably different in their origin and therefore will be discussed separately.

6-2. VAPORIZATION ICING. Ice formation within the carburetor due to fuel vaporization, or refrigeration, is a result of a temperature drop at the point of fuel injection into the air stream. The rapid vaporization of the gasoline at the point of injection can result in a 40°-70°F drop in temperature. As moisture is always present in engine intake air, ice will form in the immediate area downstream from the discharge nozzle, (point of injection). In a float type carburetor, this ice will usually form on the throttle valve and shaft, and if permitted to accumulate, will restrict the induction system to such an extent as to cause complete engine failure.

a. One of the main advantages of the "PS" type of carburetor is its "non-icing" characteristics. As fuel is discharged directly into the intake manifold the possibility of fuel vaporization within the throttle body of the carburetor is eliminated. However, under ideal icing conditions, ice may form in the manifold riser and will be evidenced by a gradual loss of power or erratic engine operation. This condition can be corrected by the application of carburetor heat.

6-3. ATMOSPHERIC ICING. Atmospheric or rime ice will usually form when flying through heavy rain, snow or ice when the temperature is in the vicinity of 32°F. This type of ice not only collects on the wing and propeller surfaces of the aircraft, but may completely restrict the inlet air scoop filter. As this ice cannot be removed by the application of carburetor heat, continued flight must be made on either heated or protected intake air.

6-4. RAIN. When operating an aircraft in areas of heavy precipitation, unstable metering of fuel by the carburetor may be experienced. That is, the carburetor may seem to go "rich" or "lean". This unstable effect is the result of water passing through the air sections of the carburetor and seems to have the greatest effect on downdraft installations.

a. Lean conditions may result from water passing through the venturi tube, thus causing a reduction in venturi suction, and on carburetors equipped with an automatic mixture control when water passes through the AMC needle orifice.

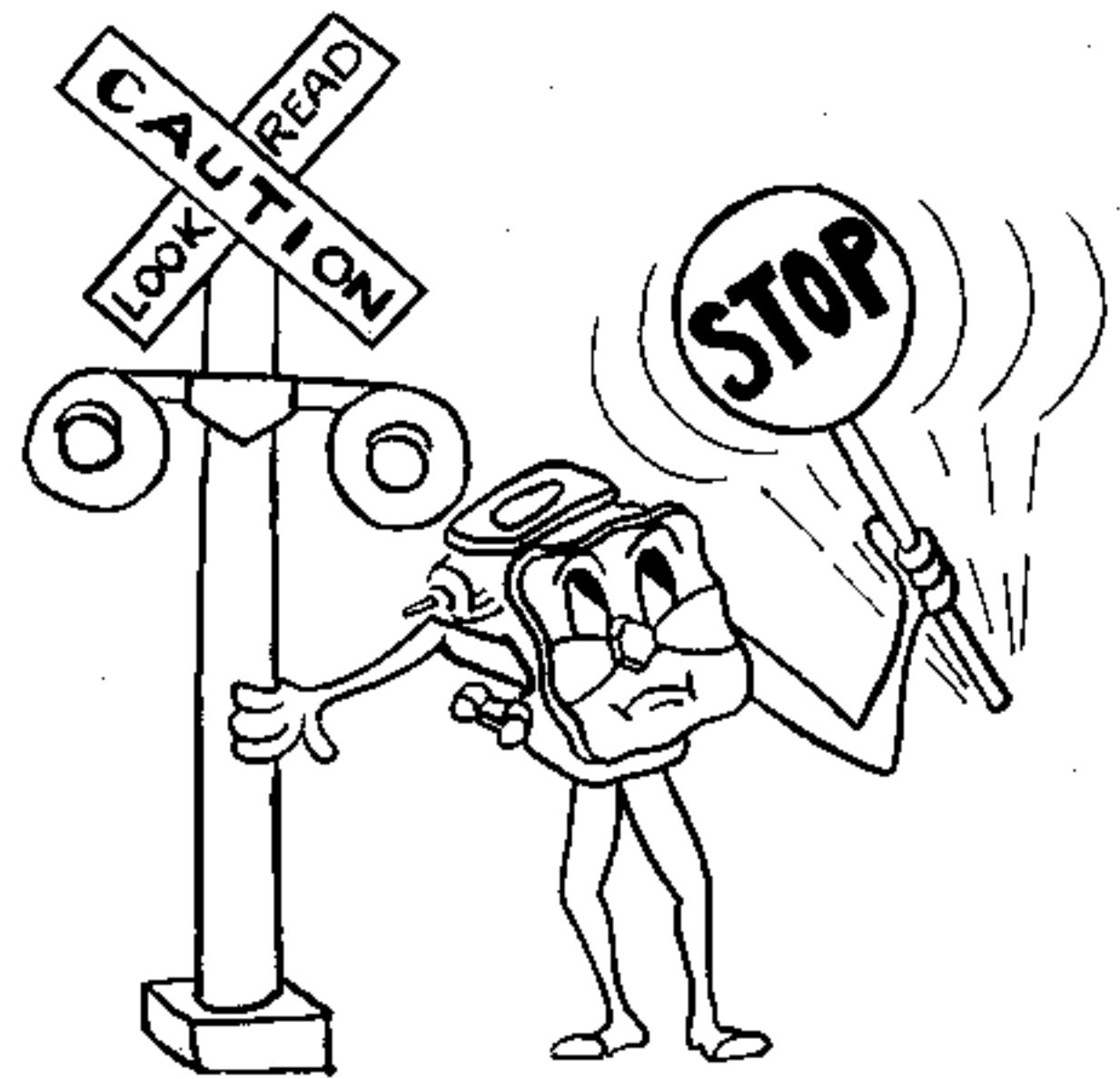
b. Unstable metering on PSD carburetors may result from water passing through the vacuum reducer and will usually be apparent by rough engine operation.

c. Standpipe type vacuum reducers are now incorporated in PS downdraft models to minimize the effect of the natural moisture traps in the air sections resulting from its installed attitude.

6-5. ICE AND SNOW. Power loss resulting from induction system restriction is often encountered when operating under these conditions. The restriction can form in the air scoop, air filter, or carburetor screen, (if used). Preventative action consists of merely the moderate application of carburetor heat prior to entering this type of precipitation. In the event a restriction has already accumulated, the application of carburetor heat and/or protected air source must be sufficient enough to raise the temperature of the critical areas above freezing.



The maximum C.A.T. specified by the engine manufacturer must not be exceeded.



6-6. To summarize the foregoing paragraphs, it has not been practical to provide features that would completely eliminate operational difficulties due to icing. An even distribution of heated air available for the induction system will allow operation of the aircraft under adverse weather conditions by pilots instructed in precautionary and corrective measures.

FLIGHT NOTES ON THE AUTOMATIC MIXTURE CONTROL AND AIRFLOW ENRICHMENT VALVE

6-7. In an aircraft engine without super-charger, a loss of power is experienced with any increase in altitude above sea level, due to

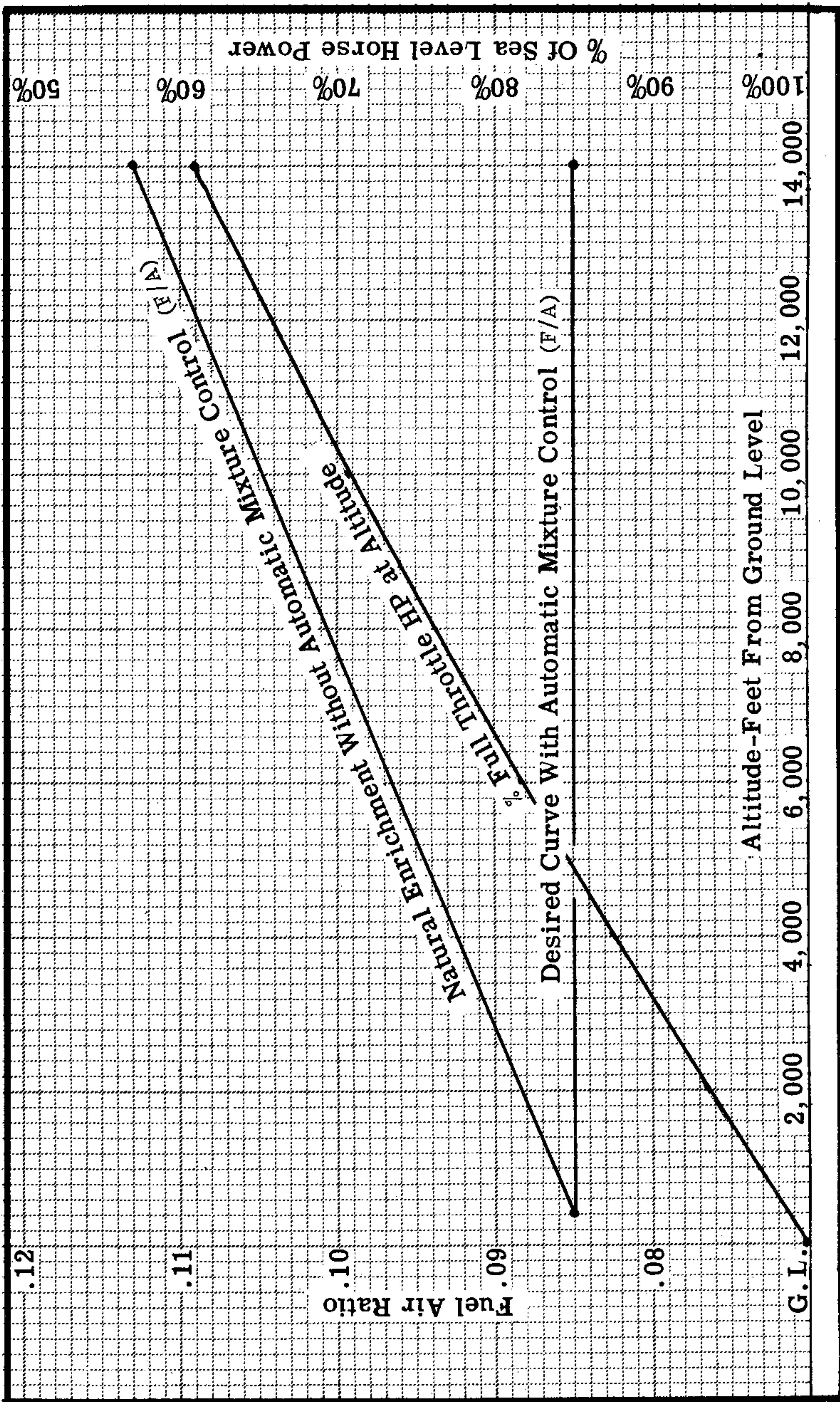


Figure 15.

the lower air density or lighter atmosphere (pounds per cubic feet). As an example an engine without super-charger at 1000 feet will develop approximately 96.8% of its rated sea level full throttle horsepower, at 10,000 feet 70.8% and at 20,000 feet only 48.0%. (Refer to chart, figure 25.)

a. The automatic mixture control, through its air pressure and temperature sensing bellows arrangement, controls the position of a contoured needle in an orifice. Each position of the needle in relation to the orifice represents a different air density condition with correction for prevailing carburetor air inlet temperature. The automatic mixture control through this mechanical arrangement automatically regulates the venturi suction force applied to chamber "B" of the regulator, effecting the necessary fuel flow adjustment to meet each change in engine requirement.

6-8. The same controlled venturi suction established by the automatic mixture control is also applied to the air side of the airflow enrichment valve diaphragm, controlling the amount of enrichment valve opening. Thus the regulating action of the AMC also reflects in the amount of enrichment valve opening. This combination gives the desired correction for variations in the engine load requirements through the enrichment range (approximately 50% to 100% of sea level rated horsepower) during both part throttle and full throttle operation. It must be remembered that it is the function of the carburetor with automatic mixture control unit and airflow enrichment valve to maintain a correct fuel-air ratio to the engine regardless of power, load or altitude conditions so that the maximum possible percent of sea level horsepower can be obtained automatically for each service altitude.