

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-143
Relating to Exemptions under Section 27156
of the Vehicle Code

OHG, INC.
VAPORIZER/REGULATOR MODEL X-1

Pursuant to the authority vested in the Air Resources Board by Section 27156 of the Vehicle Code; and

Pursuant to the authority vested in the undersigned by Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-45-5;

IT IS ORDERED AND RESOLVED: That the installation of the OHG, Inc. vaporizer/regulator model "X-1" manufactured by OHG, Inc., of 10065 A Greenleaf Avenue, Santa Fe Springs, California 90670, to be used as a substitute for Impco Carburetion Inc.'s "E" or "L" models which are components of certified Impco Carburetion, Inc.'s gaseous fuel conversion systems, has been found not to reduce the effectiveness of required motor vehicle pollution control devices and, therefore, is exempt from the prohibitions of Section 27156 of the Vehicle Code for 1984 and older model-year vehicles, excluding:

1. vehicles equipped with closed-loop carburetion (computer controlled carburetors) systems;
2. vehicles equipped with fuel injected engines;
3. vehicles equipped with unconventional engines such as stratified charge or rotary;
4. vehicles equipped with turbochargers.

This Executive Order is valid provided that installation instructions for this device will not recommend tuning the vehicle to specifications different from those submitted by the device manufacturer.

Changes made to the design or operating conditions of the device, as exempted by the Air Resources Board, that adversely affect the performance of a vehicle's pollution control system shall invalidate this Executive Order.

Marketing of this device using an identification other than that shown in this Executive Order or marketing of this device for an application other than those listed in this Executive Order shall be prohibited unless prior approval is obtained from the Air Resources Board. Exemption of a kit shall not be construed as an exemption to sell, offer for sale, or advertise any component of a kit as an individual device.

This Executive Order does not constitute any opinion as to the effect that the use of this device may have on any warranty either expressed or implied by the vehicle manufacturer.

THIS EXECUTIVE ORDER DOES NOT CONSTITUTE A CERTIFICATION, ACCREDITATION, APPROVAL, OR ANY OTHER TYPE OF ENDORSEMENT BY THE AIR RESOURCES BOARD OF ANY CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF THE OHG, INC. VAPORIZER/REGULATOR MODEL "X-1".

No claim of any kind, such as "Approved by Air Resources Board" may be made with respect to the action taken herein in any advertising or other oral or written communication.

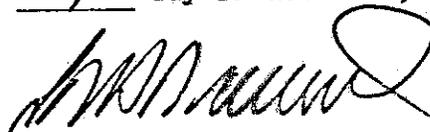
Section 17500 of the Business and Professions Code makes untrue or misleading advertising unlawful, and Section 17534 makes violation punishable as a misdemeanor.

Section 43644 of the Health and Safety Code provides as follows:

"43644. (a) No person shall install, sell, offer for sale, or advertise, or, except in an application to the state board for certification of a device, represent, any device as a motor vehicle pollution control device for use on any used motor vehicle unless that device has been certified by the state board. No person shall sell, offer for sale, advertise, or represent any motor vehicle pollution control device as a certified device which, in fact, is not a certified device. Any violation of this subdivision is a misdemeanor."

Any apparent violation of the conditions of this Executive Order will be submitted to the Attorney General of California for such action as he deems advisable.

Executed at El Monte, California, this 17th day of November, 1983.



K. D. Drachand, Chief
Mobile Source Division

STATE OF CALIFORNIA

AIR RESOURCES BOARD

EVALUATION OF OHG, INC.'S VAPORIZER/REGULATOR MODEL X-1 FOR EXEMPTION FROM
THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION
2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE

NOVEMBER 15, 1983

Issue Date: November 15, 1983

EVALUATION OF OHG, INC.'S VAPORIZER/REGULATOR MODEL X-1 FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE

by

MOBILE SOURCE DIVISION

State of California
AIR RESOURCES BOARD
9528 Telstar Avenue
El Monte, CA 91731

(This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.)

SUMMARY

OHG, Inc. has requested approval of their gaseous fuel vaporizer/regulator model "X-1" as a substitute for Impco Carburetion Inc.'s "E" or "L" models which are equivalent components of certified Impco Carburetion, Inc.'s gaseous fuel conversion systems.

OHG has submitted a pictorial and written comparison of both OHG and Impco vaporizers/regulators. OHG has also submitted comparative (vehicle converted to operate on gaseous fuel with Impco's "L" vaporizer/regulator versus OHG's "X-1" vaporizer/regulator) hot-start 505 l-bag emission test data. The tests were performed using a 1980 Ford Fairmont vehicle powered by a 200 CID engine.

Based on the staff's engineering evaluation (comparison of OHG's and Impco's vaporizers/regulators) and the test data submitted by OHG, the staff has concluded that OHG's vaporizer/regulator, in substitution for Impco's "E" or "L" vaporizer/regulator, will not adversely affect exhaust emissions.

The staff recommends that OHG's vaporizer/regulator model "X-1" be certified, thus allowing substitution of the "X-1" model for the Impco "E" or "L" models. The staff also recommends that Executive Order D-143 be issued.

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EVALUATION OF OHG, INC.'S VAPORIZER/REGULATOR MODEL X-1 FOR EXEMPTION FROM THE PROHIBITIONS IN VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA ADMINISTRATIVE CODE

I. INTRODUCTION

OHG, Inc., of 10065 A Greenleaf Avenue, Santa Fe Springs, California 90670, has requested approval of their gaseous fuel vaporizer/regulator model "X-1" as a substitute for Impco Carburetion, Inc.'s "E" or "L" models which are components of certified Impco Carburetion, Inc.'s gaseous fuel conversion systems.

OHG has submitted a pictorial and written comparison of both OHG and Impco vaporizers/regulators. OHG has also submitted comparative (vehicle converted to operate on gaseous fuel with Impco's "L" vaporizer/regulator versus OHG's "X-1" vaporizer/regulator) hot-start 505 1-bag emission test data. The tests were performed under contract by Olson Engineering, Inc. in Huntington Beach, California, using a 1980 Ford Fairmont vehicle powered by a 200 CID engine.

II. CONCLUSION

Based on the staff's engineering evaluation (comparison of OHG's and Impco's vaporizers/regulators) and the test data submitted by OHG, the staff has concluded that OHG's vaporizer/regulator, in substitution for Impco's "E" or "L" vaporizer/regulator, will not adversely affect exhaust emissions.

III. RECOMMENDATIONS

The staff recommends that OHG's vaporizer/regulator model "X-1" be exempted, thus allowing substitution of the "X-1" model for the Impco "E" or "L" models for 1984 and older model-year vehicles, excluding:

1. vehicles equipped with closed-loop carburetion (computer controlled carburetors) systems;
2. vehicles equipped with fuel injected engines;
3. vehicles equipped with unconventional engines such as stratified charge or rotary;
4. vehicles equipped with turbochargers.

The staff also recommends that Executive Order D-143 be issued.

IV. VAPORIZER/REGULATOR DESCRIPTION AND COMPARISON

The OHG vaporizer/regulator model "X-1" is designed to replace Impco's "E" or "L" models during installation of certified Impco gaseous fuel conversion systems.

Both, OHG and Impco, vaporizers/regulators reduce the liquefied fuel pressure from the tank to 1.5 psi in a first stage of regulation, and require a 1.5" H₂O vacuum to draw the fuel from the regulator to the carburetor. However, according to OHG, the "X-1" vaporizer/regulator is designed for improved vaporization of the fuel for smooth operation and start up in extremes of low and high temperatures.

For a pictorial and written comparison (internal and external) of both OHG and Impco vaporizers/regulators see Appendices.

V. EVALUATION

The staff performed an engineering evaluation of the OHG vaporizer/regulator. Evaluation consisted of reviewing and comparing the design and operational characteristics of both OHG and Impco vaporizers/regulators. The regulators reduce the pressure of the fuel to the same level and allow the vaporized fuel to be drawn into the carburetor under the same degree of negative pressure. Therefore, exactly the same amount of

fuel will be delivered through the "X-1" to the engine as the "L" regulator. The improved heat-transfer design of the "X-1" vaporizer enhances engine start-up in cold weather, but at the same time, tends to increase the temperature of the fuel. Hot start emissions tests were, therefore, performed to check whether it, high fuel temperature, will have any adverse effect on emissions.

A California-certified 1980 Ford Fairmont powered by a 200 CID engine was used for the emissions impact evaluation. Testing consisted of comparative (vehicle converted to operate on gaseous fuel with Impco's "L" vaporizer/regulator versus OHG's "X-1" vaporizer/regulator) hot-start 505 T-bag emission tests. A summary of the test results is shown in the Appendices.

VI. DISCUSSION

Impco previously claimed that their model "L" vaporizer/regulator has the same performance characteristics, including discharge pressure/rate and heat exchange capacity, as the "E" model. The components of these two Impco vaporizers/regulators are somewhat different in design; however, they operate in the same manner and meet the same performance requirements. Impco submitted, in 1982, comparative emission test data to demonstrate the equivalency of the two vaporizers/regulators.

The model "L" vaporizer/regulator has, therefore, been approved as an alternate for the E model (CARB Executive Order B-4-8A, dated December 15, 1982).

OHG, Inc. specifically stated in its application that the "X-1" converter is not a substitution for automobiles with feed-back controls.

Based on the fact that both Impco and OHG vaporizers/regulators have identical first and second stage regulation pressures and based on the comparative emission test results, the staff concludes that their performance and functions are the same and the "X-1" vaporizer/regulator may be used in place of the Impco "E" or "L" models.

APPENDICES

Table

Comparison of OHG X-1 Model Versus
Impco L Model Vaporizer/Regulators
1980 Ford Fairmont - 200 CID
Hot-Start 505 Tests

<u>Vaporizer/Regulator</u>	<u>Exhaust Emissions (gm/mi)</u>			<u>Fuel</u> <u>Economy</u>
	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>(mpg)</u>
Impco L	0.24	1.2	1.9	15.70
OHG X-1	0.21	0.1	2.1	15.89

OHG, INC. MODEL X-1
VAPORIZER-REGULATOR (CONVERTER)
REPLACEMENT FOR IMPCO MODELS L AND E

RICHARD BAVERSTOCK, VICE PRESIDENT ENGINEERING FOR OHG, INC., IN HIS PREVIOUS 25 YEAR EMPLOYMENT BY IMPCO CARBURETION INC., DESIGNED THE IMPCO MODELS E, J AND L CONVERTERS MARKETED BY THAT FIRM AND ACCEPTED BY THE CALIFORNIA AIR RESOURCES BOARD THROUGH 1983.

AS A LOGICAL PROGRESSION AS A FIRST STEP IN PRODUCING AN ADVANCED CARBURETION SYSTEM FOR OHG, INC., MR. BAVERSTOCK DESIGNED THE X-1 MODEL TO BE COMPATIBLE WITH IMPCO CARBURETORS, ALSO DESIGNED IN THEIR ENTIRETY BY MR. BAVERSTOCK. THE DESIGN OF THE CARBURETORS UTILIZES A CONSTANT DEPRESSION (AIR VALVE) TYPE OF CONSTRUCTION, WHICH, WITH INNOVATIONS, WILL BE THE BASIS OF OHG, INC. CARBURETOR DESIGNS AS WELL.

AS MAY BE SEEN IN THE PICTURES COMPARING THE IMPCO MODEL L AND THE OHG, INC. MODEL X-1, THE BASIC DESIGN IS SIMILAR IN THAT EACH RECEIVES LIQUID FUEL FROM THE SUPPLY TANK AT PROX. 180 PSI.

THIS PRESSURE IS REDUCED TO ~~15 PSI~~ (40" H2O) IN A FIRST STAGE OF REGULATION (AS SHOWN ON GAUGE # 1). UPON RELEASE FROM THE PRIMARY REGULATOR, THE LIQUID FUEL IS PROPELLED AGAINST THE HEATED WALLS OF THE VAPORIZING MAZE WHERE THE FUEL IS CONVERTED TO A DRY GAS AND HEATED TO APPROXIMATELY 80° F AT FULL RATED CAPACITY OF 300 HP FOR THE X-1.

THE FUEL FLOW IS STOPPED AT A SECONDARY REGULATOR VALVE WHEN THE ENGINE IS NOT IN USE. A VACUUM OF ~~15" H2O~~ IS REQUIRED TO DRAW FUEL FROM THE VAPORIZER REGULATOR. (SHOWN AT GAUGE #2)

THESE PRESSURES ARE COMMON TO ALL BAVERSTOCK DESIGNED VAPORIZER-REGULATORS MANUFACTURED IN THE PAST TWENTY FIVE YEARS.

THERE ARE DESIGN DIFFERENCES IN THE X-1 FOR WHICH PATENTS ARE BEING REQUESTED. THESE ARE DESIGNED TO IMPROVE COLD WEATHER (-30°) VAPORIZATION, MORE ACCURATE FIRST STAGE REGULATION AND ECONOMICAL MEANS OF MANUFACTURE. THESE DIFFERENCES WOULD NOT AFFECT EMISSIONS IN EVERY DAY USE, BUT SHOULD LESSEN EMISSIONS IN UNUSUALLY COLD CONDITIONS.

OHG, INC. CATEGORICALLY ASSERTS THAT EMISSIONS WILL NOT BE INCREASED BY SUBSTITUTION OF THE X-1 FOR ANY IMPCO VAPORIZER-REGULATOR USED WITH THE CONSTANT DEPRESSION (AIR VALVE) DESIGN OF CARBURETORS.

OHG, INC. DOES NOT RECOMMEND THE USE OF IT'S VAPORIZER-REGULATOR WITH ELECTRONIC FEED-BACK APPLICATIONS IN THEIR PRESENT FORM. IT'S PLANNED MARKET IS FOR USE ON LIGHT, MEDIUM AND HEAVY DUTY TRUCKS. OHG, INC. IS RECOMMENDING AGAINST PASSENGER CAR INSTALLATIONS BECAUSE OF MINIMAL UNDERHOOD ROOM AND HIGH LIABILITY RISK.

VAPORIZER-REGULATOR COMPARISON

OHG, INC. MODEL X-1

IMPCO MODEL L

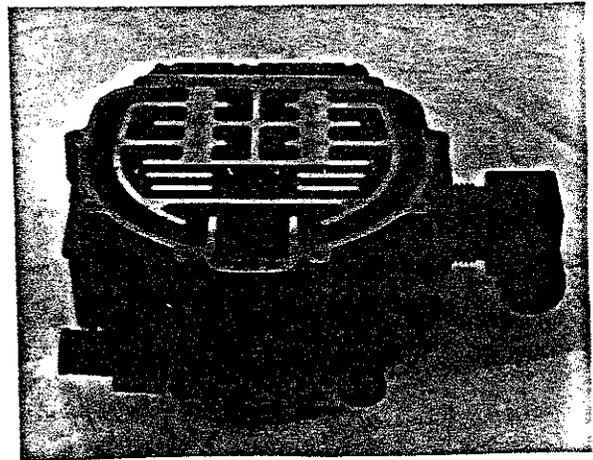
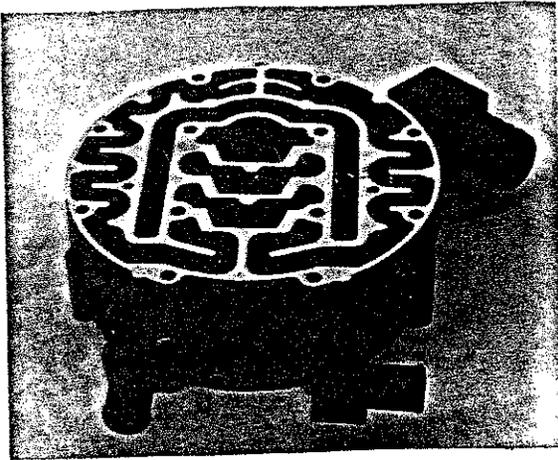
#1

VAPORIZER LABYRINTH

NOTE MAXIMUM AREA OF X-1 VAPORIZER UTILIZED FOR HEAT TRANSFERENCE FROM "U" SHAPED COOLANT WATER PASSAGE TO SURROUNDING GAS PASSAGES. THE THREE CENTRAL CAVITIES CONNECT SEQUENTIALLY THROUGH DRILLED HOLES IN THE LOWER ANGLED WALLS. LIQUID FUEL ENTERS THE UPPER CENTER CHAMBER, PROGRESSES THROUGH THE LOWER CHAMBERS, AROUND THE OUTSIDE LABYRINTH TO THE FUEL OUTLET AT THE TOP OF THE PICTURE UNDER THE CURVED DIRECTIONAL FLOW VANE. THIS DESIGN INSURES FUEL VAPORIZATION IN THE COLDEST WEATHER.

MODEL X-1

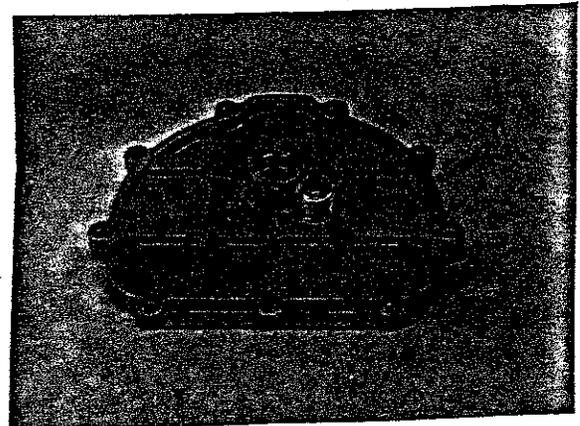
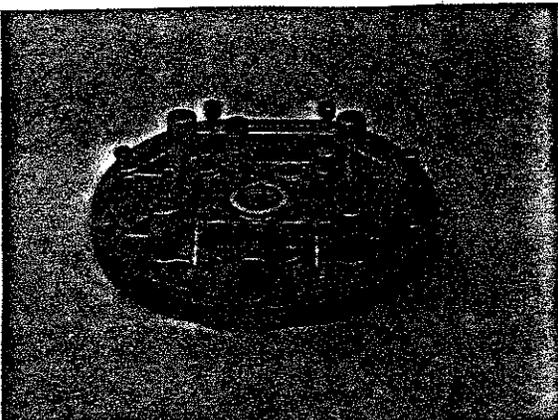
MODEL L



#2

VAPORIZER COVER (BACK)

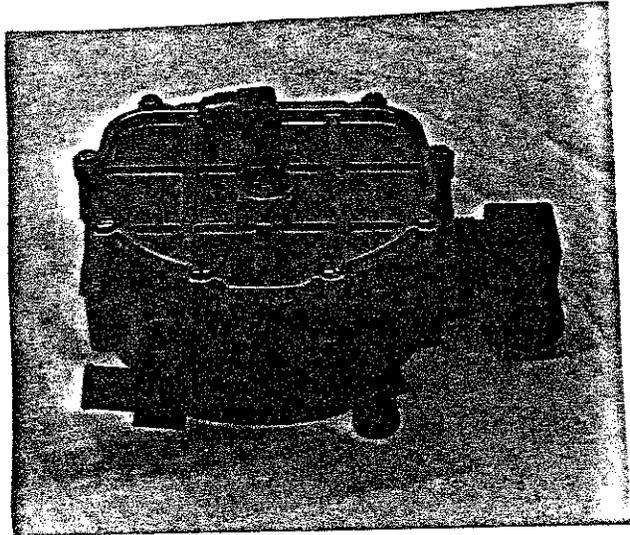
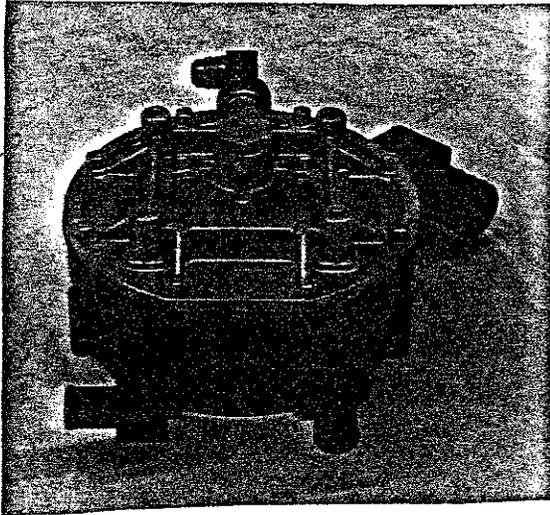
EACH UTILIZES A PRIMARY VALVE CLOSING IN THE DIRECTION OF FUEL FLOW. IMPCO L FUEL ENTRY DIRECT THROUGH BACK COVER, OHG, INC. FUEL ENTRY THROUGH SIDE OF COVER TO REDUCE ASSEMBLED BULK.



#3

VAPORIZER COVER ASSEMBLED TO BODY

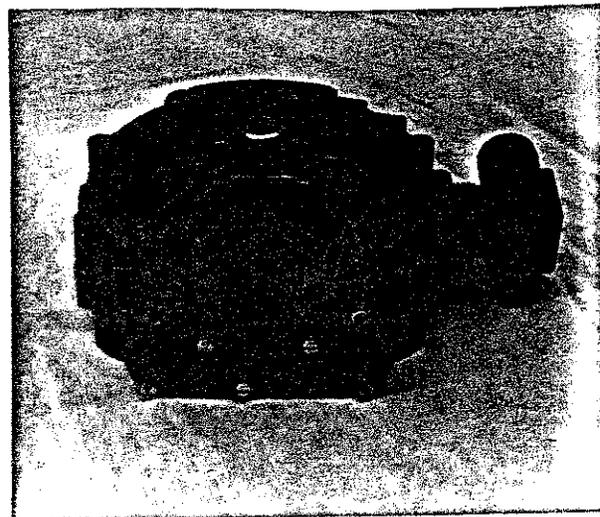
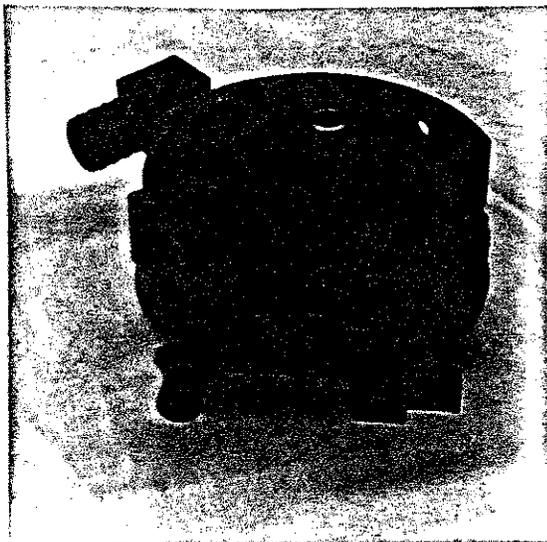
SHOWS ASSEMBLY WITH FUEL INLET FITTINGS, GAS OUTLET FITTINGS ON THE RIGHT, AND WATER INLET AND OUTLET FITTINGS IN PLACE.



#4

VAPORIZER-REGULATOR BODY, TOP VIEW

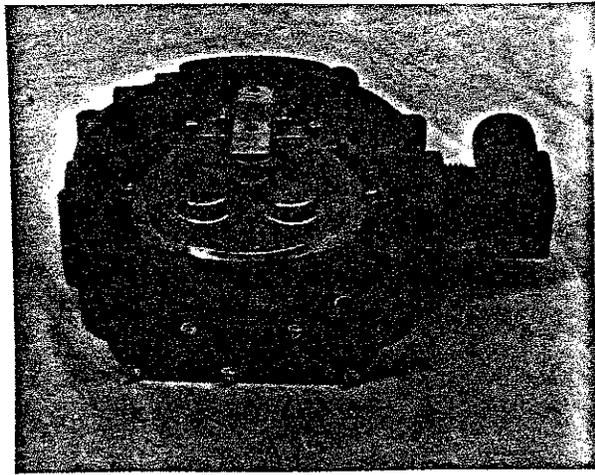
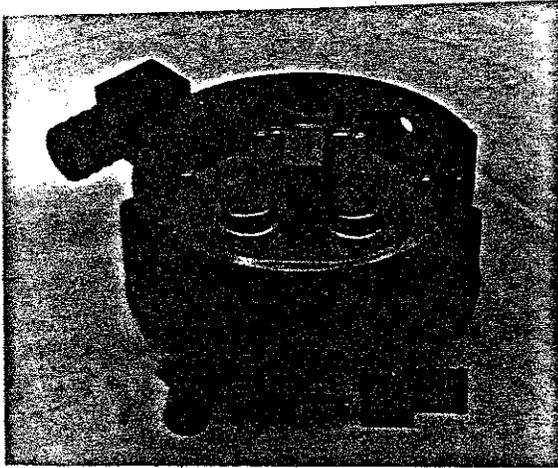
SHOWS SIMILAR CONSTRUCTION WITH SECONDARY REGULATOR FUEL INLET JETS AT TOP OF PICTURE. NOTE LARGER AREA OF PRIMARY REGULATOR DIAPHRAGM MOUNTING BASE IN X-1 CASTING.



#5

PRIMARY DIAPHRAGM AND COVER ASSY. INSTALLED

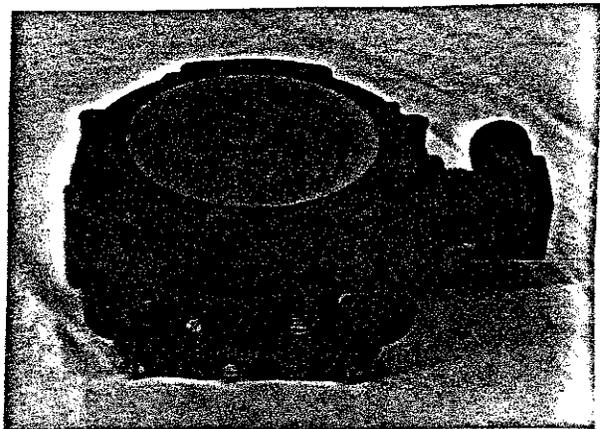
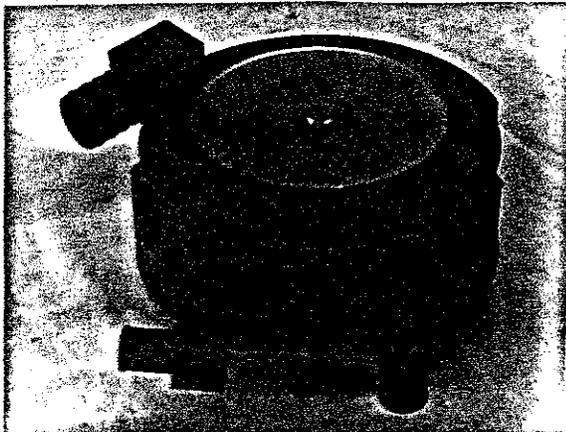
NOTE LARGER DIAMETER OF OHG, INC. MODEL X-1 PRIMARY REGULATOR DIAPHRAGM AND COVER FOR MORE ACCURATE CONTROL OF PRIMARY FUEL PRESSURE OF 1.5 PSI (40" H2O). INSTALLED ON EACH COVER IS THE SECONDARY VALVE LEVER AND SEAT ASSEMBLY HELD CLOSED BY A SPRING UNDER EACH LEVER. THIS SPRING TENSION DETERMINES THE OUTLET FUEL PRESSURE OF -1.5" H2O (PARTIAL VACUUM).



#6

SECONDARY REGULATOR DIAPHRAGMS IN PLACE

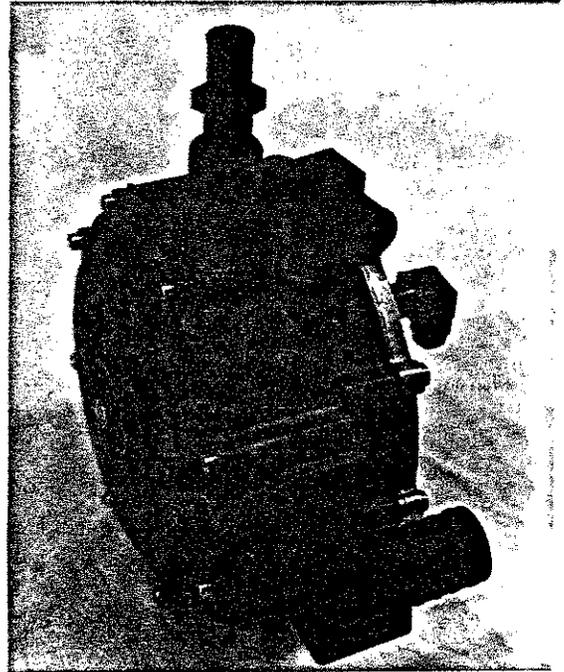
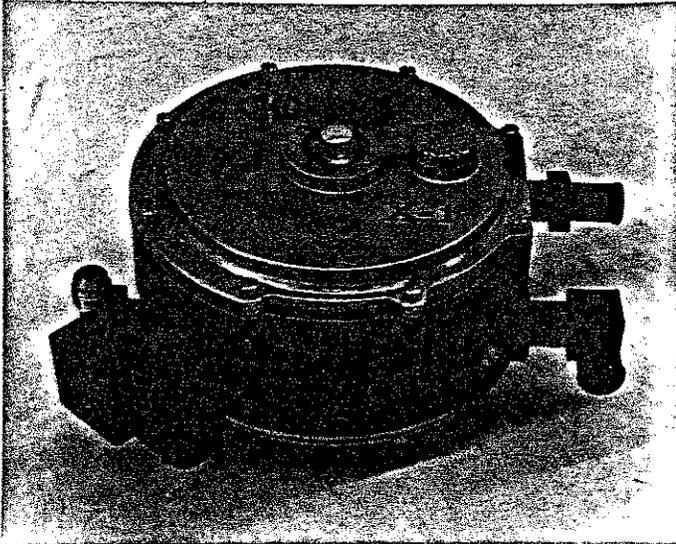
AREA OF SECONDARY REGULATOR DIAPHRAGM IS SLIGHTLY GREATER IN THE IMPCO MODEL L (1/8" DIA.)



#7

COMPLETED ASSEMBLIES OF X-1 AND L VAPORIZER-REGULATORS

NOTE REDUCED BULK OF X-1 ASSEMBLED FOR EASE OF INSTALLATION.



#8

PRESSURE GAUGES WITH ENGINE RUNNING

GAUGE #1

SHOWS PRECISE 40" H2O PRIMARY
REGULATOR PRESSURE W/ENGINE RUNNING

GAUGE #2

SHOWS -1.5" H2O (VACUUM)
REQUIRED TO DRAW FUEL FROM
THE X-1 VAPORIZER-REGULATOR

