

Special Fair of Science Projects—50 Pages

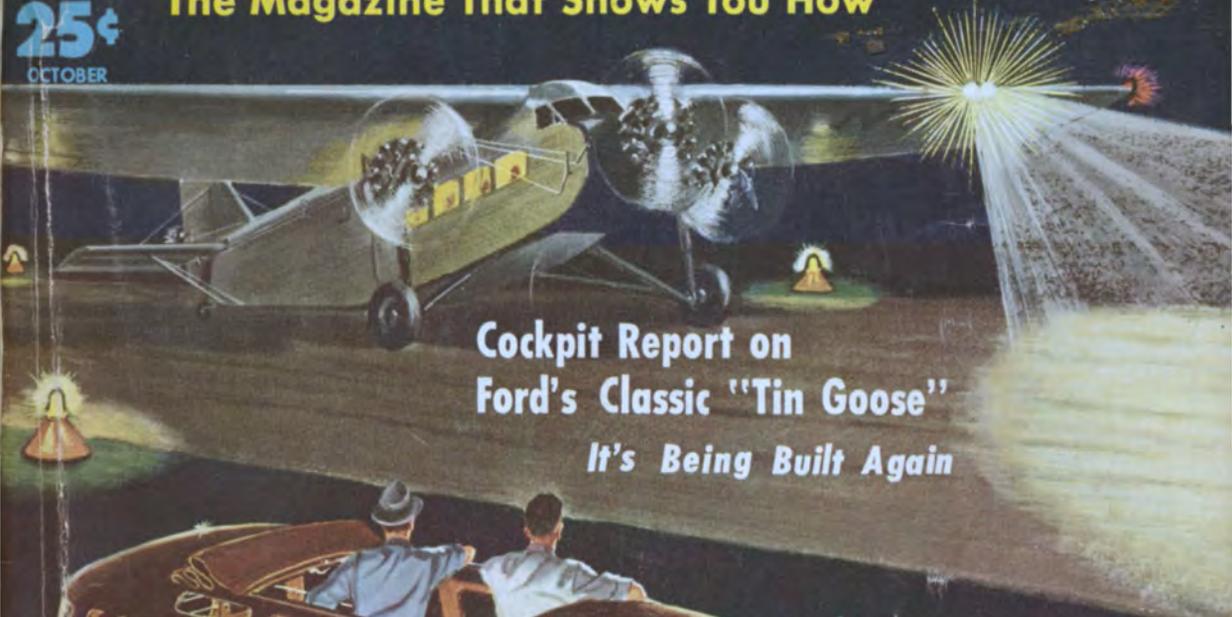
**Cloud Chamber – Electric Slide Rule – Photographing Stars
and Satellites**

SCIENCE and MECHANICS

–Firing Rockets
–Basement Ballistics
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Camera Case
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–and many others

The Magazine That Shows You How

25¢
OCTOBER



**Cockpit Report on
Ford's Classic "Tin Goose"
*It's Being Built Again***





Individual wheel suspension may make the VW Microbus look a little bow-legged on the turns, but the tilt or sway angle was only $3\frac{1}{2}^\circ$ on our circle test.

ground clearance, and a sliding roof that is ideal for moon-gazers and suntan worshippers.

On the other hand, speed worshippers would do well to stick to a wagon with more horses. If you insist, the Microbus will do 58 true *mph* or even top 60 *mph* with a slight tailwind helping. Although the ride at these speeds feels much smoother than you would expect of such a relatively light 2,450-pounder, the engine is laboring far beyond its rated speed. As any strudel-noggin knows, this makes for *eines kurzes leben*. In fact, there's a decal pasted on the windshield that tells you this vehicle should not be driven over 50 *mph*.

Unless you've had experience driving buses or delivery trucks, your first trip in the Microbus will be a memorable one. After you step up into the driver's seat (and it's a long stretch for the short-legged), you suddenly find yourself up high and up front with no gleaming hood and engine to hide behind, and driver vision that will let you see the potholes a few feet in

What our tests reveal about

Volkswagen's Unique Station Wagon—Bus

SMALL car maneuverability, a bus driver's view of the road, and space for a family of nine complete with luggage—such things are built into the remarkable Volkswagen Microbus De Luxe. Along with them goes fuel economy that is almost twice as good as that of the average domestic V-8, a generous nine inch

front of your wheels, as well as the traffic jam miles ahead. In heavy traffic, your bumpers are practically breathing down the tailpipe of the car in front of you. And you suddenly realize how safety conscious you can become. You also find that swinging the bus around the curves is a different kettle

of reflexes. Because you are sitting over your front wheels, you can turn for the curve later than you would with a conventional car, and the tendency is to turn sharper. Steering with the wheel nearly horizontal to you seems to come easily, though, and you'll soon find you can really tuck this baby through snug openings. That's not too surprising, since the Microbus is actually $11\frac{1}{2}$ inches shorter and $5\frac{1}{2}$ inches narrower than the Rambler American—the little Rambler, that is.



You have a bus driver's view of the road ahead in this tall vehicle.

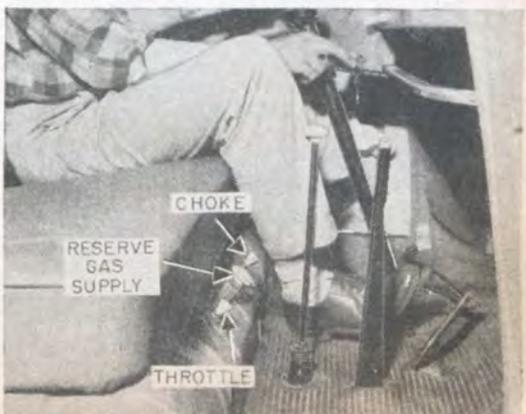


Just the thing for large families or Cub Scout packs. Entrance to the rear is aided (above) by spring-loaded step released by pedal. While bystanders will have no objection, getting in and out of the driver's seat (right) can be awkward for ladies, but getting into the front passenger's side is not too difficult (upper right) because of the fold-down step provided.



While the feeling of not having to worry about what's going on up yonder by the right front fender may be relaxing, the driving of one of these buses in heavy traffic is not. As is true of the rest of the Volkswagen clan, you have to make mit der engine revolutions to keep up with the parade. The small engines and high gear ratios (overall ratio is 22.3 to 1 in 1st gear, 5.1 to 1 in high gear) make this necessary, and the four forward gears make it possible. If you can still remember how to shift for yourself, though, you can scoot right along with the traffic pack. You won't win any drag races but, with smart timing and well-paced down-shifting, you can ride the speed limits fairly consistently everywhere except on the super roads. As an example of why you need to downshift frequently, you would find that, while at around 30 mph you could negotiate a 5% grade in high (4th) gear, at 50 mph this melts to a 1½% grade.

There's a psychological bonus that comes with working away at a gearshift once more. The car responds in direct ratio to your skill in handling it. There's no time delay while the automatic transmission makes up its mind which gear you should be in, and then delivers the goods, often with a lurching screech of rubber. With a gear-shift car, the driver is a boss who makes immediate decisions, and he stays alert in order to make the right ones. Perhaps this is a factor our



Line-up of controls and pedals. Stick shift is a standard H-pattern for four forward speeds. For reverse, you push stick down toward floor, then swing it to the left and down. Note wide and open glove compartment.

MODEL: Volkswagen; Micro Bus DeLuxe; 4 cylinders

TEST DATES: May 26 through June 8, 1958

GENERAL ROAD AND WEATHER CONDITIONS: Portland concrete, generally smooth, level and dry; Spring days: 29.4-29.9 in. Hg. barometric pressure; 60-80° F temperature

MILEAGE AT START: 3060

MILES COVERED: 463

GAS: Regular; **OIL:** SAE 20W-30

CURB WEIGHT (with 10 gal gas): 2450 lbs; 45% on front wheels; 55% on rear wheels

TIRE PRESSURE: 28 psi front; 32 psi rear

SPARK SETTING: 7½° BTC at Idle rpm

REAR AXLE GEAR RATIO: 4.43 to 1 with 1.4 to 1 reduction at rear wheels (or total reduction ratio of 6.2 to 1)

TRANSMISSION: Manual with synchromesh on 2nd, 3rd, 4th gears: 3.6 to 1 in 1st; 1.88 to 1 in 2nd; 1.23 to 1 in 3rd; 0.82 to 1 in 4th; Reverse, 4.63 to 1

TEST DATA

GASOLINE MILEAGE (checked with fuel volume flow meter and 5th wheel. Temperature 73° F; Relative humidity 30%; Barometer 29.6 in. Hg.)

LEVEL ROAD FUEL CONSUMPTION (carried weight 490 lb. Average of two or more runs made in opposite directions over same road):

| | | | | | |
|--------------|------|------|------|------|------|
| True MPH | 25 | 30 | 40 | 50 | 55 |
| True MPG | 32.0 | 31.3 | 29.7 | 25.3 | 21.8 |
| True Ton MPG | 47.0 | 46.0 | 43.6 | 37.2 | 32.1 |

TRAFFIC FUEL CONSUMPTION (carried weight 425 lb): Simulated traffic pattern of city driving—stops, acceleration, braking, at speeds primarily of 30 and 45 mph:

| | | |
|----------|--------------|------------------|
| True MPG | True Ton MPG | True Average MPH |
| 21.3 | 30.6 | 23.2 |

CITY-COUNTRY FUEL CONSUMPTION (miles covered on 5 gal gas at speeds of 30, 40, and 50 mph):

| | | |
|--------------|----------|------------------|
| True Mileage | True MPG | True Average MPH |
| 128.9 | 25.8 | 33.3 |

OVERALL FUEL AND OIL consumed during test, including warm-ups:

| | | | | |
|---------------|----------------|-----------|----------|---------|
| Total Mileage | Total Gal Fuel | Total Oil | True MPG | Oil MPG |
| 463 | 23.0 | -1 qt. | 20.1 | 500 |

OVERALL EFFICIENCY to move car's mass against road friction and air resistance, calculated from level road mpg, weight, and frontal area of car: 13.4% at 30 mph; 19.5% at 50 mph

ACCELERATION—LEVEL ROAD (timed with 5th wheel; carried weight 420 lb; Temperature 84° F; relative humidity 65%; barometer 29.4 in. Hg.; average of two or more runs in opposite directions over same road):

| | | | | | | |
|------------|------|------|------|------|-------|-------|
| True MPH | 0-20 | 0-30 | 0-40 | 0-50 | 20-40 | 20-50 |
| Time (sec) | 5.40 | 10.2 | 19.8 | 38.4 | 14.5 | 33.1 |

Gear Shift Pattern: Standing start; 0-15 mph in 1st; 15 to 31 mph in 2nd; 31 to 43 mph in 3rd; 4th to top speed. 20-40 and 20-50 mph in 3rd gear

SPEED ¼ MILE SPRINT FROM STOP: 45 mph (true) in 26.4 sec.

MINIMUM ACCELERATION time for 0-50 mph (true) over level road with no wind, best spark setting, premium fuel and driver alone: 33.7 seconds

ACCELERATION FACTORS:

| | | | |
|----------|------|-----------|----------------------|
| True MPH | Gear | MPH./sec. | Ft./sec ² |
| 10 | 1st | 3.6 | 5.3 |
| 20 | 2nd | 2.6 | 3.8 |
| 30 | 2nd | 1.7 | 2.5 |
| 40 | 3rd | 0.95 | 1.4 |
| 50 | 4th | 0.35 | 0.51 |

HILL CLIMBING AND DRAWBAR PULL:

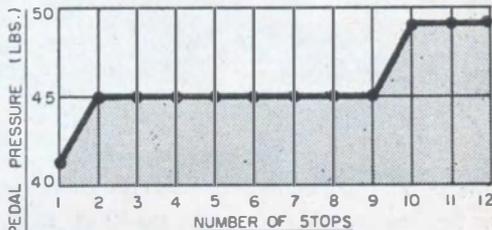
| | | | |
|-------------|------|---------|-------------|
| Approx. MPH | Gear | Grade % | Pull in lb. |
| 30 | 4th | 5¼% | 150 |
| 50 | 4th | 1½% | 40 |

SPEEDOMETER-ODOMETER CORRECTIONS: Odometer distance 10.00 miles; true distance 10.15 miles; odometer error at 40 mph —0.15 miles. Multiplication factor and % of error 1.015 and —1.5%:

| | | | | | |
|-----------------|----------|------------|-----------------|----------|------------|
| Speedometer MPH | True MPH | Engine RPM | Speedometer MPH | True MPH | Engine RPM |
| 60 | 58.5 | 3750 | 30 | 31.2 | 2060 |
| 50 | 49.6 | 3190 | 20 | 21.5 | 1420 |
| 40 | 40.4 | 2630 | 10 | 10.8 | 700 |

LATERAL SWAY TEST OF CORNERING ABILITY: At steady 40 mph on 285-ft radius circle, side tilt angle recorded was 3½°

BRAKE FADE TESTS (repeated applications of brake from 40 mph to 20 mph at deceleration rate of 7 ft/sec²): As indicated below, pedal effort did not double in 12 test stops



LONGITUDINAL DIP ON BRAKING: At a steady deceleration rate of 21 ft/sec², body nose diving angle was 1½°

PARKING BRAKE TEST: When brake was applied hard and suddenly from 20 mph true speed, car braking distance was 65 ft. (Left wheel did not lock; defective)

CHASSIS DYNAMOMETER HORSEPOWER (tests made by Clark Automotive Service, Chicago): Temperature 78° F; relative humidity 73%; barometer 29.4 in. Hg.

| | | |
|----------|------------|------------|
| MPH True | Engine RPM | Horsepower |
| 15 | 1000 | 6 |
| 30 | 2000 | 14 |
| 46 | 3000 | 18 |

HORSEPOWER AT REAR AXLE (values calculated from acceleration data with allowances made for efficiencies and rotational inertia):

| | | | |
|----------|------------|------------------------------|-----------------|
| MPH True | Engine RPM | Equiv. Engine Torque (lb ft) | Axle Horsepower |
| 15 | 1000 | 52 | 10 |
| 30 | 2000 | 47 | 18 |
| 50 | 3200 | 38 | 23 |

Per cent of advertised engine horsepower to rear wheels: 64%.

PERFORMANCE FACTORS

(Calculated)

58 mph (true) at maximum advertised horsepower and 30 mph at max adv torque. Engine rpm at 60 mph (also revolutions per mile) 3850 rpm. Average piston speed at 60 mph (also, ft/mile) 1620 ft/min. Cu ft per minute of mixture at 60 mph (also, cu ft/mile) 81. Maximum engine horsepower (adv) per ton of car (curb weight) 29. Maximum engine horsepower (adv) per cu in. displacement 0.495. Power performance factor (a weighted average of CR, piston displacement, and curb weight): 45.

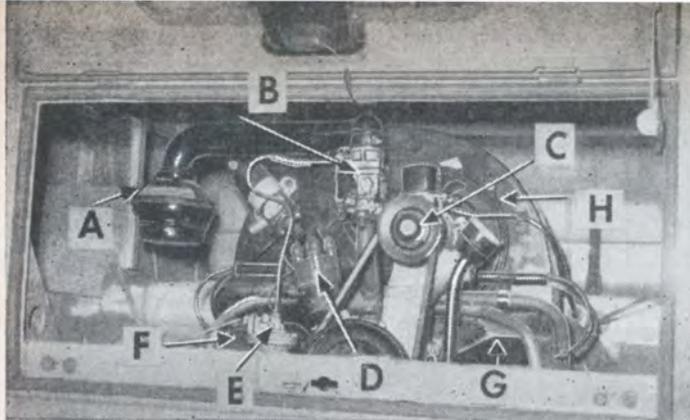
Above data and signed certification are reproduced from test reports.

CERTIFICATION

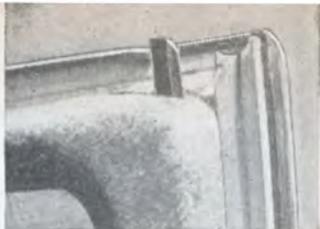
I certify that the test results in this report are the actual findings obtained in tests, conducted in accordance with engineering practice, on the automobile named and under the conditions specified.

Edw J Chert

Member, Society of Automotive Engineers, American Society of Mechanical Engineers, Director, Automotive Research Laboratories, Evanston, Illinois.



The VW rear engine, a flat four with twin opposed cylinders, is under luggage area on the Microbus. Note: (A) air cleaner; (B) carburetor; (C) generator; (D) distributor; (E) fuel pump; (F) left cylinder block; (G) right cylinder block; (H) blower and air duct housing (this engine is air-cooled).



These locking spikes at top and bottom of center doors keep them from being bumped open. Turn of door handle shoves them into place.

domestic designers have overlooked, in their search for ways to insulate the ladies from the hardships of shifting, steering, and, generally, staying in complete charge of the driving.

There's an interesting performance comparison between the Microbus and a Karmann-Ghia we tested in 1956. For those who came in late, the Ghia is also a Volkswagen, sleekly styled down into a sporty two seater, but still containing essentially the same power plant and gear ratio as the rest of the VW family, including this Microbus. With its slick streamlining and minus some 665 of the pounds the bulky Microbus has to tote around, the Ghia naturally is faster on acceleration, to the tune of a little over a second from 0-20 mph up to quite a number of seconds from 0-50 mph. The lighter, lower Ghia also manages to obtain a few more miles from a gallon of gas. Yet the 20.1 over-all fuel mileage achieved by the Microbus is still economical rations for such a spacious and boxy workhorse (about 28 ft. of frontal area). To give you an

Thunderbird, 10.9 mpg.

The foot brakes on the Microbus showed little fade and a very small increase in pedal pressure in our stopping tests. The parking brake on our test bus was not up to par, however, and failed to lock the right wheel. Water penetration tests showed the Microbus to be watertight under medium to heavy rainstorm conditions, a record



Backing into a small parking slot is not difficult with this small bus, but you'll have to develop your own set of aiming points.

Driver's Observations

ROADABILITY: Maneuvers nimbly because of short length and wheelbase, relatively light weight and responsive and easy steering. Tracking excellent despite tendency to bounce on the bumps. Strong winds and sharp gusts affect it more than they do most cars because there's more area for the wind to work on, and relatively less weight to resist the push. Corners tightly with little sway though rear end may skid on damp surfaces if you power her around the turns too fast. At higher speeds, bounce from rough roads smoothes out considerably and handling seems remarkably sure-wheeled for a light weight bus-like vehicle. At low speeds over rough surfaces, she's quite a jouncer, but recovery from bounce is prompt.

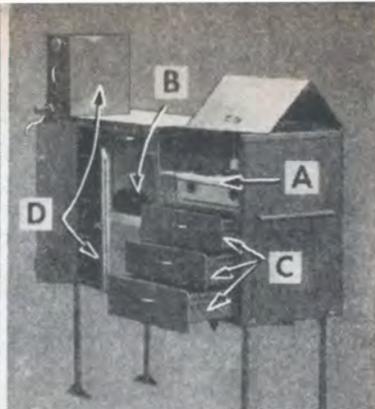
RIDING AND DRIVING COMFORT: No worm's eye view of the road ahead in this high vehicle, and no massive engine in front of you. Has the same built-in willingness and go-

anywhere guts that characterize the VW sedan. Forward gear shift action very smooth. Reverse shift occasionally had to be coaxed on test bus. Headroom generous throughout. Hatroom adequate. Kneeroom generous. Stretch-out legroom limited for first two seats, plentiful for third seat. Wind roar slight and vent whistle slight but engine and gear noises are constant and noisy companions. Seats not overly padded but feel comfortable; not adjustable, however. Width of bus and lack of arm rest leaves driver with little to brace against.

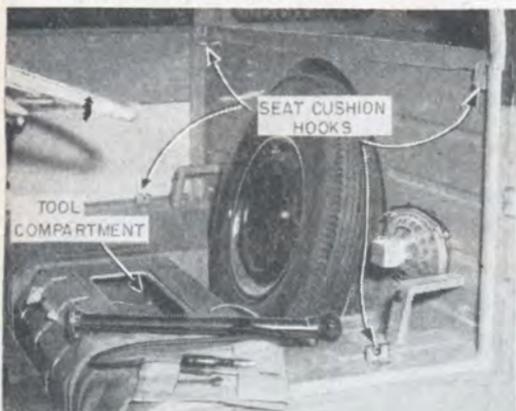
INSTRUMENTS AND CONTROLS: Speedometer, odometer; generator, oil, turn signal indicator (one), and bright light warning dot all in one dial cluster. Ignition key-starter, the usual push-pull light switch (turn to dim instrument panel), a dome light switch, and windshield wiper (electric, one speed) switch complete the simple, plain, instrument panel. Right-

hand wiper balky on test bus. Takes more eyeshift from road to read speedometer, which is not as close to eye level as it is on domestic cars. Choke, throttle, and reserve gasoline controls by right calf of driver; no fuel gage. Dim button in usual place. Open "glove compartment" shelf (49 x 2 3/4 high x 7 1/2 inches deep). Two dome lights, front and back. Tube, 3 in. dia. runs up front under instrument panel for defrosting (two vents); open sleeve valve to bypass heated air to warm cab; no blower, uses that of engine. Fresh air inlet through tunnel in cab roof, regulated by five-position throttle plate. Key for ignition and one for door locks and rear luggage door. Keep this door closed while driving so downwash of air at back won't carry exhaust fumes into bus.

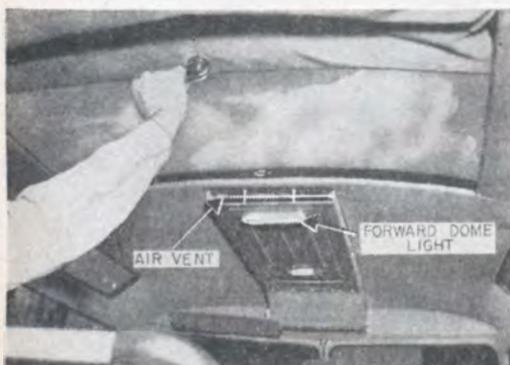
Locks not covered, may freeze. Jack mounts located front and rear on both sides, for easy slip-proof jacking. No undercoat on test bus but quality of finish and trim top rate.



This V-1 Camper Unit, made by Saxe and Co., 915 West Olive Ave., Burbank, Calif., includes storage chest containing (A) gas stove; (B) ice box; (C) storage drawers, and (D) stove fuel and water tanks. Two stretcher-type beds (E) have clamp supports and rail assemblies for easy installation and removal. Price of unit complete is \$495.



When you get a "flat," simply lift off the front seats and there are both your spare tire and the tools you'll need.



A twist of the wrist (plus a slight heave-ho) slides sun-roof back to give you a view of open sky. Closed roof was watertight on test bus.



SPECIFICATIONS

ENGINE: Horizontal Opposed, Overhead, 4 cyl. Bore 3.031 in.; stroke 2.520 in. Advertised maximum brake horsepower 36 hp at 3700 rpm. Taxable horsepower 14.7. Advertised maximum torque 56 lb ft and mean effective pressure of 116 psi at 2000 rpm. Compression ratio 6.6 to 1. Piston displacement 72.7 cu in. Fuel specified: Regular.

TRANSMISSION: Manual; Synchronesh on 2nd, 3rd, 4th gears. Rear axle ratio: 4.43.

STEERING: Turning circle 39 ft. curb to curb. Overall ratio 15.1 to 1. Torque to turn $9\frac{1}{2}$ lb ft static; $2\frac{1}{2}$ turns lock to lock.

EXTERIOR: Wheelbase $94\frac{1}{2}$ in. Overall length $164\frac{1}{2}$ in. Overall width $68\frac{1}{2}$ in. Overall height unloaded $74\frac{1}{2}$ in. Curb weight 2450 lb (with 10 gal gas, oil and water). Minimum road clearance 9 in. at rear shock mtg.

INTERIOR: Headroom: front seat 37 in. and rear seat 39 in. Legroom: front seat $40\frac{1}{2}$ in. Kneeroom: rear seat $11\frac{1}{2}$ in. to $14\frac{1}{4}$ in. Depth: rear seat $18\frac{1}{2}$ in. and $19\frac{1}{2}$ in. Hiproom front seat $56\frac{1}{2}$ in. and rear seat $58\frac{1}{2}$ in. Total front seat adjustment at floor: 0 in. forward or back.

VISIBILITY: Windshield area 782 sq in. Rear window area 448 sq in.; from eye of 5 ft 10 in. driver and seat in best position, distance from driver's eye to road over left front fender is 15 ft 7 in.; over hood center 20 ft 2 in.; over right front fender is 22 ft 10 in.

EQUIPMENT: Battery: 6-volt; 77-amp hours. Tires: 4 ply 6.40x15; recommended pressure 28 psi front, 32 psi rear. Springing: front torsion bars, rear torsion bars. Frame U rails welded to body floor panel with six cross members.

CAPACITIES: Fuel tank $10\frac{1}{2}$ gal. Crankcase 2.65 qt. Cooling system (air cooled). Differential $\frac{1}{2}$ pt. Transmission 5.3 pt.

only a few of the cars we have tested can match.

Family Living, Unlimited. As you can see by studying some of the accompanying photos, the Microbus DeLuxe is ideally suited to family living on a large order (both the family and the living). With various adaptations, it can be a station wagon, a bus, a house trailer, or a truck. As a station wagon with superb visibility for driver and passengers all around, you leave the conventional seats, or benches as the VW boys call them, in place. (Incidentally, these seats are fastened in position far more securely than the seats we have seen on most station wagons.) Or one or more of the seats may be removed to secure more storage space or bedding-down room for youngsters. The delivered-in-Chicago cost of the Microbus DeLuxe with a sun-roof and built-in heater is \$2,668.50. Radio, a supplementary heater, windshield washers and the wide, pop-out

It's nine inches from the ground up to the rear shock mount, which is a generous road clearance these days. It's also the same clearance that you had on your old Model A Ford.



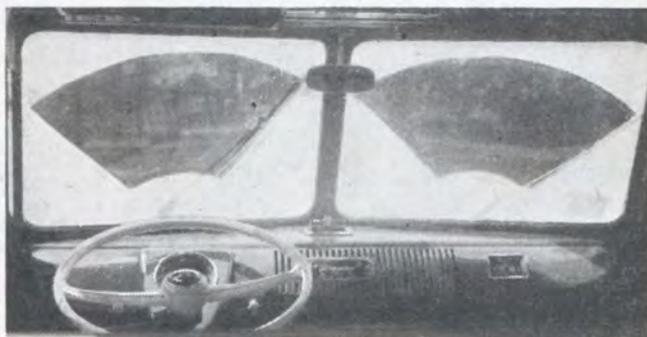
Access to both gas tank and engine compartment is with a large "key."



Some idea of the relative length and height of the Microbus can be gathered from this comparison with a Buick.



For comfort, simply use fold-down portion of second seat as a foot rest.



Wiper clearance seems a little old-fashioned, but then there's no wrap-around to muddy up on you.

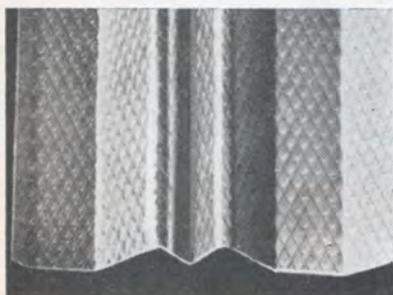
step for the side doors and fold-down step for the right front passenger, are optional extras. If you don't want the sun-roof, you can so specify and save yourself \$102.

The same DeLuxe model Microbus can also be obtained converted to a camper with permanently built-in refrigerator and bunks for \$2919.88. Or, and this is what many are ordering, you can obtain the Microbus DeLuxe as is, and

then purchase a separate V-1 camping conversion for it which is interchangeable with the regular station wagon seats, as shown in photos.

For the economy minded, there is the regular Microbus, which doesn't have the fancy colors or the little viewing windows around the top. At \$2212.50, it represents a remarkable amount of dependable and economical transportation underneath you.—DON DINWIDDIE.

Improved Aluminum Roofing and Siding



DIAMOND-RIB aluminum building material is embossed with a glare diffusing diamond pattern and a flat top rib configuration. A non-siphoning feature prevents moisture from penetrating side laps after the sheet is installed. The new design is said to give the sheet up to 30% greater load bearing strength than heavier gage .024-in. conventional corrugated or V-crimp aluminum, although it costs less than either.

Each sheet is about 50.3 in. wide, providing



48-in. coverage after lapping. Lengths range from 6 through 16 ft. Accessory materials such as diamond embossed plain ridge roll, coiled flashing, rubber filler strip and improved aluminum nails with attached neoprene washers are available. The new Kaiser Aluminum product is available at hardware dealers.