

POPULAR SCIENCE

An aerial, high-angle photograph of a multi-lane highway. A yellow car is in the left lane, and a red car is in the right lane. The cars are moving away from the viewer, and motion blur is visible on the road surface. The background shows a grassy area on the left and a road shoulder on the right.

SEPTEMBER • 35c Monthly

More Home Space at Low Cost

**New Ways to Use
Built-Ins**

Special 32-Page Section in This Issue

**How to Defend
Yourself on
the Highway**



It has no springs and no differential, and only Uncle Sam can buy it. But it's fun just to imagine—

What You Could Do with a Mechanical Mule

IF YOU could get one away from the Quartermasters Corps, you would find plenty of right-around-home uses for the four-wheeled Mechanical Mule. This doughty little vehicle, made by Willys Motors for the Army and Marine Corps, should be just the thing for getting in cordwood, lugging farm equipment to the back forty, setting fence posts, hauling produce off the field, and plowing snow

off driveways. Home owner and farmer alike could find a dozen chores for it.

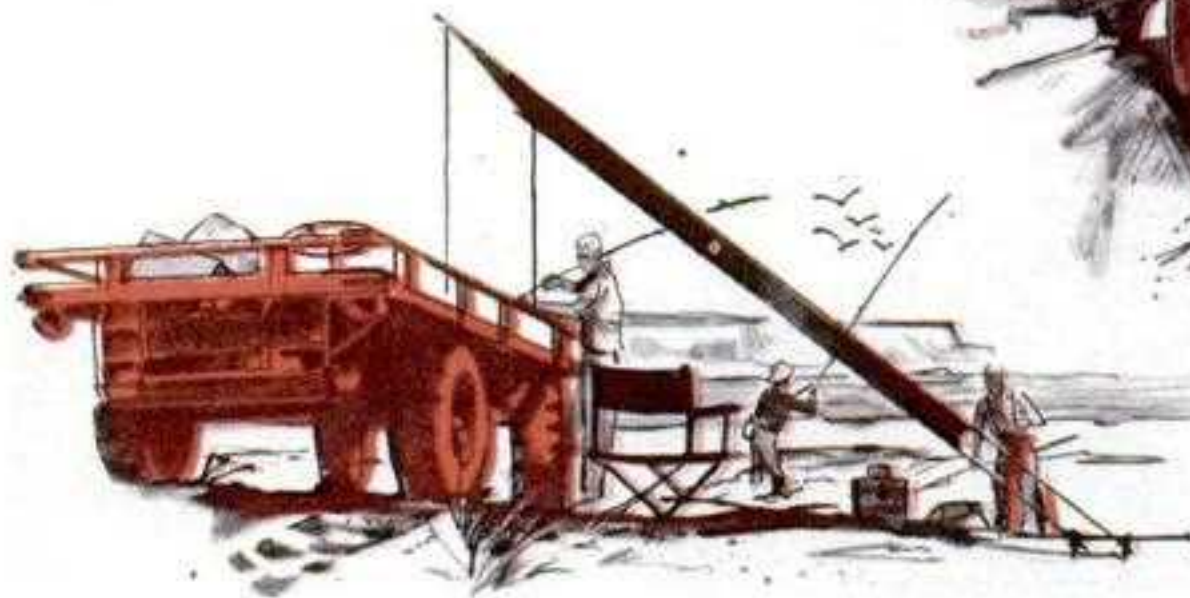
More exciting still is the prospect of heading into the back country with the Mule, to hunt far from beaten trails, pack supplies when you go to make that uranium strike, or haul a boat to isolated waters.

Don't rush out to buy it, though. Willys Motors will tell you to put your money

Stiff-legged but plucky, this tough little Mule won't balk at any job



OFF-TRAIL PORTAGES with a canoe or boat could be high adventure. To negotiate bad spots, the driver could walk behind.



WHEELING ON SAND, the Mule could take surf fishermen to lonely beaches far from roads, with their tackle and camp gear.



ON FARM OR RANGE, the half-tonner could haul fence posts, timbers or concrete blocks right up to the work site.



A-HUNTING YOU COULD GO far afield, even across unbridged streams. The Mule would easily carry three men and supplies.

back in your pocket—the only customer they're selling is Uncle Sam. But they won't mind your looking under the olive drab and seeing what makes this capable little wagon tick. Nor is there any law against dreaming about what you could do with it if . . .

As utilitarian as a wheelbarrow, the M-274 1/2-ton weapons carrier is as shrewdly engineered as a missile. It has not a single useless part, not a smidgin of tailfin or fender, no differential, nothing automatic, and only the barest essentials of operator comfort. But it will go just about any place army-booted feet can, and do tricks that would make a Detroit

designer's jaw drop. It can, for instance.

- Land hard on its wheels or upside-down, bounce, and drive off unscathed.
- Be driven from a riding, walking or crawling position.
- Ford streams 18 inches deep.
- Climb a 60-percent grade, loaded.
- Carry 1,000 pounds, 100 more than its own weight.
- Run on sand, rocks, or other rough country at speeds up to 25 m.p.h.
- Turn in a 20-foot circle.
- Become a four-wheeled trailer for high-speed road travel.

The stark essentials that make this motorized beast of burden perform so well

are a high-torque pancake engine, a six-speed power train, four-wheel drive, and four-wheel steering.

The engine is air-cooled (no radiator to freeze or be shot full of holes). Except for magneto ignition, it has no electrical system. You start it by pulling a cable up front. Oversquare ($2\frac{3}{4}$ " bore, $2\frac{1}{4}$ " stroke), it has a 6.5:1 compression ratio, overhead valves, fan cooling, and a governor that limits it to 4,300 r.p.m. Although rated at only 16 horsepower, it packs a lot of torque (40 lb./ft.) on the useful part of the speed curve.

The power train is through a two-speed transfer gear and a conventional three-speed-and-reverse transmission. This gives six forward speeds, with a gait of one m.p.h. in low low.

The four-wheel drive is flat-out and uncompromising. Every wheel is geared to all the rest. You can't spin one on mud or ice; if any wheel has firm footing, you move. But because there are no differentials, tires screech if you turn sharply on a hard road surface, and you have to pour on the gas to overcome wheel friction, scraping some rubber off in the process. On grass, gravel, soil and other off-road surfaces there is enough wheel slip to make the lack of differential action unimportant—dirt flies but you turn on a dime.

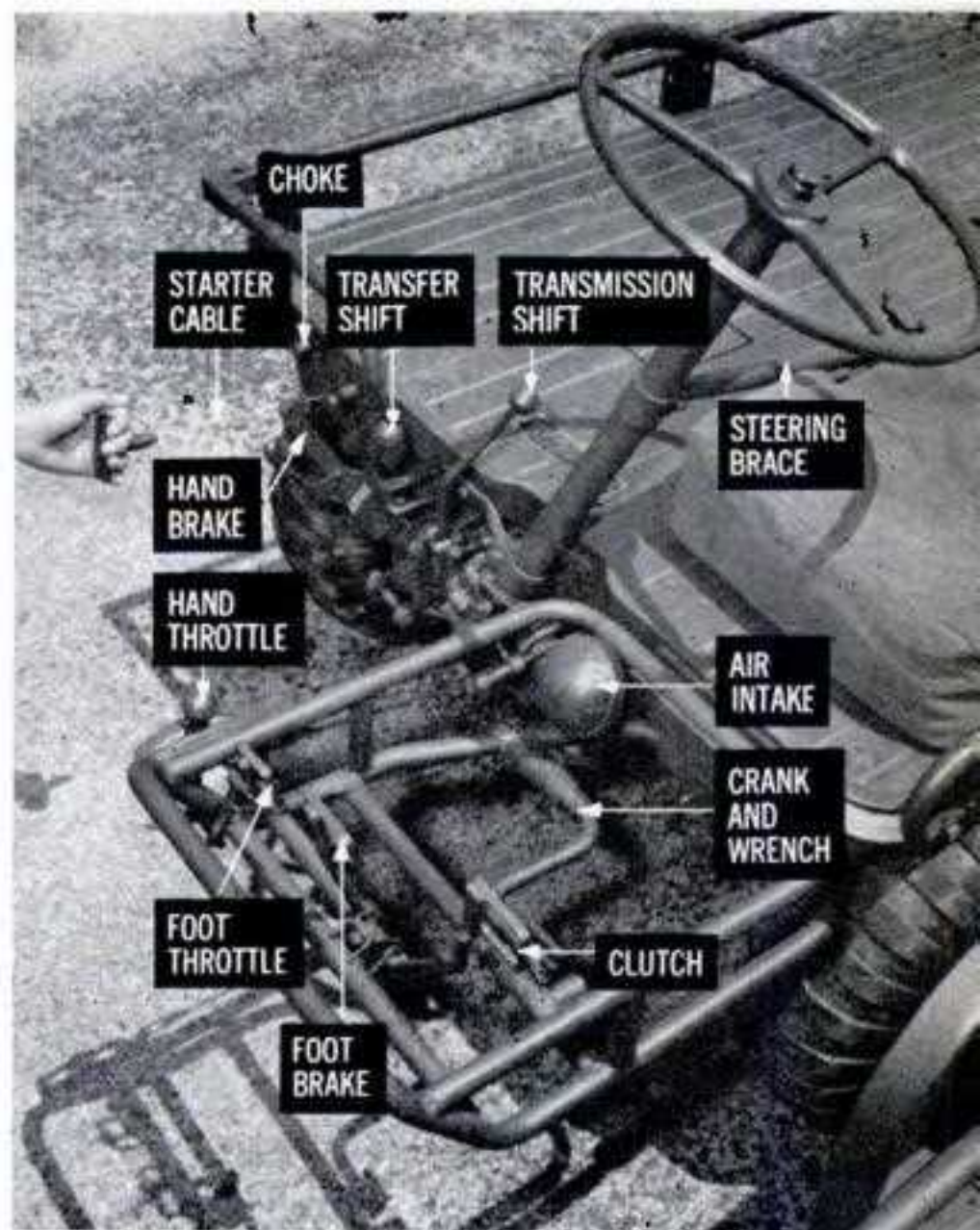
The four-wheel steering is sudden stuff, so quick it would take a sports-car fan by surprise. Hit a rutty road at top speed and you're plenty busy. Since the wheel is offset at an angle, like a one-arm lunch-room chair, you learn to steer on the bias. It works.

Soft, plump tires with only 12 pounds of air in them soak up some of the jolts, but there are enough left to make the ride eventful and occasionally put daylight between you and the driver's seat.

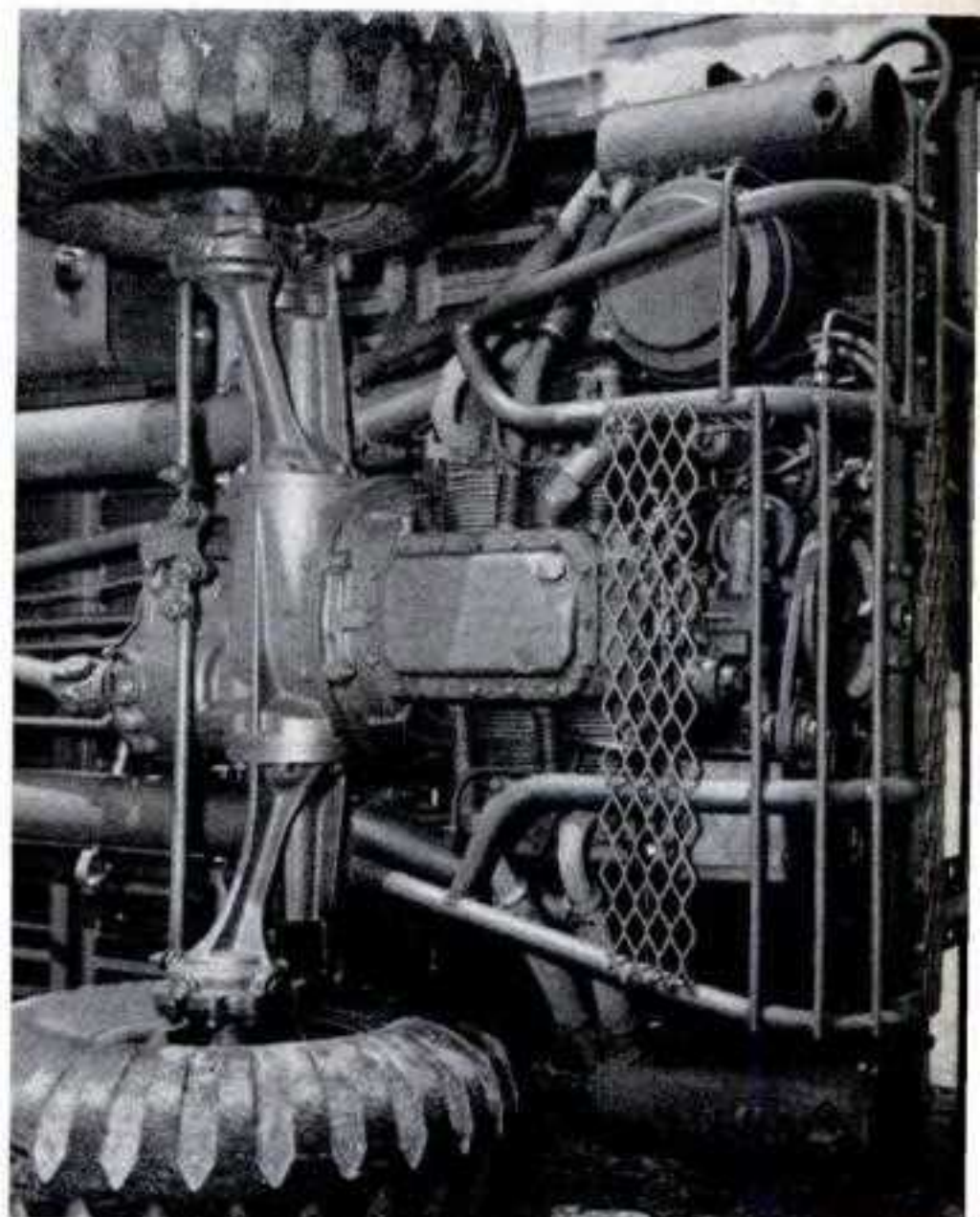
Riding the bed itself (there's only one seat, for the driver) is downright Spartan, but possible. You hang on to the railing around the platform and keep your feet up out of the way of the wheels, which swing out from under on turns.

Hey, Sarge, the bridge is out! Asking no favors in rough country, this tough little utility wagon doesn't mind getting its feet wet.

Suppose a cross-country trek brings you to a pond or stream. The Mule can ford water a foot and a half deep. With its



THE MULE'S BRAINY END: A strut braces the steering wheel. Single seat is for the driver.



HARD UNDERBELLY shows durable drive end. A gearbox at each wheel adds 1:2 reduction.

engine air intake just under your ankles, big tires that afford some flotation, light weight, and power on all four wheels, it can navigate even on soft bottoms.

To drive from the ground, while walking or even crawling behind the vehicle, you unbolt the steering column and lock it in one of two other positions. Then you set the hand throttle, pinch the clutch pedal against the footrest with your right hand, shift into gear, and let in the clutch by uncrimping your fingers. Your left hand controls the hand brake. On a hill, it takes a brand-new set of driving reactions to keep the Mule from rolling back on you—*whoops!* Forget and use a forward gear? Since you're walking at the front end, only reverse must be used, or the Mule will mow you down.

To stop, you pull the hand brake, which seemed to work backward when you drove from the seat (push to set it). From the ground, it works the way you're accustomed to having hand brakes work, which is what Willys had in mind.

To cover roads fast, you can tow the

Mule at 50 m.p.h. behind a car, truck or jeep. When detached at your destination, it becomes a mobile self-propelled vehicle instead of a dead trailer.

For towing, you unship the steering column, seat and footrest and stow them under the flat bed. Throttle, brake and clutch cables have quick-release couplings that make all this a two-minute job. The rear wheels lock straight, and the hitch hooks onto the front ones for two-wheel automatic steering, making the Mule a highly roadable trailer.

A new idea in engines, the Mule's was designed to be die-cast of aluminum. Cast-iron liners are shrunk and pinned into the aluminum cylinder block. The flywheel housing, manifolds and many other parts are also of aluminum. Although these are being sand-cast at present, volume production would be done in dies, the castings requiring a minimum of machining. Such an engine might find its way eventually into a small car. Thus the Mechanical Mule might break trail for a different kind of automobile.—*Harry Walton.*

Mule's big brother may someday go on civilian market

Now being tested by the Army, this convertible personnel and cargo carrier is even newer than the Mule—and you may eventually be able to buy it. Fully roadable at up to 60 m.p.h., the still unnamed Willys vehicle will seat six or carry 1,500 pounds of payload. With the spare seats

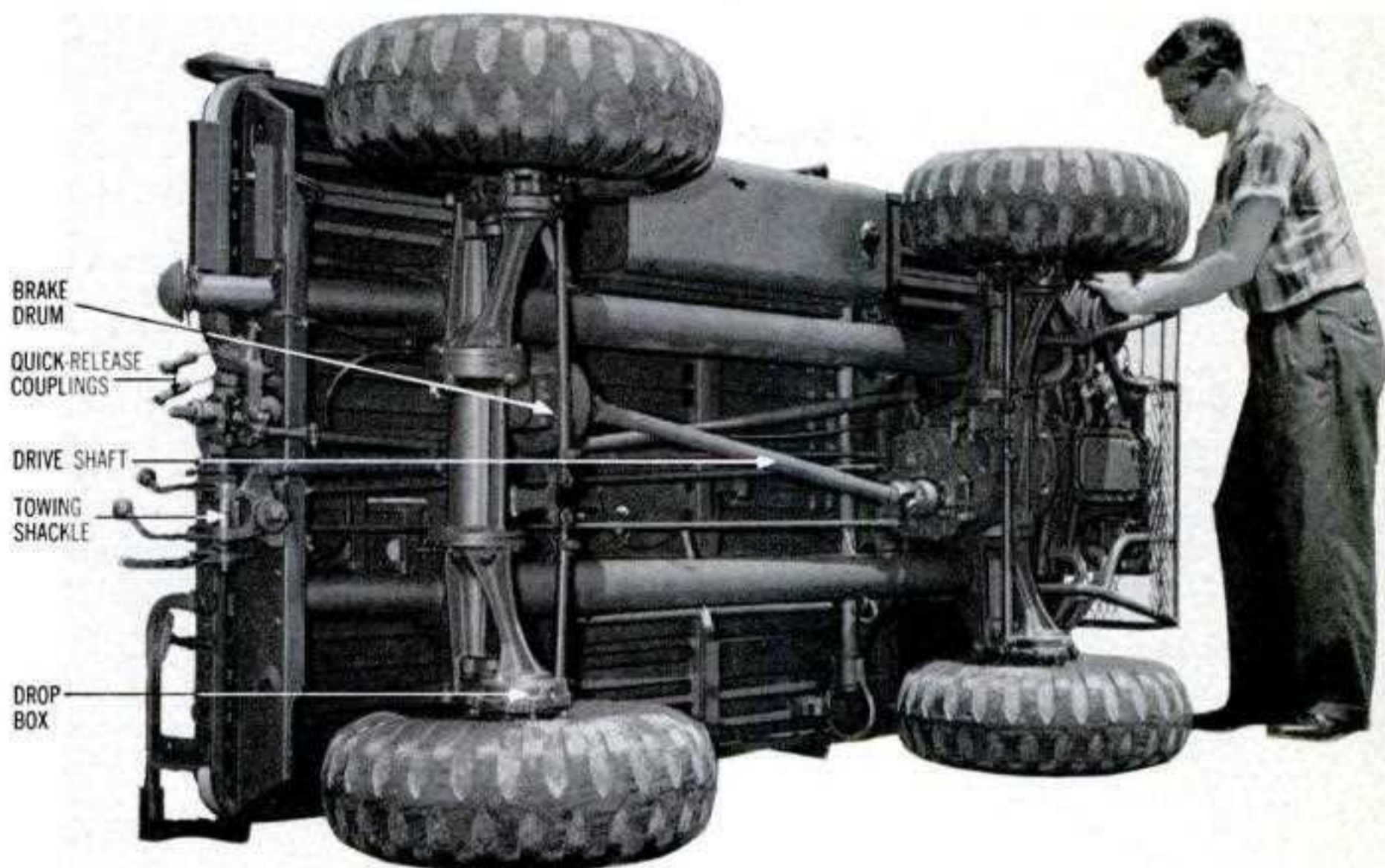
folded flush into the bed, there are 50 square feet of cargo platform.

Powered by a different, much larger pancake engine than the Mule's (164-cu. in. instead of 53, rated at 100 hp.), this vehicle has independent wheel suspension, four-wheel drive, and selective two-

IT'S FOR PEOPLE: Six can ride, on real seats behind a windshield. Rear two face backwards.

... AND CARGO, TOO: Payloads up to 1,500 pounds are readily hauled on the platform body.





Nothing bleeds if Mule is flipped on its side; oil, gas stay in. Righted, it's ready to run.

or four-wheel steering. Like the Mule, it will be rugged enough to drop by parachute, sufficiently goat-footed to climb 60-percent grades.

It may even swim. The hull-like body can easily be made watertight, and could be fitted with a propeller driven by a rear power take-off.

Much lighter than the Jeep (1,500

pounds instead of 2,665) the proposed $\frac{3}{4}$ -tonner will turn as sharply as the Mule. It has a full electrical starting and lighting system. A three-speed transmission and transfer shift give it six forward and two reverse speeds.

The manufacturers see it as having potential civilian uses for farmers, sportsmen, airport and factory workers.

SEATS FOLD FLUSH into the floor to make flat cargo deck. Well accommodates rider's feet.

PLAIN DASH has no instruments; they're on floor hump. The extra lever shifts the transfer gear.

