

Robot Navigator Rides the Jeep

SECRETLY DEVELOPED, THE ODOGRAPH MAKES THE TINY QUARTER-TON A SURVEYOR



Feeling its way through the darkness with the magic aid of the odograph, a jeep leads tanks to launch an attack

IN THE back seat of a jeep the Army has put a brass brain to note how far and which way the jeep goes. By recording the car's course on a sheet of paper, it not only provides proof of where GI's have gone, but also keeps men from getting lost and enables them to locate and liquidate the enemy quicker.

Given a map and this mechanical checker-upper, known as an odograph, an armored column can be led through smoke, fog, or pitch darkness as swiftly and certainly as though every landmark and guidepost were visible.

With an odograph, a scout can map unfamiliar territory in a jiffy, by simply driving over it. The line traced by the pencil

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Photographs by William W. Morris

of the odograph will show the direction and distance he travels, thereby producing a map for others to follow.

The position of an artillery observer who dashes out in an odograph-equipped jeep need not be painstakingly determined with surveying instruments before the big guns are fired. The device in the back seat will show exactly where the observer is the instant he hops out of the car.

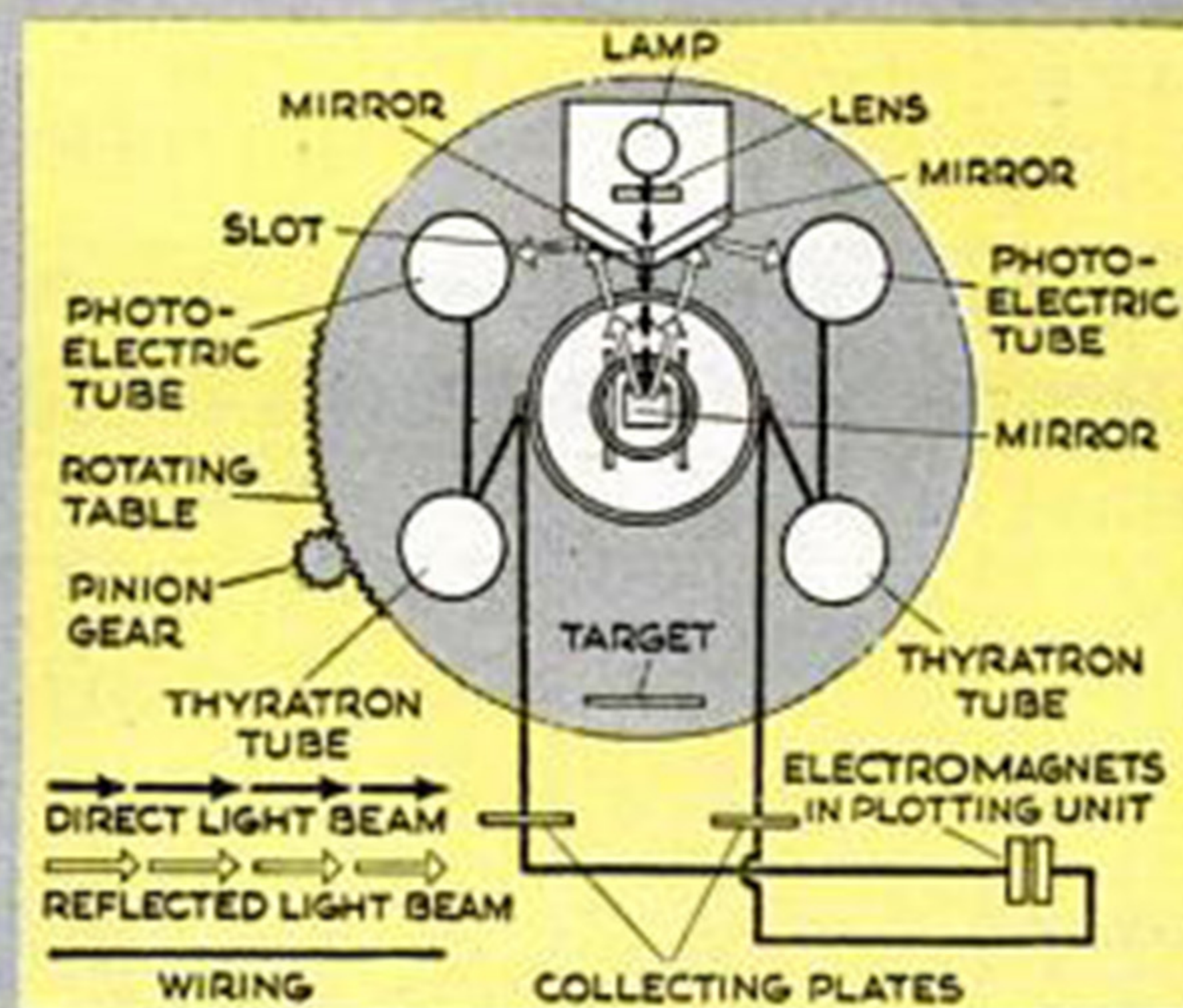
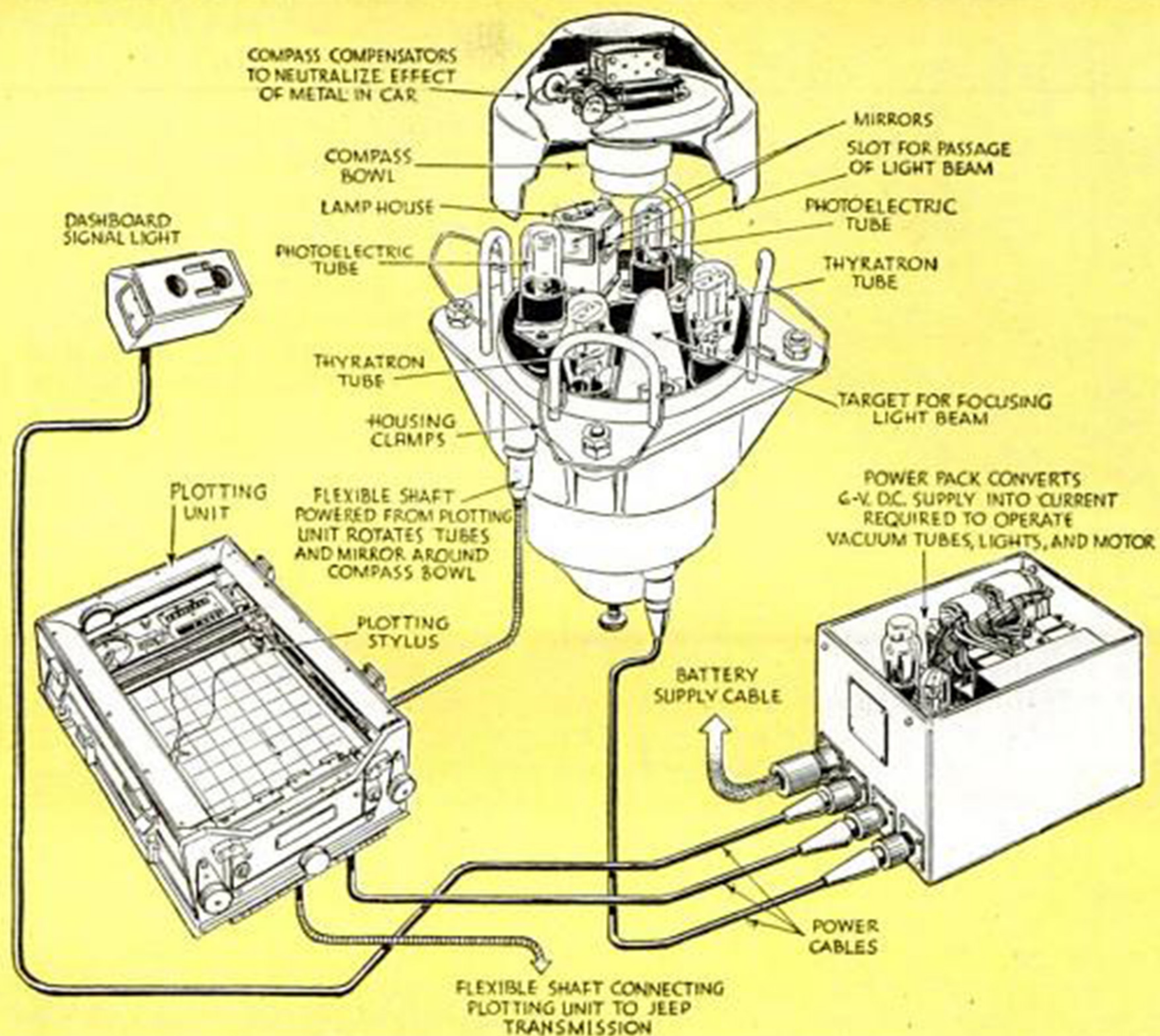
Thus, odographs are not merely a means of keeping confused men from running around in circles, but also a means of training mighty weapons on the target more suddenly. The odograph, in fact, is so helpful in combat that when Lt. Gen. George S. Patton saw one of the early models tested at the Desert Training School, he declared: "When I go into action, I want one of those machines, even if I have to take a company of mechanics along to keep it in running order."

The odograph is one of the most complex of modern military instruments, but has been so perfected that GI's have learned to handle it in a couple of weeks. Several hundred of these mechanical draftsmen have been built and used to supply field commanders with essential maps much faster than such maps could be drawn by human experts. Standard producer of the odograph is the Monroe Calculating Machine Company, Orange, N. J.

This lightning cartographer is a 200-pound maze of mechanical and electronic apparatus, difficult to duplicate without a model. Hence, until recently, the odograph was one of America's most carefully guarded war secrets. The idea came from the Engineer Board, the research organization of the Corps of Engineers. Civilian scientists and engineers helped develop the idea in locked laboratories. Only a few key employees of the two computing-machine companies that have manufactured odographs were told what use would be made of the various parts, and soldiers were instructed to destroy the instruments rather than let them be captured. But now this remarkable invention can be described.

It has four parts: a power pack, a dash-

THESE MAIN PARTS MAKE AN ODOGRAPH INSTALLATION



Odograph mounted in a jeep. Drawing shows how vacuum tubes in compass unit detect changes of course

HOW IT WORKS. When the jeep changes direction, mirrors mounted on the compass card (see drawing at top) reflect a beam of light as the card swings to and fro in the suspended bowl. The reflected light energizes one of two photoelectric tubes paired with thyatron tubes, which control the flow of current to turn the compass table accordingly. This motion is transmitted to the plotting unit, where a stylus records the change of direction on the map. At the same time, the plotting unit is informed mechanically as to the jeep's speed, by means of a flexible shaft from a speedometer drive in the car's transmission. These data, combining direction and distance, are co-ordinated by the plotting unit and recorded on a sheet of graph paper by the stylus, a pencil held above the paper by two arms. One arm moves back and forth across the paper, the other up and down. These arms move the pencil to trace a line on the paper corresponding to the course of the jeep, whether it is slowly zigzagging through a forest or racing down a straight highway at 60 miles an hour. A dial alongside the paper shows the direction in which the jeep is headed, and counters indicate the number of miles it has come north or south, and east or west, since leaving its starting point



IN DARKNESS, SMOKE, OR FOG, a jeep equipped with the odograph can follow a course on a map

board indicator, a compass, and a plotting unit. These parts are connected by electric cables and flexible shafts. The power pack simply steps up the current from the jeep's battery to the required voltage. The dashboard indicator merely warns the driver of the jeep when the odograph has stopped, or it is time for him either to change his course or put a fresh sheet of paper in the plotting unit. The compass and the plotting unit are the intricate parts.

Compensating magnets neutralize the effect on the compass of the metal in the vehicle. Two mirrors on the compass card reflect a beam of light as the compass swings to and fro. This reflected light en-

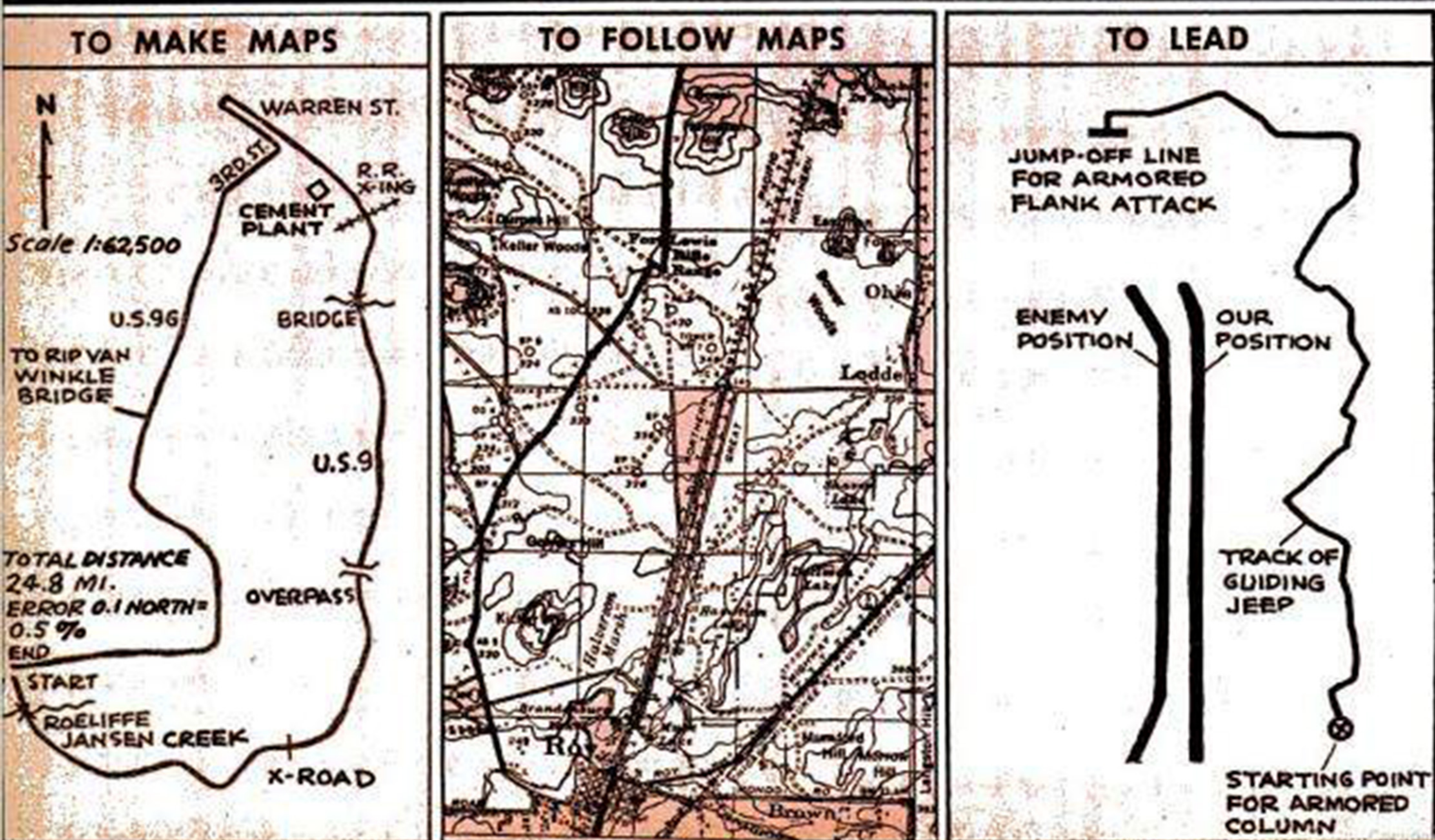
ergizes one or the other of two photoelectric tubes. These are paired with thyatron tubes, which control the flow of current from the power pack to the plotting unit to inform the latter of the direction.

The plotting unit is a metal box, about the size of a portable typewriter case, and well filled with shafts, gears, magnets, and a motor. On its upper surface, protected from moisture and dust by a glass cover, is the plotting paper. An 8½ by 11-inch sheet, the size of ordinary typewriting paper, is used; it is divided by lightly printed lines into one-inch and 1/10-inch squares. Fresh graph paper can be run in when necessary by turning a roller. Shaded lights illuminate the top of the plotting unit, and the driver, by glancing over his shoulder, may see instantly both where he is and how he got there.

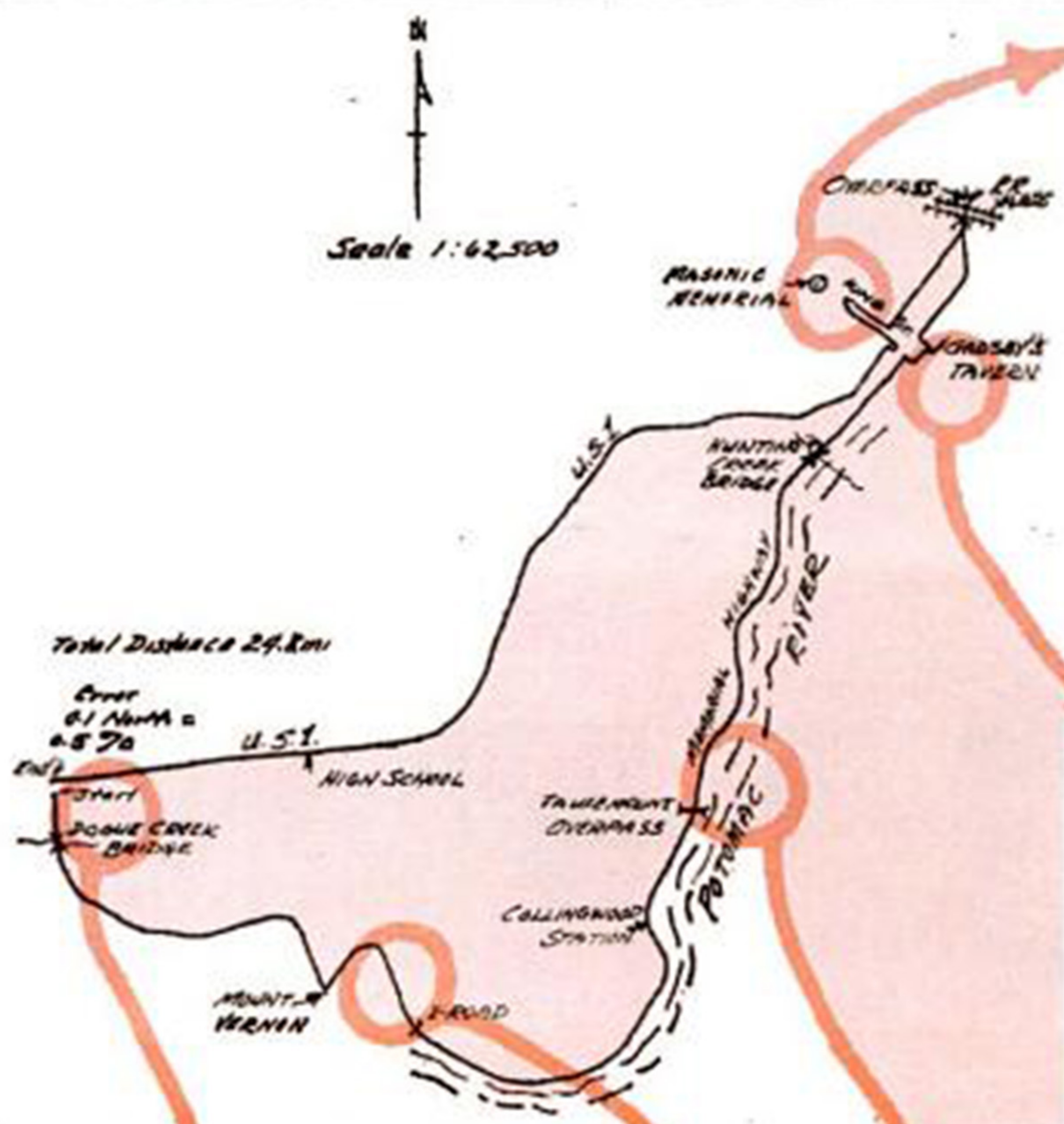
To make a map, the odograph operator need only place a sheet or roll of the ruled paper in the plotting machine and select a scale by turning a knob. He may let a mile be represented on his map by any distance from an eighth of an inch to three inches. Thus, by varying the scale, he may record his course over any area from about nine to 6,000 square miles on a single sheet of paper. If he wishes to show the location of bridges, railroads, or other topographical features, he may mark them in on the paper in the plotting machine without interfering with the mechanism.

Maps made this way are accurate enough for most military purposes. Allowances must be made for hills or other irregularities, because the machine records the

THREE WAYS THE ROBOT NAVIGATOR IS USED AT THE FRONT



FOR POPULAR SCIENCE READERS, an Army jeep made a trial run over highways near Washington, D. C., to show how the odograph would record the journey



Start of the trip. The other photographs show the jeep passing the various landmarks noted on the map made by odograph



While the jeep is rolling, the stylus traces its route upon graph paper



actual distance traveled by the vehicle rather than air-line distances. Slight errors may be caused, too, by the wheels slipping or spinning. But under average conditions, the map drawn by the odograph will not be off more than a mile for every 50 or 100 miles traveled on roads, or a mile for every 35 to 75 miles covered across country.

When an accurate map is already available and is to be followed, it may be placed in the machine, and the line drawn by the odograph's pencil will show the progress

and position of the jeep on that map at all times. This facilitates detouring around enemy obstructions without getting lost.

The odograph can be used for all sorts of exploring after the war. Great areas of the earth remain to be mapped, and this can be done more quickly, thanks to this invention. The odograph may also provide a guarantee that forests, ranches, oil fields, and highways have been properly patrolled. It may even interfere with the pleasures of traveling salesmen.