ELECTRONICS AND THE MOTOR CAR

By S. R. WINTERS

ACTING independently but toward the same broad purpose, the conservation of millions of automobiles and automobile tires, three inventors have designed, respectively an automatic electronic tire inspector; an electric-eye device to facilitate the parking of automobiles alongside curbs, without scraping our dwindling supply of rubber; and an electronic tester for auto headlights. The curb indicator is especially aimed toward assisting women drivers, whose parking problems are proverbial, in that the electric eye "sees" the automobile approaching the curb and warns, either visually or audibly, how close the driver is to the curbing.

The tire inspector reaches its greatest usefulness in tire inspection service during manpower shortage. This also is an automatic device, which exposes cuts, bruises, and embedded foreign material in tires, and then writes its own record of the concealed faults.

Electric eyes are employed in a device designed for the General Motors Corporation for testing automobile headlights, which eliminates the errors common to faulty human judgment.

STUDIES TIRE FAULTS

The electronic tire inspector, invented by William H. Capen of Mountain Lakes, New Jersey (patent rights assigned to the International Standard Electric Corporation of New York City), involves the use of a portable X-ray machine for focusing rays on punctured automobile tires and a photoelectric cell for exposing the exact spot of entry of nails or gravel into the ailing tire. The electric eye, somewhat like an electronic burglar alarm, rings a bell when the intrusive foreign objects which have penetrated the tire surface are brought before it.

When the rays from the portable X-ray apparatus penetrate the tire and strike a fluorescent screen the result is a radiograph, seen directly through a slit or tiny window. (See Fig. 1). The cell is connected to a radio amplifier and the necessary auxiliary controls for actuating an audible or visual indicator. The amplified radio signals are able to operate one or more of the following indicating devices: a bell, a recording tape, a warning light, a meter, and a brake for interrupting the rotation of the punctured tire. Inasmuch as the X-rays and the electronic unit are inclined to interfere with the appointed functions of each other, the fluorescent screen is applied to a sheet of lead glass. A shield, with a narrow slit in front of the lens, cuts down the field of vision of the photocell and at the same time magnifies the injured section of the tire. This small X-ray machine, with its companion electric eye, may be used in thousands of gasoline service stations with the conventional pit and hydraulic jack, thus expediting the periodically Government-required inspection of millions of automobile and truck tires.

ELECTRON-RAY PARKING AID

Versatile phototubes may save rubber other than by acting as simple inspectors of tires.

The electric-eye curb indicator, an invention of John Ray Toney of Los Angeles, California, by inference at least, was designed especially for women automobile drivers, whose error of judgment in accurately judging parking distance is traditional. A frequent sight on city streets is that of women, and men too, alighting from their automobiles to confirm their beliefs that th parking positions are awkward. Scraping of the rubber tires is inevitable. Mr. Toney proposes the installation of a series of photocells and their inseparable companions, lamps, on the front and rear fenders of automobiles. According to the inventor, the electric eye gauges the distance between the wheels and curbstone accurately, parking the vehicle almost automatically.

The photocells and auxiliary equipment are disguised in a suitable housing before being installed on the front and rear portions of a car. The ray of light from the lamphouse illuminates a tiny portion of the curbstone—the beam or pencil of light casting rays at an angle greater than zero and less than a straight angle. These pencil "marks" are indicated by arbitrary diverging lines, A and B (Fig. 2), and the light, energizing the photo-cell, is so narrowed down as to be included between another arbitrary set of lines, C and D. The outer lines, A and D, of the two diverging pencils of light intersect at E, pointing out the greatest distance from the automobile at which the curb is to be detected.

This invention is sufficiently flexible to admit of varying the size of the beam of light, the angle of divergence between the beams, A and B, and also the amount of light entering the photocell. The angular positions of the lamp-house, and the encased electric eye, as they are mounted on the front and rear fenders, may also be adjusted to vary the point or position of intersection of the axis of the electric bulb and the electric eye. They, too, may be altered in their downward slant of installation for focusing light on the curbstone or roadside object.

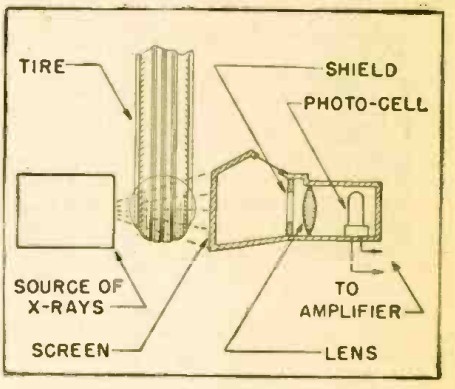

Fig. 1—The electronic auto tire inspector.

Of the approximately 30,000,000 passenger

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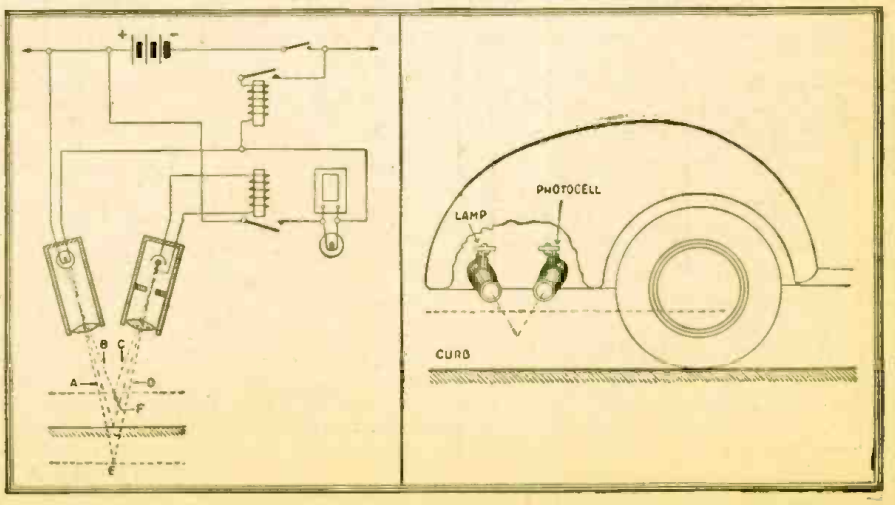

Fig. 2, left—How rays reflected from the curb control the car; right—in place beneath fender.

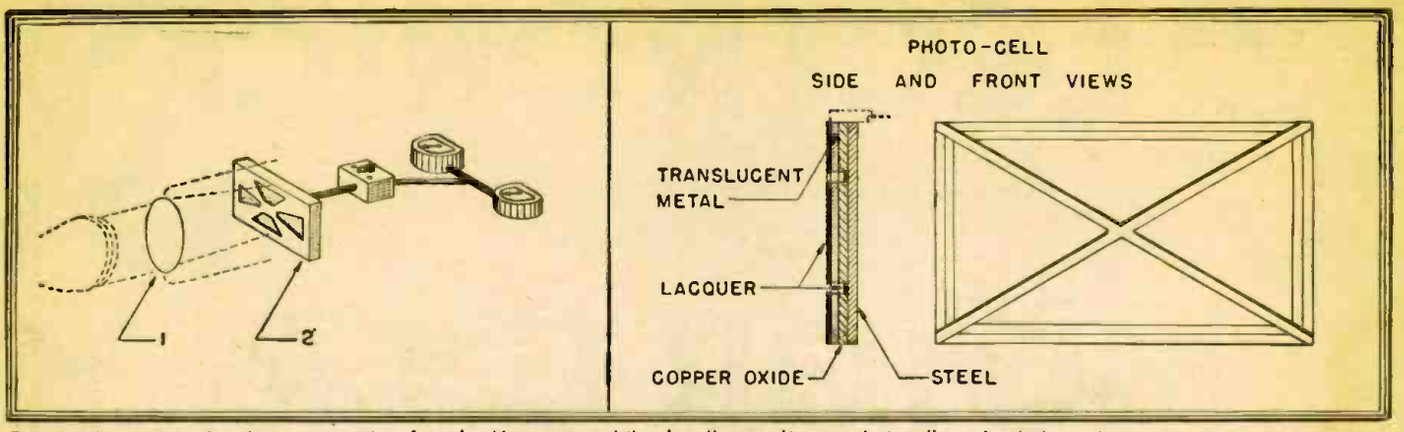

Fig. 3—An automatic electronic meter for checking automobile headlamps. It uses photocells and a balanced circuit actuating two meters.

automobiles in the United States, about 10,000,000 have been taken off the highways by the necessary stringency of gasoline and tire rationing. Several other million cars are limited in their travel by fuel restrictions, and petroleum and rubber authorities are issuing grim warnings that available automobiles in 1944 must be conserved as instruments of war—transporting men and material to and from armament and airplane factories. This means that engines, batteries, ignition systems, crank cases, anti-freeze solutions, and headlights must be preserved by judicious care and frequent testing. An electronic device for automobile headlight testing has been invented for the General Motors Corporation by Thomas W. Meeder of Indianapolis, Indiana. Eliminating the possible errors of human judgment in focussing and measuring the amount of illumination in the present method of testing headlights, a series of photoelectric cells scientifically aims the headlights subject to scrutiny and then measures accurately such light intensities. During this war or afterward, electronic engineers will have the opportunity of installing and servicing this General Motors' apparatus in thousands of service stations and at Federal and State automobile testing stations.

Shown in Figure 3-a, the lens and photoelectric cell assembly are indicated by the numerals 1 and 2. The cell may be contained in any suitable housing, at the forward end of which is stationed the condensing lens, which casts an image onto the photoelectric cells at the rear of the housing. This image may fall directly on the photocells, or a screen of any suitable light-excluding material may be interposed, with a series of four openings, as indicated in the diagram. The inventor has discovered, by practical experiments, that the most favorable results are obtained by having the image slightly out of focus at the point where it falls upon the light-sensitive cells. The distance from the focal point is not necessarily appreciable —nor is it critical—just sufficiently out of focus to spread the image. A switch assembly is employed to effect the required connections between the photocells and the two indicating meters. If a screen of light-impervious material is used, it is mounted immediately ahead of the light-sensitive cells.

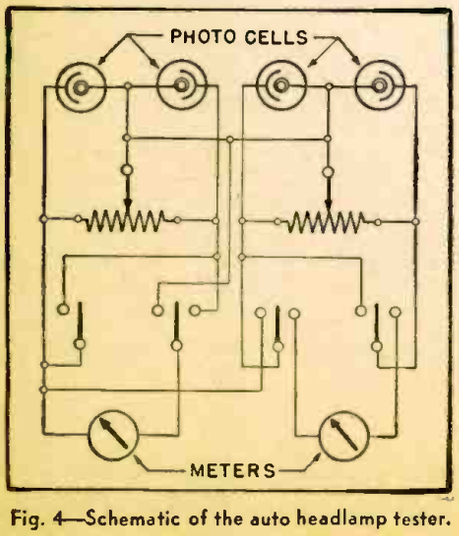

Fig. 4—Schematic of the auto headlamp tester.

Of the various types of photoelectric cells, the "barrier-layer" is preferred by the inventor for his electronic automobile headlight tester. It is photo-voltaic—generating a voltage, the magnitude of which depends upon the strength of the light falling on its sensitive surface. The "barrier-layer" type of cell is comprised of a metallic plate, with a layer of some substance such as selenium or copper oxide over it. This plate may be flexible, though the diagrams (Fig. 3-b) show a rectangular form. It is coated with a translucent metal sheet, the latter having a raised portion near its periphery. Diagonal cuts are then made down to the plate, thus forming grooves. A moisture-proof coating, such as lacquer, is sprayed over the face of the assembly. The lacquer, desirably so, makes its way to the bottoms of the grooves. There is no arbitrary manner of doing the spraying, provided the raised portions near the periphery remain uncovered. This may be insured by use of a mask, or the raised sections can be sprayed and then scraped or washed.

The diagonal cutting of the metallic plate means that the barrier-layer is divided into four distinct sections—comprising an equal number of photoelectric cells. They have a common terminal, of any polarity, in the form of the metal-backing plate, and separate terminals of the opposite polarity, in the form of the raised marginal portions. The lacquer at the bottoms of the grooves is insurance against short-circuiting between nearby sections, which might be caused by moisture collecting at the bottoms of these grooves. There are two potentiometers for calibration purposes. One of these potentiometers is connected across the independent terminals of the two vertical segments of the photo-cell, and the other across the two horizontal segments. A variable center tap is provided so that, with equal amounts of light falling on each one of a pair of segments, the voltage across each side of the potentiometer is equal. Meters are connected in the circuit of each pair of plates, as shown in Fig. 4. It may readily be seen that, with all sections of the photocell equally lighted and the potentiometers properly balanced, there will be no flow of current through the meters and their indication will be zero.

In actual practice, the test-head is aimed by aligning sights provided on it, with reference points on the automobile, the lights of which are to be tested. The head is then shifted into position in front of the headlight, while at the same time maintaining its axis parallel to the direction in which it has been aimed. The test-head is now in position so that if the headlight is truly aimed and focused, light of predetermined relative intensity will fall on the photoelectric cells. To achieve this objective, the cells must be calibrated as to sensitivity to set such a headlight. For the latter purpose, it may be desirable to insert variable resistance units (not shown in the diagrams) in the four electrical conductors. Most favorable results, experiments have indicated, are accomplished when the apparatus is set up so that the lens will be situated 18 inches or less from the headlight lens.

By use of the two potentiometers mentioned above, this electronic device may be employed in the accurate aiming of a beam of light from an automobile headlight. With the photocells in the position shown in Figure 3, a reading of the meter other than zero will indicate whether the beam of light is too high or too low. Appropriate markings on the scale of the indicating meter will tell to the operator how much the beam is off the correct line, whether the beam is straight ahead, or to the right, or left, as well as up or down. The device also measures the candlepower of total light values of all the sections involved, thus indicating precisely the candlepower of the headlight under test. Thus individual perception, which varies with individuals, is no longer an uncertain factor in testing automobile headlights—the variable human equation gives way to electronics, which can grade 2,000,000 shades of color or measure the intensity of a beam of light with the finiteness of micrometer-like precision.

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A new three-minute test of night vision is being installed in Navy ships and training centers to help in checking the fitness of men for duty as night flyers, night lookouts and other work requiring "cat's eye" vision.

Apparatus for the test is portable and consists of a luminous dial made of radioactive material sandwiched between two discs of glass. The dial has a very faint glow. This illumination can be cut down still further by the use of filters. It is necessary for the man taking the test to distinguish a letter T, showing up very faintly in silhouette against the glowing dial. He must tell the position of the letter as it is rotated by the examiner.