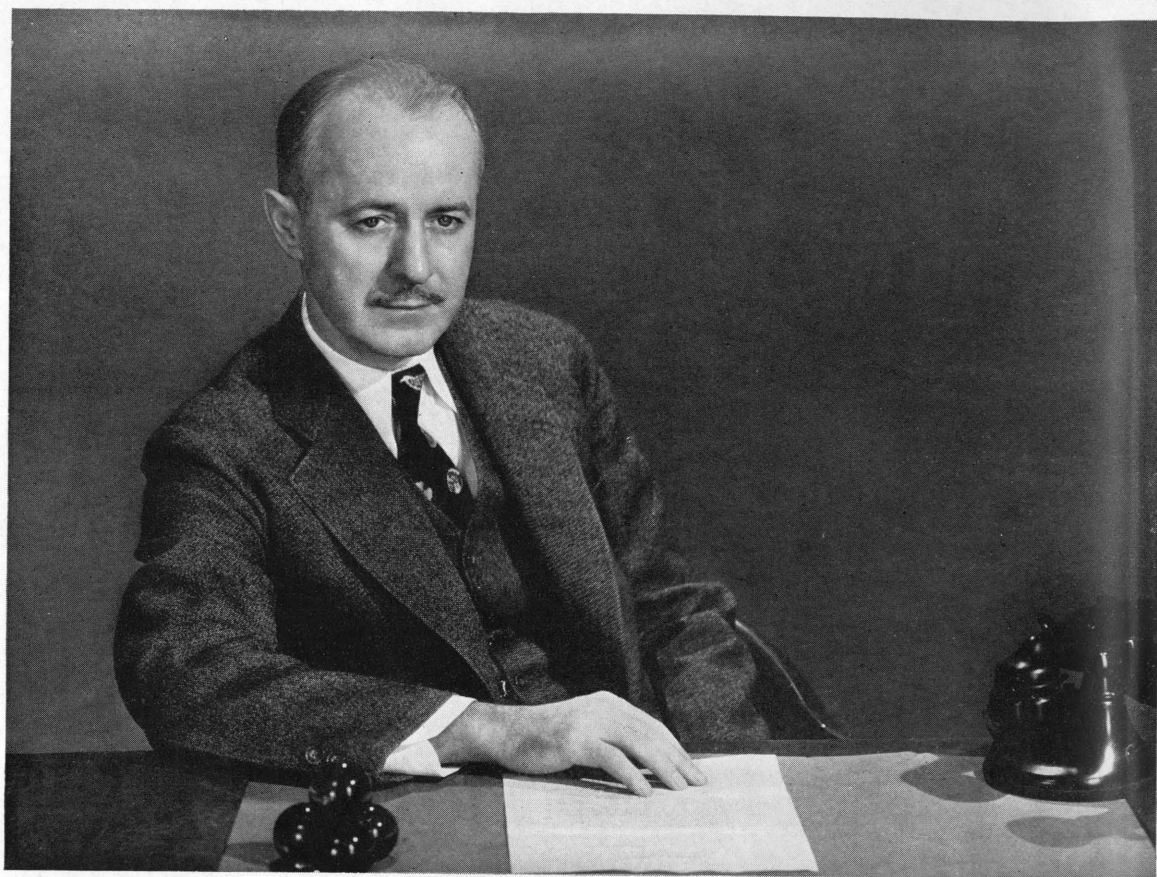


How Science Tested
The Human Body
for
“AUTO-FATIGUE”
and its effects on motorists



Based on research by
Andrew H. Ryan M.D.
Assisted by Mary M. Warner



A NOTE ON DR. RYAN

ANDREW H. RYAN, M. D., is a well-known authority in the field of fatigue-study. His work on this subject dates from the World War, when he was appointed a director of fatigue research among munition workers, conducted by the U. S. Public Health Service.

He has held professorships in physiology at several universities and has conducted research and lectured extensively on industrial hygiene.

For the past several years Dr. Ryan's career has been devoted to research problems of occupation, nutrition, and hygiene in industry, and he is a consultant to manufacturers on scientific problems relating to these subjects.



Dr. Ryan discusses the results of his tests with K. T. Keller, President, Dodge Brothers Corporation

HOW THE EFFECTS OF "AUTO-FATIGUE" ON MOTORISTS ARE MEASURED

By Andrew H. Ryan, M. D.

SINCE antiquity, man has known that there is such a thing as fatigue and has had to contend with its effects. And with the gradual speeding-up of industrial processes, and the quickening of pace brought about by modern living habits, the subject of fatigue, whether nervous or muscular, has engaged increasingly wider attention.

It was not until the last half of the past century that physiologists and psychologists began to study fatigue in a scientific way with the purpose of applying their findings to the improvement of living—through fatigue reduction.

Laboratory studies revealed that fatigue caused an impairment of the efficiency of performance of certain nervous, mental and muscular functions of the human body.

The application of these researches did not for a long time extend beyond the fields of education and medicine. It was not until the World War that "fatigue" assumed its present-day economic importance.

Industrial, or as it is sometimes called, Occupational Physiology and Psychology are still young sciences, but great progress has been made since the war days. A striking example of this progress is to be found in this present study.

During the war we were just beginning our attempts to measure accurately the degree of

fatigue caused by different kinds of work, and different lengths of working days. In the research of the fatigue of automobile driving, we have developed and applied methods of fatigue measurement considered impossible 15 years ago.

Such is the background of fatigue study. What is the fatigue problem in automobile riding?

The automobile has ushered in a new era in man's growth and life.

The automobile is so powerful, so fleet, so individual that a man now thinks in different terms than formerly. Where he then took a walk for a few miles, he now skips off to another state. Whereas his muscles formerly tired, it is now his nervous system.

It is the era of individual transportation. But with it has come a new fatigue hazard.

Strange as it may seem, the danger of automobile fatigue is greater today than it was fifteen years ago in spite of the greater perfection of all automobiles.

Why? Because cars are used more now than then—because we now travel at greater speeds, cover longer distances and are consequently subjected to greater strain than we were when the automobile was less perfect and less used.

That is why automobile fatigue deserves more attention now than ever before. And what is the effect of fatigue—what is its hazard?

Fatigue causes a deterioration or impairment of human functions.

Under the influence of fatigue one is not able to focus the attention or "concentrate" as well; one's sense of perception is impaired; one's muscular co-ordination and control are less perfect.

At once it is obvious that these are the precise functions that one must constantly exercise and must depend upon while driving.

There is also another consequence of fatigue that may become a distinct handicap in obtaining the full benefits and advantages of automo-

bile transportation. Fatigue lowers our efficiency in the performance of our work and deadens our appreciation of pleasures and recreation.

We undertook to measure the amount of fatigue produced by driving different distances and different automobiles.

These measurements were based on the amount of impairment produced in various nervous, mental and muscular functions of the human body.

The general methods of procedure with a description of the tests and results are given in the following pages.

GENERAL PROCEDURE

THE drivers report at the laboratory at 7:45 a. m. Each driver receives all of the tests in approximately the same order, morning and evening, under conditions as nearly uniform and free from psychic disturbances as possible.

On the road, the cars follow each other closely at all times in order to expose the driver of each car to similar conditions of traffic and weather.

All test drives were made over one of two definite routes: one a concrete highway and the other a road of which one-third was concrete and two-thirds dirt and gravel. The test route was thus standardized and the element of novelty eliminated.

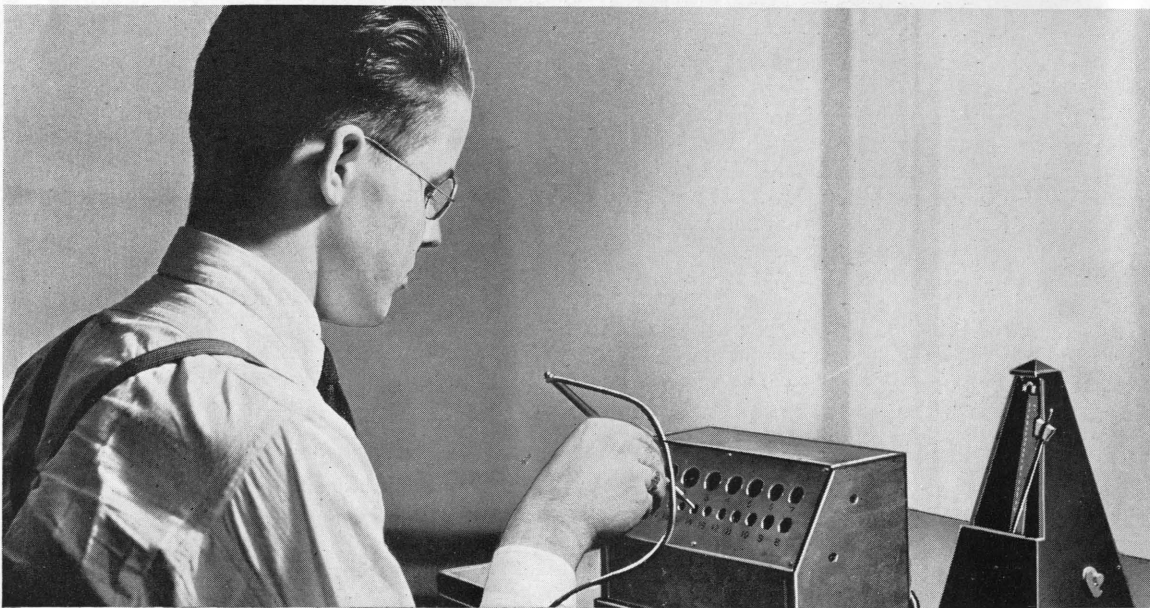
In order to equalize the effort or responsibility of leading or following, the drivers alternate their road positions at different points so that each

driver leads and follows approximately the same length of time.

A brief history is obtained daily from each driver covering the amount of sleep, activities and pastimes of the day and evening before each drive.

Records are taken from the instruments on the cars when leaving the laboratory; at the city limits; and at several fixed points along the highway, going out and returning.

Immediately upon returning at the end of the road trip, the tests of the morning are repeated. The morning and evening records are made on the same daily record sheet for each test, and the results averaged each day and transferred to a collecting sheet.



DESCRIPTION OF THE TESTS

1. HAND-EYE CO-ORDINATION TEST

THE photograph shows the instrument used to perform the test, and the driver taking the test.

The driver sits facing the instrument, the essential part of which is a brass plate having

two rows of holes beginning with one $\frac{3}{4}$ inch in diameter, and decreasing by $\frac{1}{32}$ inch for each, down to a diameter of $\frac{1}{8}$ inch, making a total of twenty holes.

The driver is required to insert a brass stylus into each hole beginning with the largest and moving toward the smallest, without touching the edge of any hole. The speed at which the stylus is inserted is controlled by a metronome.

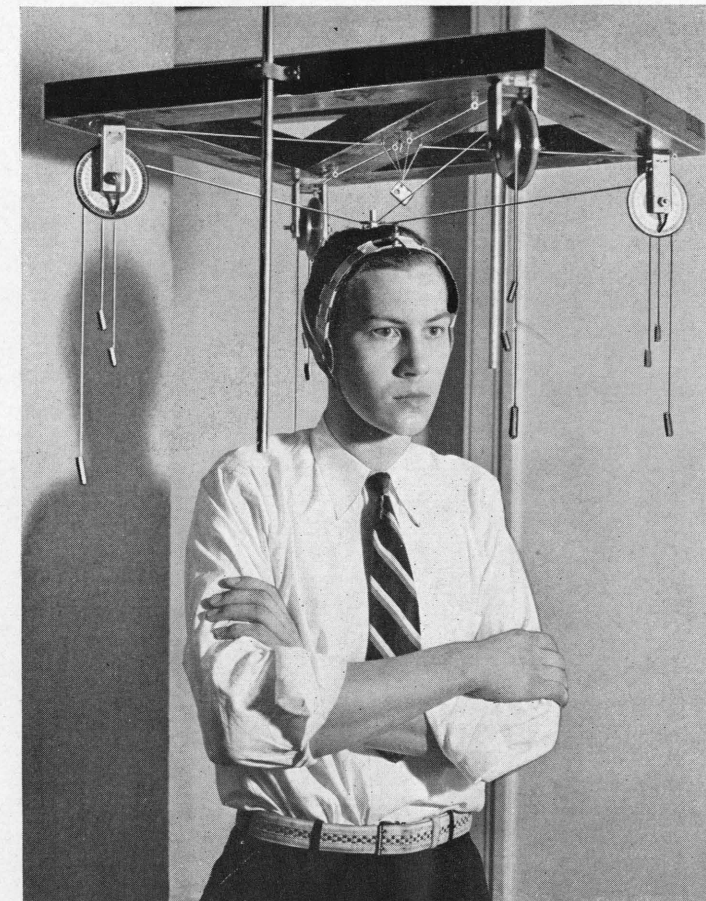
If he does touch the edge of a hole, the contact closes an electric current, sounding a buzzer contained in the box.

The score taken is that of the smallest hole

into which the driver can insert the stylus without sounding the buzzer.

Fatigue brings about an impairment of co-ordinated movements, so that a man cannot insert the stylus into as small a hole as in the unfatigued condition.

This apparatus, long in use in college laboratories, has been recently improved by Professor Jacklin.



2. POSTURAL STEADINESS TEST

THIS instrument measures the amount of sway of the body when a driver is standing beneath and attached to it. The test may be made with the eyes either closed or open.

The apparatus consists of a square frame mounted on vertical rods for adjustment to the height of the driver. On each corner of the frame is mounted an aluminum pulley wheel having a groove in which a silk thread rides.

The driver wears a helmet which is connected with four threads, each going over one of the four pulleys shown at each corner of the apparatus. A weight is tied to each thread. The pulleys are constructed with pawls so that each pulley can move only in one direction, toward the driver.

When the head sways back and forth as it does

in standing, traction is made between the thread and the pulleys, and one or the other pulley turns, depending on which way the head sways. There is a device for starting and locking the pulleys so that the amount of sway in one minute can be measured exactly.

It is our belief that this is the most sensitive instrument available for the measurement of the amount of unsteadiness of the body in the standing posture. It was devised by Professor Miles and used in these tests for the first time, insofar as we know, to measure the fatigue of occupation or activity.

Since steadiness in standing depends upon the acuteness of certain senses, this instrument measures their impairment that comes with fatigue.

3. VASCULAR SKIN REACTION TEST

THE accompanying photograph illustrates the method of performing this test. The subject sits with forearm exposed and resting on the table.

The investigator makes two strokes on the forearm with a special instrument that insures constant pressure over the curved surface of the arm, so that the stroke is the same in all tests.

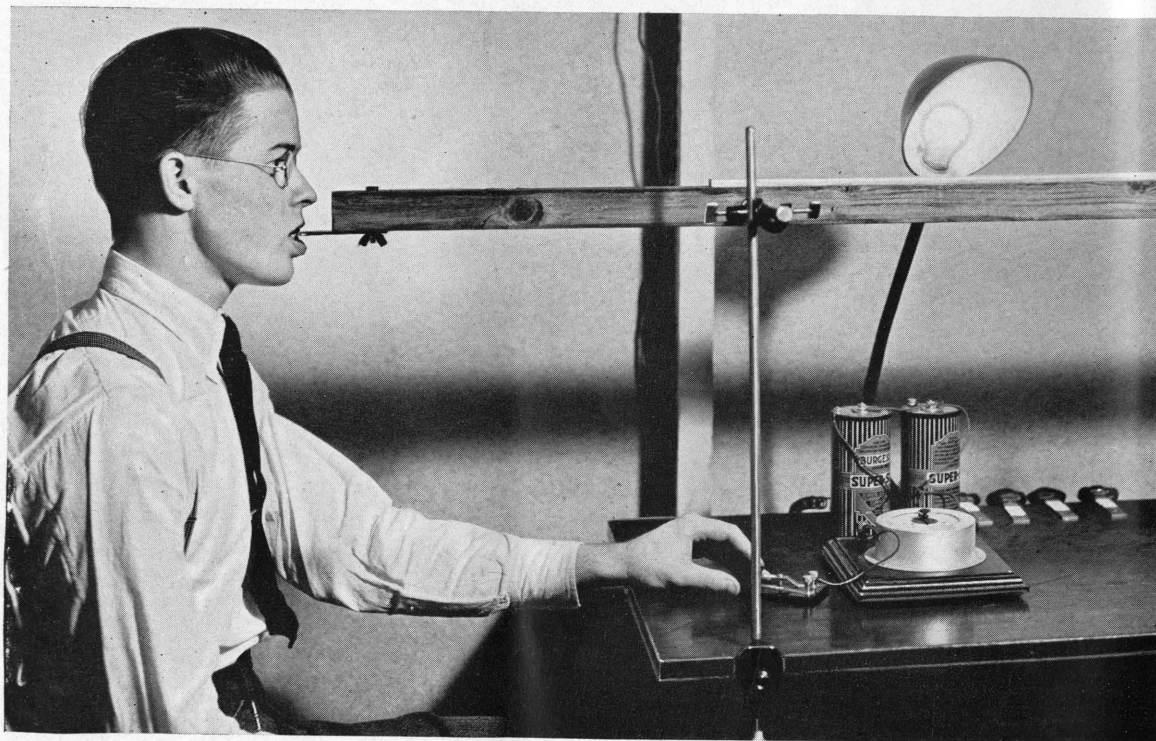
After the stroke is made, a white streak appears on the surface of the forearm, due to a reflex contraction of the blood vessels of the skin. This contraction is under the control of the sympathetic nervous system.

In the unfatigued condition, the white streak remains for a much longer time than in the fatigued condition. The duration of the streak is read on a stop-watch. This test must be performed in a dark room under constant illumination.

This test has already proved of value in the



study of fatigue of munition workers during the war, when it was introduced by the author.



4. VISUAL ACUITY TEST

THE apparatus consists of a graduated scale mounted on a long frame, which in turn is supported on upright rods clamped to the edge of the table.

A small rider carries a card with the letters "I" and "i" drawn in black ink, separated by a distance of one millimeter.

The driver is seated at one end of the apparatus with the head fixed in a definite position by having him bite on an impression previously made of his own teeth. The impression is mounted on a brass strip which can be quickly fastened to the apparatus.

The driver looks for three minutes at the card

which is placed at such a distance from the eyes that he can just see it distinctly when unfatigued. In the fatigued condition, the letters become blurred for varying lengths of time, depending upon the amount of fatigue.

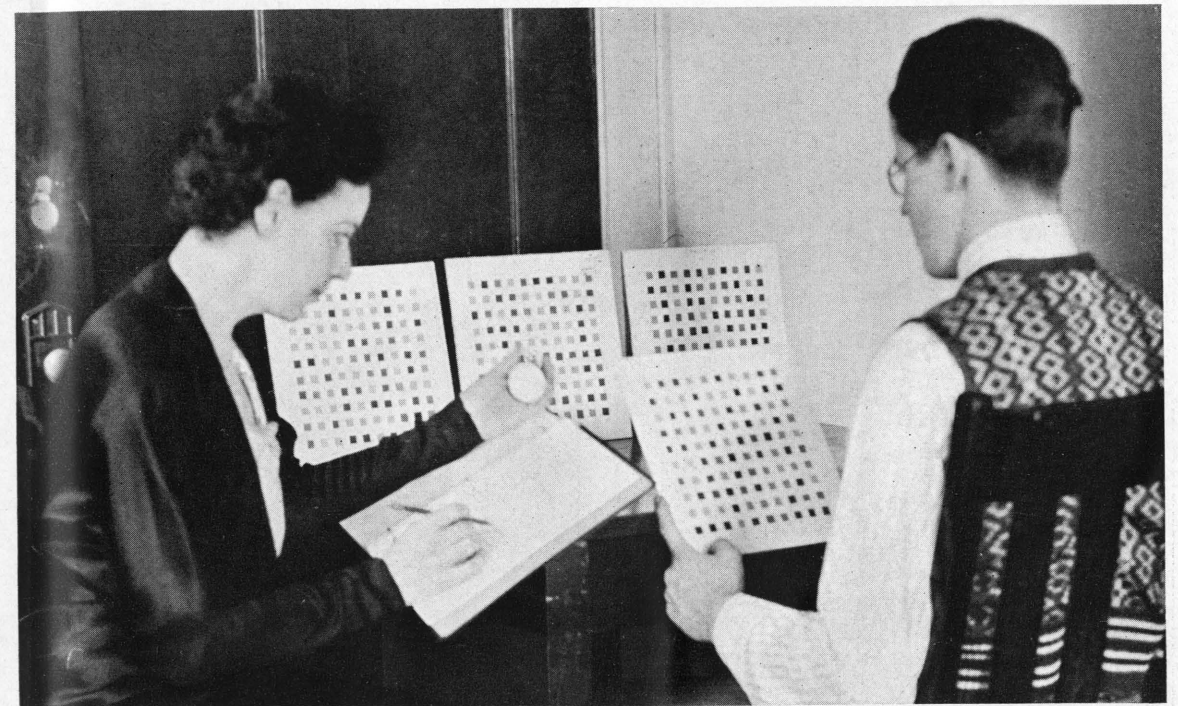
Under the actual conditions of the test, the letters appear alternately clear and blurred many times throughout the three-minute period.

In order to record the length of time during which the image is seen clearly, a key is provided for the driver to press when the object is blurred, and to release when it becomes clear. Closure of the key operates an electric counter which records

each fifth of a second that the key is closed. At the end of the test, the total time of blurred vision is read on the counter.

During the war Kent, of England, reported that industrial fatigue caused an impairment of acuity of vision, but we were not then able to obtain satisfactory results with the test method used by him.

The above method was devised by Ferre and Rand to study the effect of illumination upon eye fatigue. We have found it to be a measure of general fatigue as well, and have adopted it for this purpose for the first time.



5. COMPLEX REACTION TIME

Color Naming Test

THIS is a test of the ability to sustain attention—or, in other words, to concentrate.

It requires the subject to call off the names of 1,200 colored squares as rapidly as possible.

The accompanying photograph shows the driver holding in his hand a card on which are mounted 100 small colored squares (1 centimeter square).

There are ten of these colored squares in each row, arranged in chance manner. (The colors used are black, blue, green, orange, yellow, red, pink, violet, grey and brown.)

As soon as one card is finished, the driver continues with the second, third, etc., until 1,200 colors have been named.

The investigator is shown with a key to the cards in one hand, and a stop-watch in the other.

She records the time required to name the colors, and the number of errors made.

Fatigue causes an increase in the time required to name the colors, and an increase in errors made. Since keen, sustained attention is required for safe driving, this test directly measures one of the important elements entering into driving.

If there is impairment of this function, it is obvious that a driver cannot give close attention to hazards such as stop lights, passing machines, curves, and the many unexpected events of a drive.

Other investigators using this test have shown that loss of sleep increases the time required and the errors made in its performance. We have found similar results caused by the fatigue of automobile driving.

6. MENTAL ADDITION TEST

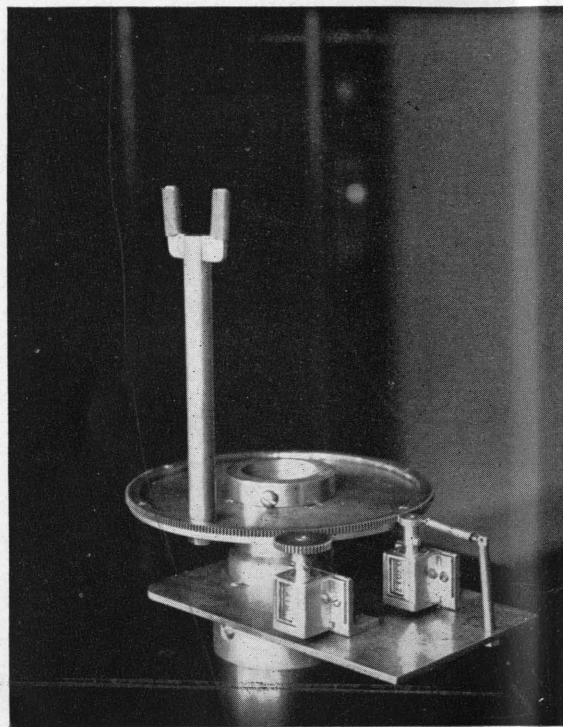
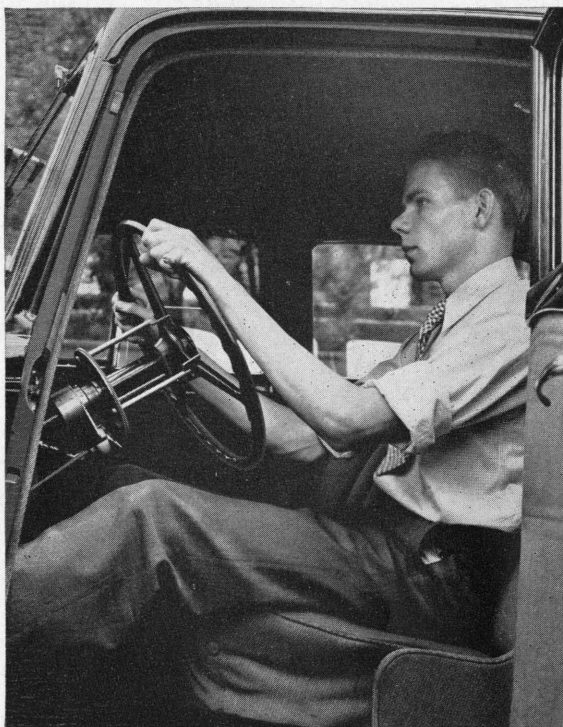
THIS test consists of having the driver add twenty-one columns of fifteen numbers each, the numbers being 2 to 9 inclusive, and the order being chosen by a method which insures random selection.

The time required by the driver to obtain correct answers is recorded as his score.

Fatigue due to loss of sleep has been shown to

increase the time required to obtain correct answers. This is the result in part of errors made in addition, and in part a slowing up of the mental processes. We have found the same result is brought about by automobile driving.

This test was chosen because it practically duplicates an activity used in business, home or school—the application of which is obvious.



7. STEERING-WHEEL MOVEMENTS

ONE photograph shows the detail of construction of the "steering-meter." The other photograph shows the meter in place on the steering-wheel.

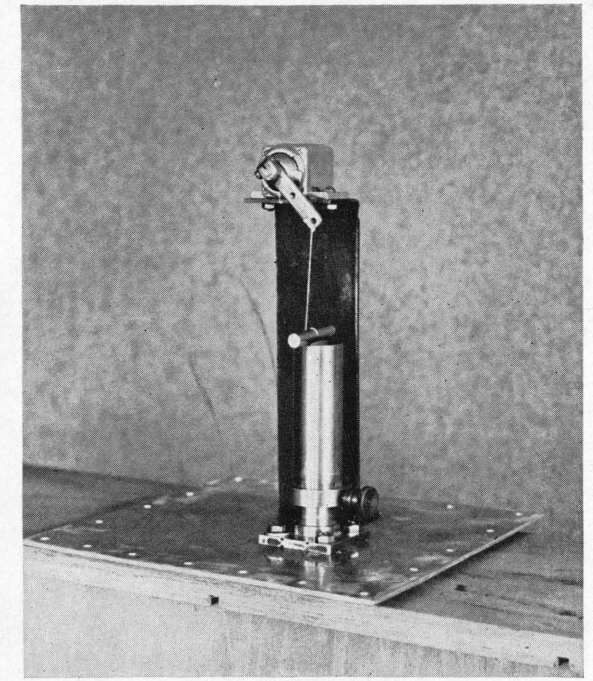
Each time the steering-wheel is turned, it moves the large gear wheel, which in turn operates the two Veeder counters.

The counter on the left has a ratchet arrangement, so that movement in only one direction is recorded. On the right is another counter, connected with a gear wheel which has only one tooth, and a spring, connected in such a manner that the tooth is always engaged to the

large gear wheel. This counter records every movement of the steering-wheel, either to the right or left.

The steering-meter, by means of the two Veeder counters, will record the number of times the steering-wheel is turned back and forth, and the total circumferential distance through which it is turned during a drive.

The steering-meter enables us to measure the effect of fatigue on the efficiency of steering—giving us a measure of the degree of effort required.



8. RESTLESS MOVEMENTS

Two photographs are shown of the instrument used to register the movements of the driver against the back of the seat.

One photograph shows details of the instrument, and the other shows it in place on the back of the seat.

The instrument consists of a square sheet of aluminum on which is mounted a Veeder counter. It is sewn to the upholstery on the back of the seat. A very small hole ($\frac{1}{8}$ inch) was made in the back of the seat, and a fine wire carried through by means of a long needle, perforating the upholstery on the front surface of the back

of the seat, a little below the mid-position of the back.

It is tied to a flat button that sinks in the upholstery, and the other end of the wire is fastened to a spring inside the adjustable tubes shown in the photograph. The spring is then attached to a Veeder counter.

The same principle is used in recording the movements underneath the driver's seat.

The purpose of these instruments is to record the number of restless movements the driver makes in his seat while driving, and whether or not they increase with fatigue.

RESULTS

FIRST, as to the tests themselves as quantitative measures of fatigue. The tests as described obviously permit of measuring certain human functions. This is not enough—the manner of administering, controlling and interpreting the results is equally important in developing a technique for quantitative fatigue measurement.

Briefly, our tests were planned somewhat to resemble industrial tasks in their nature, differing in that each test was confined to some simple function of the body and planned so that these functions could be accurately measured, taking into account the practice, warming up, and spurt effects so generally encountered in hourly curves of industrial output.



Other research workers, as well as ourselves, have in the past, with the aid of expensive instruments, studied the speed and accuracy of simple human reactions before and after conditions that were believed would cause fatigue. An increase in time and increase in errors were in general the result—but the results were often contradictory and unreliable. The effects of fatigue are often offset by increased effort in tests of short duration, such as these.

In our present research on auto-fatigue, we have one test devoted to the reaction time and errors (complex reaction time), and in the case of a certain car, we have obtained after long drives an increased reaction time in twenty-two out of twenty-four drives; and an increase in errors in twenty-one out of the twenty-four drives, while in three there was no change. The average increase in time was 6.51% and errors 99.37% in these tests.

How are we to account for such positive and consistent results? Largely by controlling the elements of practice and spurt in the manner of conducting the test. Our test which required 1,200 reactions eliminated such factors.

In comparison with these results, we have those of eight tests made on days in which there were short drives, light exercise, or recreation, the increase in time was 0.44%, and the increase in errors was 7.06%—quite in contrast to the results obtained on the driving days. It may also be pointed out that on these control days, all of the other tests showed an improvement in the average evening performance as compared with the morning test.

That the tests themselves, in the manner in which they were administered, are accurate measures of fatigue, is indicated by certain statistical conditions that are satisfied.

Briefly, the differences between the averages obtained for the Dodge and other cars proved to be significant when compared with the probable error of the differences between the averages; and a high degree of correlation existed between the results of different tests made on the same day on each driver.

In measuring and comparing the fatigue produced by driving different cars, all six laboratory tests described were given to each driver so that the measurement of fatigue

occurring as a result of any drive was based upon the results of the entire six tests, instead of just one.

To be more specific, let us say we are comparing the fatigue produced in the Dodge car with that occurring in another car, which we shall call car B.

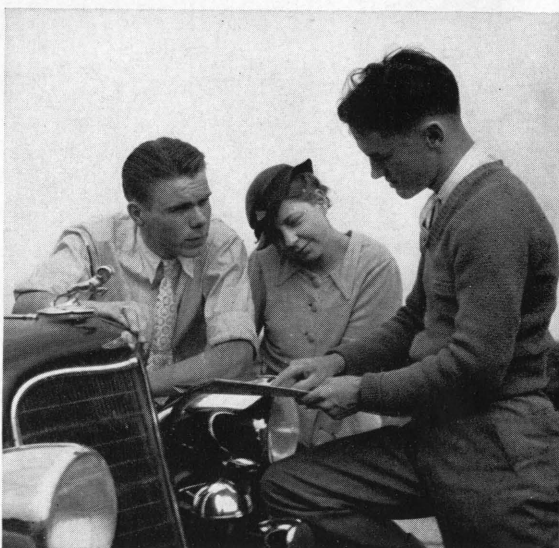
Each driver is tested each morning, both cars are run over the same road, exposed to same traffic, weather, and road conditions, and the drivers of each car are again tested at the completion of the drive.

On the second day following, the same drivers are sent out with the same cars, but the driver who previously drove the Dodge now drives car B, and vice-versa.

This method of procedure is continued until we have obtained six road trips for each of four drivers on each of the two cars. The test-results are recorded and calculated in terms of the per cent. change in each test for all road trips on each car.

We are able, then, to compare the average impairment of human functions that each test measures, for each car. From this we proceed to obtain the average of all tests for all drivers on each car, giving the same weight, or emphasis, to each test.

The data so obtained give some very interesting results, not only on auto-fatigue but upon the accuracy of the test methods themselves, the application of which extends beyond the automobile industry.



COMPARATIVE IMPAIRMENT OF HUMAN FUNCTIONS RESULTING FROM DRIVING DODGE AND TWO OTHER CARS

AVERAGE PERCENTAGE IMPAIRMENT AFTER DRIVES

24 TRIPS EACH CAR AVER. DISTANCE 349 MILES	DODGE	1	2	3	4	5	6
		1	2	3	4	5	6
23 TRIPS EACH CAR AVER. DISTANCE 330 MILES	DODGE	1	2	3	4	5	6
		1	2	3	4	5	6

KEY TO TEST RESULTS
6. MENTAL ADDITION
5. COMPLEX REACTION TIME
4. VISUAL ACUITY
3. HAND-EYE COORDINATION
2. POSTURAL STEADINESS
1. VASCULAR SKIN REACTION

Of the cars compared with Dodge, the test-results showed that, in the case of Dodge, there was 54 to 65% less impairment of human functions measured by the tests, than in the other cars tested.*

The accompanying chart shows in detail the comparative results obtained on Dodge and two other cars.

The test runs upon which these results are based, covered over 40,000 miles of driving.

A woman driver showed effects of auto-fatigue similar to those obtained on the men drivers.

There were other interesting facts disclosed in the experiments, dealing with the effect of prolonged drives; dirt and gravel roads, wet and slippery pavement, effect on passengers, etc.,

*In making these tests, Dodge was compared against a car produced in large volume in the lowest-priced group, and against one of the leaders in a higher priced class.



but lack of space prevents further discussion of them here.

There are, however, two additional test-records taken during the course of the drive, the results of which will be mentioned. Records obtained from the steering-meter during the drives provided some new and important information on steering.

In driving a car a distance of 350 miles over a concrete highway, a driver will oscillate the steering-wheel back and forth as many as 10,000 to 15,000 times; and on a dirt and gravel road, twice as much.

It is thus obvious that the ease of steering is an important item in the reduction of auto-fatigue. And auto-fatigue shows its effects on the handling of the steering-wheel. We found that fatigue increased the number of oscillations of the steering-wheel per mile. The effect of fatigue was thus to decrease the efficiency and increase the effort of steering.

That the effort and discomfort of driving are increased by fatigue is further indicated by the "restless-meters" on the back and underneath the seats. These meters showed that restlessness in the driver's seat increased with fatigue, there being a greater increase in the more fatiguing car.

A curious result was discovered when we compared the statements made by the drivers about the way they felt with the results obtained in the tests at the end of the drive. While the tests and the feelings of fatigue agreed generally on days when the drivers said they felt very tired, there was not very good agreement on other days. Often a driver said he felt "pretty good" at night after a drive, when his tests showed the opposite.

Fatigue then increases the hazards of driving, increases the effort and discomfort of driving, and lowers the efficiency of the driver for other pursuits.

ANDREW H. RYAN, M. D.

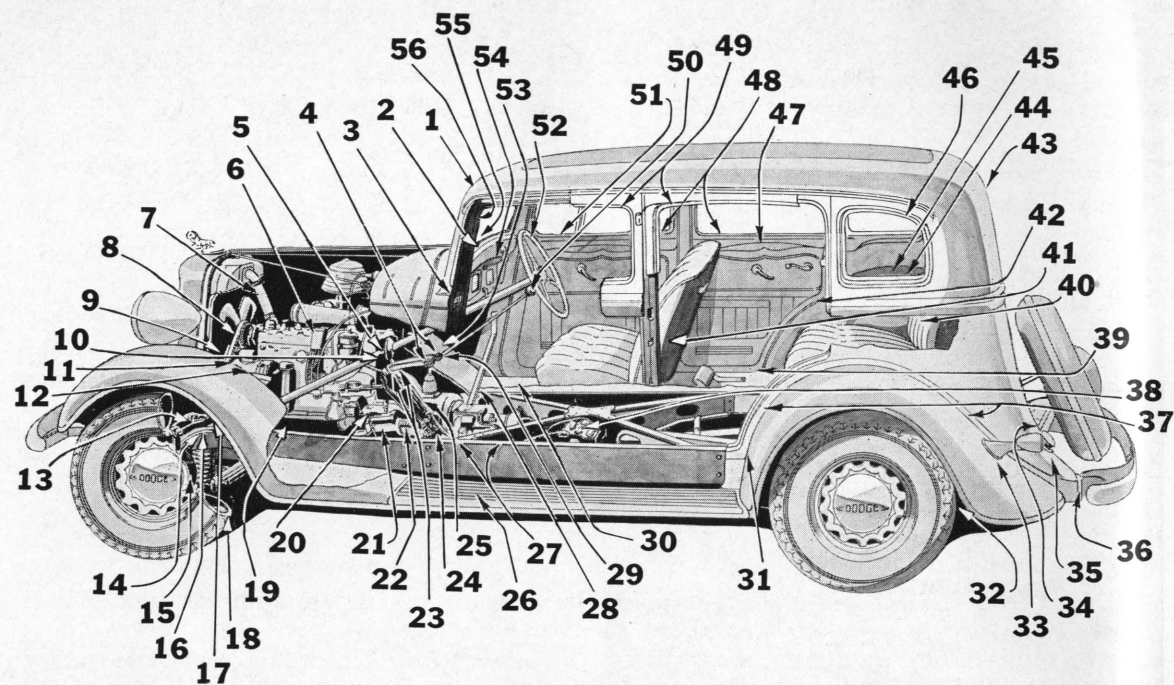


Diagram shows the 56 vital points where Dodge utilizes rubber

WHY THE NEW, BIGGER DODGE IS SO MUCH EASIER RIDING

You have heard claims galore about easy riding. But in the foregoing pages, Dr. Ryan has come forward with conclusive proof that Dodge is actually 54 to 65% less fatiguing. And that's proof that Dodge must be easier-riding, too. If Dodge didn't offer you such driving ease, such comfort, such effortless handling, it couldn't be so easy on your nerves.

Rubber at 56 Vital Points

To begin with, Dodge utilizes rubber at 56 vital points. You are thus protected against road shock, noise, bumps, and other factors that make riding disagreeable and more tiring. Iron isn't rattling against iron, steel isn't scraping against steel. Vibration—the deadly enemy that is slowly, steadily shaking ordinary cars to pieces—is smothered, so Dodge lasts longer, runs with fewer repairs.

The very engineering advantages that give Dodge such completely modern comfort and riding ease also provide the economy for which this dependable Dodge is famous.

Floating Power Engine Mountings

With Floating Power, engine vibration never

reaches the body or frame of the new, bigger Dodge. At the highest speeds, you have complete smoothness. There is no "jitter," no jarring or jolting from vibration.

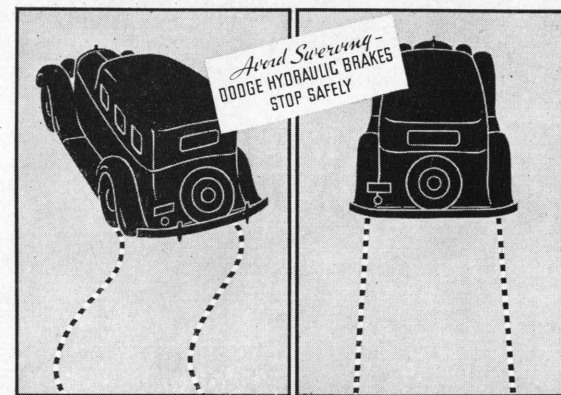
The illustration shows Johnny Farrell, champion golfer, driving off the hood of a new Dodge—with the engine running at high speed! In an ordinary car, such a drive would be impossible—



engine vibration would shake the car and destroy the golfer's aim. But with Floating Power, Johnny Farrell has a driving plane as smooth and even and steady as the finest turf.

Cross-Steering

Engineers have devised an entirely new type of steering principle for Dodge. It is called cross-steering. Road shocks never reach the steering wheel; there is no "shimmy," no wheel-fight. Finger-tip steering control is at last possible. When you take a sharp turn in the new, bigger Dodge, you don't have to struggle with the wheel in order to right the car. *It rights itself.* All the effort, all the strain of steering has been banished in this new Dodge.



Hydraulic brakes are safe, sure, smooth—and quick in action! Weatherproof, self-equalizing; save expense of frequent adjustments. Save tires and brake linings, too

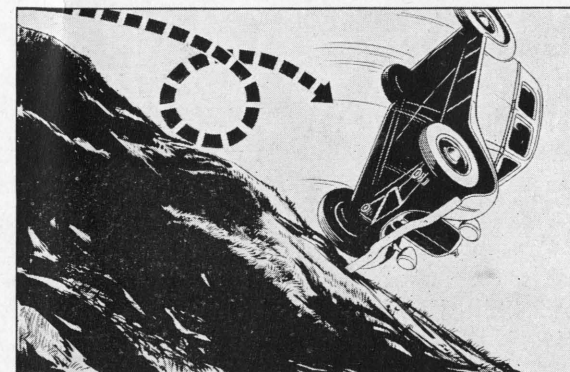
efficiency. Unlike ordinary brakes, you do not have to get the "feel" of Dodge hydraulic brakes in order to stop the car without a sudden jerk. Hydraulic brakes are self-equalizing. They don't require frequent adjustments—which means real economy. They are easier on tires and brake linings, too. The peace of mind and security given by these safe brakes go a long way toward making your ride more pleasant, less wearing on your nerves.

Safety All-Steel Body

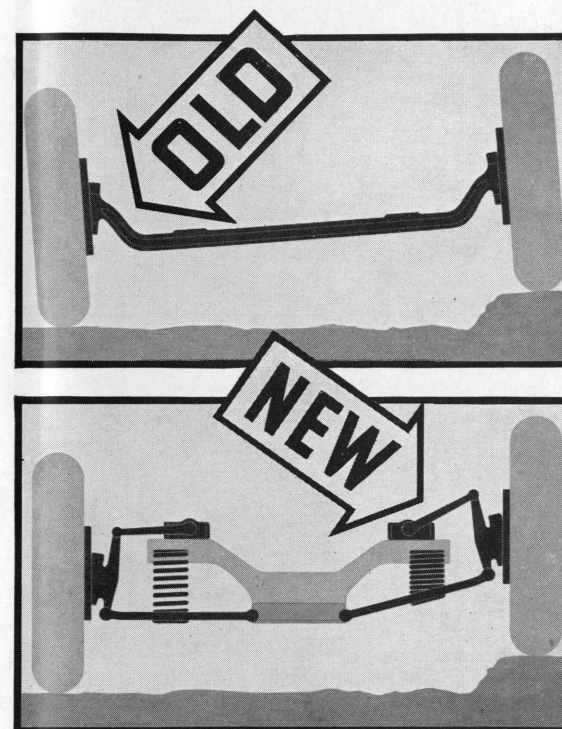
The Dodge all-steel body is another contribution to safety and comfort. Dodge has used an all-steel body since 1914, just as Dodge has always pioneered in giving motorists safety and dependability.

There are no squeaks or rattles in this body. It is welded electrically into one unit of sturdy steel.

Time and again Dodge test cars have been deliberately toppled down steep hills, rolling over and over, crashing against rocks, smashing their way to the bottom—without serious



In dramatic tests, Dodge cars have been deliberately pushed off steep cliffs—plunging, crashing, rolling over in mid-air... then able to drive off under their own power



The simple diagram at top shows what happens when one of the front wheels—mounted in the old-fashioned way—hits a bump. Now look at the lower diagram. When the "Floating Cushion" wheel hits a bump, the independent suspension springs move upward. The rest of the car remains on even keel. AND YOU DON'T FEEL THE BUMPS! The same action takes place when the wheel strikes a rut or hole—except that the wheel falls instead of rising

"Floating-Cushion" Wheels

Independent front-wheel suspension has been developed to a point in Dodge where it is superior to the ordinary "knee-type" suspension. The wheels actually step over bumps and ruts. Rough roads are made smooth. There is no pitching or rolling of the rear seat. For the first time, a completely smooth, leveled ride is yours.

Hydraulic Brakes

Braking is almost automatic with Dodge hydraulic brakes. Not only do they come to a full stop, quickly, evenly, smoothly. They require a minimum of foot-pressure for safety and

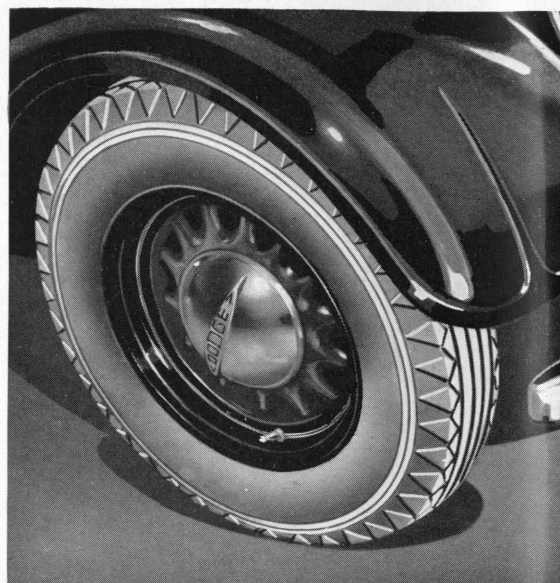
damage to body or chassis. This is the kind of protection every motorist owes his family in these days of high speed and congested traffic.

Quiet Gears

There is no annoying clash or grind when you shift gears in a Dodge. They are quiet in every speed—including first and reverse. They shift easily, noiselessly, effortlessly.

Airwheel Tires

Big, smart-looking, these low-pressure tires help to cushion you against rough roads. And they provide an extra element of safety in braking on wet pavement or gravel roads. Some cars charge as much as \$32 extra for the tires and wheels needed for this feature. But it is standard equipment on every Dodge.



ADVANTAGES OF THE NEW, BIGGER DODGE

Roominess

With its long wheelbase, Dodge offers the roominess, comfort and pride that only a big car makes possible. Yet it is a fact that this big Dodge costs you \$80 to \$150 less than many cars on the same or smaller wheelbase!

Smartness

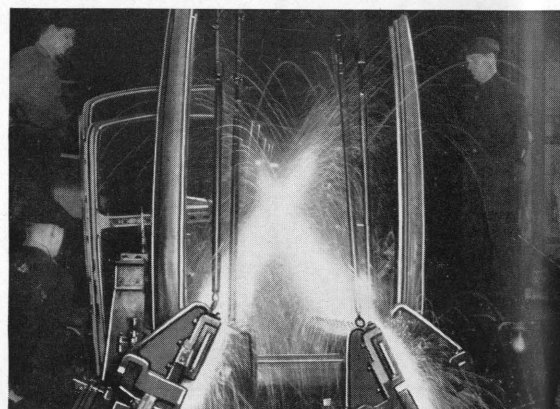
With its sleek lines, its impression of verve and dash, this new Dodge has an air of youthful style, of advanced luxury. Definitely the favorite car of the younger set, Dodge beauty has the stamp of approval of the country's leading style experts.

Speed

A powerful, responsive engine provides all the speed you want in this new Dodge. And no matter what speed you drive, you have absolute smoothness, free from vibration and shock.

Thrilling Performance

Just press the accelerator! Feel that big Dodge leap ahead. See the other cars slip back as Dodge jumps into a quick lead. Take the corner—steering is amazingly easy—you glide around the turn without having to struggle with the wheel. The car rights itself... Find a road that's rough and hard. You won't know it's anything but concrete. "Washboard" surfaces are leveled out. Shift into any speed, including reverse. There's no clash of gears; no grind. Climb the hills—you can feel the surging power of the mighty Dodge engine carrying you upward. Set any standard of performance you please—Dodge will more than live up to it.



Dodge Safety all-steel body being welded into what becomes one solid unit of steel

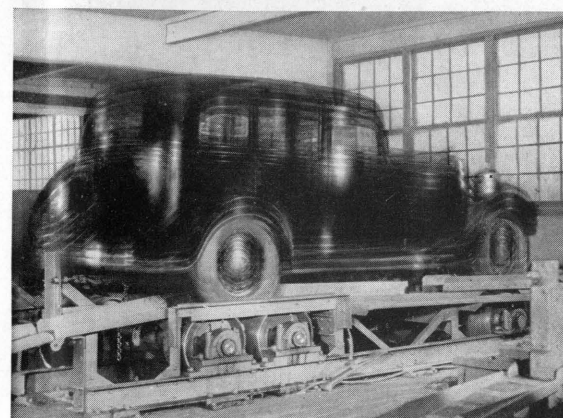
Safety

Safety is built into this big, rugged Dodge right at the factory. Strong steel body, welded into one safe unit. Hydraulic brakes that are always equalized, stop quicker without swerving. Duplate safety plate glass windshield. Sturdy bridge-type frame, ten times more rigid than ordinary frame construction. In a Dodge, you give your loved ones the utmost in protection.

Quality-Built

In spite of the fact that Dodge is a low-priced car, just a few dollars more to you than the smaller, lowest-priced makes on the market, no expense is spared to give it thorough quality. It has a modern ventilating system, with a windshield that opens for summer comfort. Cast-iron braking surfaces, exactly like those in high-priced

cars, to cut relining bills. Rust-proofed body and fenders. Special alloy valve-seat inserts that save gas and provide thousands of extra miles without the need of valve grinding. Aluminum alloy pistons, for quick pickup and brilliant performance. 4 piston rings instead of the customary 3—for oil economy and better performance. 33 ball and roller friction bearings—more than any other car in its price class. Parking brake entirely separate from the foot-braking system. An oil filter. Air-intake silencer. Dozens of quality features that cost you not one penny extra—many not even found in high priced cars!



The "Belgian Roll," a particularly fiendish testing device. The new Dodge stood up under 600 hours of this torture!

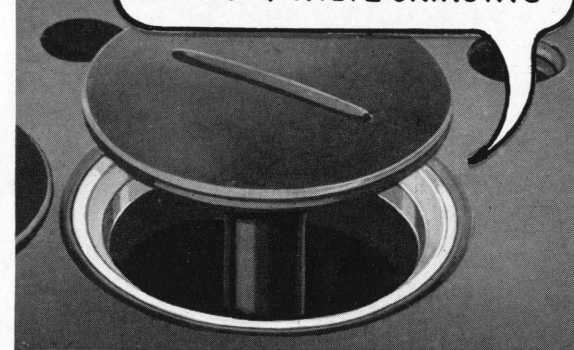
Economy

These Dodge features assure economy all along the line; in gasoline (owners report 18 to 22 miles to the gallon); in oil, tires, brake lining, brake adjustments, longer life, valve grinding—in all repairs and operating costs.

What's Back of Dodge?

Dodge is the largest builder of fine cars in the

I MAY LOOK SMALL AND UNIMPORTANT BUT I GIVE THOUSANDS OF EXTRA MILES WITHOUT VALVE GRINDING



Valve seat inserts, used by Dodge, save gas and postpone valve-grinding for extra thousands of miles

world. For 20 years the Dodge name has stood for quality, for precision manufacturing methods, for progressive engineering. Equipment, resources, man-power and experience combine to make Dodge the biggest value your dollar can buy. Dodge is sold by more than 4200 dealers in the United States. No matter where you drive, you will find approved Dodge service available.

DRIVE A DODGE

Visit any Dodge dealer now. Drive a Dodge. Take it for a long, hard trip. Give it every test. Then ask about the "Show-Down" Plan—that wonderful new method that lets you compare cars for yourself, in your own way. Learn how little it costs to buy—to own—a Dodge. Prove to your own satisfaction Dodge gives you so much extra value—for so little more than you'd pay for the smaller, lowest-priced cars.

