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SAYS BEST PROOF OF ETHYL GAS LIES IN RECORD OF USE

Vice President Midgley of
General Motors to Bring
This Up at Coming Hearing

CITES IMMENSE SALES,
WITH NO BAD EFFECTS

Tells of Laboratory and Other
Tests Made by Company to
Check up on Its Action

From World Staff Correspondent
Special Despatch to The World

DAYTON, O. May 8.—At the hearing to be held before the Surgeon General May 20 on ethyl or leaded gasoline, Thomas Midgley, jr., Vice President of General Motors and "Father of Ethyl Gas," to-day said the defense of the product would rest largely on field experience.

"The one paramount fact in the case," he told a reporter for The World in his offices at the General Motors Company research laboratory five miles from this city, "is that for two years we have been selling ethyl gas. In that period we have sold perhaps 300,000,000 gallons through 20,000 stations in twenty-eight States. A check-up shows not a single station or garage man affected. That is better than any laboratory tests. It is a large-scale service test."

Laboratory Tests Too

The company will put in laboratory records as well. Among them will be the records of the local plant, where animals have been exposed and where for two years Dr. Robert Kehoe of the University of Cincinnati has kept tabs on the physical condition of the forty men employed there.

The results have been negative. Mr. Midgley said. The men are examined at least once a week. So far no one has developed any untoward symptoms and the animals have shown no ill effects.

"Have any tests been made on human beings?" he was asked.

"No. If any are made, I will be

the first and only one to be experimented on," he replied. "Our tests consist of observing our men and seeing that nothing happens. We have perfected a method of handling the stuff so there is no danger, if it is not misused. At that, we are constantly learning something new. Our position is exactly that of the electrical companies when that art was new. In the pioneer days, men were killed because of ignorance. Now, if a man is killed, it is because somebody is careless.

Death Due to Ignorance

"The deaths in Bayway were due to ignorance of the effects of tetraethyl lead. The primary effect of the stuff is to exhilarate like alcohol. They wanted to and did stay at work until the sleepless stage developed. We know better now. The minute a man shows signs of exhilaration he is laid off. If he spills the stuff on himself he is fired. Because he doesn't want to lose his job, he doesn't spill it.

"That's one trouble. If it would only burn or be immediately unpleasant, we'd have no difficulty through carelessness."

"Is there danger in getting it on one's hands?" the reporter asked.

"No; let me show you." He had an attendant bring a quantity of pure tetraethyl, washed his hands thoroughly in the fluid and dried them on his handkerchief.

I'm not taking any chance whatever," he said. "Nor would I take any chance doing that every day."

Mr. Midgley said he had received no report concerning tests made at Columbia University nor by Dr. Henderson of Yale.

No Danger in Exhaust

The dangers to the public from the exhaust from motors using the compound, Mr. Midgley declared to be nil. The danger compared to the danger from carbon monoxide, said he, is as one to 300.

"We have made no tests on the possible effect of the discharge from motors in the streets," he continued. "The only laboratory equipped to make such tests is that of the Bureau of Mines in Pittsburgh.

"There is one interesting feature about the agitation. Ethyl gas is feared only where it is not known. In those State where it has been in use one or two years there is no clamor against it.

"But no more of it will leave our plants until it is settled that there is no danger in the stuff used properly and with reasonable care," he concluded.

Mr. Midgley left no doubt of his faith in the ultimate vindication of ethyl gas.

If the value of oral administration can be demonstrated, it will be a distinct advantage over the hypodermic method, which is dreaded by many people, in spite of the trivial pain caused. As typhoid fever is contracted through the digestive tract, there seems to be good reason to believe that vaccine may be administered in the same way. We have heard so much, however, of the administration of vaccine against smallpox by the mouth, and other absurdities of a similar character, that one is naturally cautious about adopting this new method. It should have the backing of impartial observation carried out on a large scale before general acceptance can be recommended.

1. *Bulletin de l'Académie de Médecine*, XLI, 1924.

ETHYL GASOLINE AND LEAD POISONING

New uses for many substances, in this instance lead, are continually being discovered. Lead is now apparently about to enjoy a very extensive application in the matter of motor fuels where it is to be added to gasoline for the purpose of increasing the efficiency of the engine. This of course at once raises the health question of lead poisoning.

Midgley and Boyd¹ have published the essentials of the new use for lead. These investigators point out that the automobile represents the first great advance in individual transportation since man began to use the horse. This transportation is obviously dependent upon an adequate supply of liquid fuel which for a number of obvious reasons means *petroleum*. In 1921 the production of gasoline in the United States was over five billion gallons, or the equivalent of filling a standard tank car every minute of the year. The fear is that the supply of this fuel may not keep up with the demand for it. Our supply of petroleum is being rapidly depleted. While other fuels, as from shale, coal and alcohol, may offer a reserve for the future, it will be many years before sufficient material can be obtained from these sources to supply any considerable percentage of the motor fuel requirements of the country. These workers therefore investigated the problem of increasing the efficiency with which the energy of gasoline is utilized and therefore of obtaining "more miles per gallon." To do this and still maintain acceleration and hill-climbing ability, it has been found necessary to discover a substance which will permit increased pressure of explosion while using gasoline. Here the chief difficulty has been the "knock." It is well known that if substantial percentages (40-60%) of benzene or alcohol are mixed with gasoline, fairly high compression can be obtained without the objectionable "knock" with its attendant loss of power.

The authors claim to have found that the "knock" in internal combustion engines is a chemical rather than a mechanical phenomenon; hence their investigation of various "anti-knock" chemicals. These include such substances as iodine, nitrogen, silenium, tellurium, tin and lead, all of which retard the knock.

Lead tetraethyl appears to surpass all the others. As an "anti-knock" compound when compared with benzene in 25 per cent concentration in kerosene, 1 volume of it is said to be equivalent to about 625 volumes of benzene. These "anti-knock" materials have been quite widely used in airplane engines, and their great effectiveness demonstrated.

1. Chemical Control of Gaseous Detonation, etc., and The Application of Chemistry to the Conservation of Motor Fuels. *Jr. Ind. & Eng. Chem.*, Vol. 14, No. 9, p. 849 (Sept., 1922), and No. 10 (Oct., 1922).

Benzene exerts its influence as a fuel; therefore requiring large quantities for admixture, whereas, the substances named are effective in fractions of a per cent. Lead tetraethyl is a compound in which a molecule of Pb is combined with four molecules of C_2H_5 . The preparation has been put upon the market under the name of "Ethyl Gas" by the General Motors Chemical Company or, more recently, the Ethyl Gasoline Corporation.

Midgley and Boyd feel that it will be only a matter of time when all gasoline will be treated with an "anti-knock" material and that automobile engines having higher compression and giving considerably greater mileage per gallon will be used.

Foreseeing the possibility of health hazard to garage and motor workers, as well as to users and the general public, the Corporation arranged with the United States Bureau of Mines in the autumn of 1923 to begin at its Experiment Station in Pittsburgh, a series of extensive investigations on the pharmacology and toxic effects, if any, of *ethyl gasoline* when used as a motor fuel, and particularly as to the resulting exhaust fumes from motors. Reports on this work are expected within a few weeks, in which the results of animal experimentations, human exposures, the analysis of air, of street drippings, etc., are to be covered. While it is probable that the full safety of the public and others will be demonstrated as the result of these investigations, this method of procedure also illustrates a somewhat new idea in connection with the exploiting of new discoveries to the public, viz., the primary investigation of the public health aspect. As we know, there are now many substances and appliances upon the market which are dangerous to users as well as to the public which unfortunately have not been given this preliminary study.

MEASURING PERSONAL COMFORT WITH THE KATA THERMOMETER

Personal comfort depends largely upon the rate of cooling of the human body. In other words, the temperature, humidity, and velocity of the surrounding air should be within reasonable limits to permit the heat generated within the body to be removed at the same rate. Persons working under uncomfortable conditions are necessarily inefficient, although through no fault of their own. Modern industry, to produce the best results from workers, now realizes the importance of personal comfort and is installing equipment to control these three factors pertaining to human comfort.

It has been shown lately that there is no single index of comfort in atmospheric conditions. The mercury thermometer, which until recently was the only instrument used for measuring the physiological effects of atmosphere, is very inadequate for the purpose, as it merely accounts for that part of the body heat lost by radiation and convection, while a great part of the body heat resulting from the metabolic processes within the body is eliminated by means of evaporation from the surface of the body. This lack of a suitable measuring instrument was partly overcome in 1916, when Dr. Leonard Hill, of England, who introduced the kata-thermometer, brought out an improved type. This instrument measures its own rate of cooling when its temperature approximates that of the human body, and thus, under favorable conditions of the environment, serves as an index of the rate of cooling of the body itself.

The kata-thermometer is a specially constructed alcohol thermometer having a stem 20 cm. long, and a cylindrical bulb 1.8 cm. in diameter and 2.2 cm. in

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LEADED GASOLINE REPORT DAMNING, EXPERIMENTS BY EXPERT REVEAL

Details of the Columbia Tests
Show Death and Paralysis
Invariably Result From
Doses Given Animals;
Even Rats Stricken

MERE HANDLING OF FUEL
DILUTION IS POISONOUS

Article in The World Verified
That University Workers
Became Victims

From The World's Bureau
Special Despatch to The World
WASHINGTON, May 22.—Details of Columbia University experiments, which led authorities there to conclude that tetraethyl-lead gasoline is a menace to any one handling it, became known to-night, although the text of the report of Dr. Frederick B. Flinn, who conducted the experiments, still is a secret so far as complete publication is concerned.

Officials at the Public Health Service let it be known that the reason for this secrecy is that the report is so damning to leaded gasoline that Dr. Flinn is going ahead with additional experiments intended to check every conclusion he has reached. For that reason he does not wish to make public any of his statistical data yet. It is denied by all concerned that any pressure is being exerted by any one to keep the report a permanent secret.

High Spots Cited

The World, however, is able to present the text of Dr. Flinn's introduction to his report, presented Wednesday to the conference of scientists called by Surgeon General Cumming. The high spots are:

That with a few minor exceptions, only the lead diluted gasoline was used in the tests—the solution that goes to the public and not the raw tetraethyl lead itself.

That animals given treatment of small quantities of the fuel—10 cubic centimetres, or same amount that would remain on a garage man's hands if he used the gasoline to wipe off grease—died in many cases became paralyzed in others, and invariably were found through analysis to have absorbed lead. This amounts to poisoning.

That of two dozen rats so treated, all died, although rats are not usually susceptible to lead. That there is no doubt that the mere handling of the diluted fuel would cause lead absorption.

World Story Proved

In this connection Dr. Flinn again in effect verified the article printed in The World some time ago that he and his assistant, Miss Agnes Starkson, had accumulated lead during the experiments, though working under the most careful conditions. Dr. Flinn described their symptoms as some of those usually found in lead poisoning.

Dr. Horatio Williams, head of the Department of Physiology at Columbia University at that time, denied The World article as "utterly false." His contention was that accumulation of lead was not necessarily lead poisoning, though it is conceded that lead poisoning is simply the stage where the accumulation has become great enough to bring serious results.

"There is one interesting factor,"

1,000 parts of ordinary gasoline) shows that it can be absorbed under ordinary conditions around garages."

Dr. Flinn explained first that the utmost care was taken with guinea pigs, rabbits, rats, goats, pigeons and monkeys used in experiments so as to make sure they were exposed only to the same conditions any ordinary garage man might meet if he handled the doped fuel.

After telling of some of the preliminary arrangements for the experiments the text of Dr. Flinn's introductory to the report continued.

"We dosed our rabbits with 3 cc of the diluted gasoline daily over various periods. Animals, rabbits, died, but we were unable to find out whether they died of lead poisoning or not until toward the very end of some of our lung exposures. Some animals were exposed from 189 to 190 days.

"Those exposed for the longer period have shown definite signs of lead poisoning. We have had one rabbit absolutely paralyzed in the hind quarters—could not move at all. That animal, on being analyzed, showed stippings very plainly. We analyzed that rabbit and found it contained about 4.9 milligrams of lead.

"We then turned to goats for the simple reason they are more hardy and not so susceptible to respiratory diseases as rabbits. We treated these goats on the neck and on the other parts of the body with two centigrams of the diluted ethyl gasoline. We had four of those goats abraded.

"We analyzed the fetus of those goats and found lead. We have one goat now that we are still treating which is very weak in its hind quarters. Another goat shows a tendency of weakness in its left hind leg.

Fuels Compared

"In order to see whether there was a tendency between the dilute gasoline and the straight gasoline we took two of our goats and ordered distribution of the lead in the animal itself.

"We have taken two goats and put one cubic centimetre of the straight tetraethyl lead in the neck of those goats. We have dosed these animals for over sixty days at various times and the animals became hunched up and refused to eat, &c., and we feared they were going to die, so we stopped the dosage and let them rest for a few days. The animals recovered in a few days. That is the same thing that you see around industrial plants when a man is taken away from industrial exposure.

"About two weeks ago one of these goats became suddenly paralyzed in its hindquarters, cried all day long and passed out. We examined this goat and found lead in the organs, 3 1/2 MM. in the brain, the total brain weighing about 25 grams; we found lead in the bones and we found about .8 of 100 grams in the muscles, showing that lead was pretty well distributed throughout the whole animal.

"As to the other goat, we have stopped the lead for the time being to see if it will recover, and it has shown signs of coming out of the lead intoxication in two weeks.

Garage Conditions

"Passing on to the gas chamber, we were uncertain exactly how to approach that question. We tried various evaporation tests of various materials, powders &c. We threw gasoline around like you would have it around a garage, where it would not be absorbed through wooden floors, and we found that the rate of evaporation varied according to the temperature, the air movement and as to how the gasoline spreads itself over the surface.

"However, we did find that we could evaporate about 400 cc. on the average, inside of about four hours, of gasoline. We used that as a criterion and exposed animals four hours in the gas chamber. The gas chamber contains approximately 120 cubic feet of air, and the air is charged about six times an hour. As far as we could determine, both by analyzing the air and by analyzing the fumes afterward, this would contain about .03 of lead per cubic foot.

"We evaporated our gasoline by pas-

we put them in. They showed no signs of any bad effect from gasoline.

"We decided to use that as a criterion, so we then exposed these animals to the vapor of gasoline in this air chamber, containing approximately, as far as we can determine, about 300 milligrams of lead per cubic foot. Strange to say, and rather to our surprise, we found the rats rather susceptible to lead poisoning.

"I do not quite understand it. We exposed only two dozen rats and each one died. We exposed them anywhere from fifty-six hours to over two hundred and twenty hours, and each time we analyzed we found lead in them.

"Our experience leads us to believe that if a man is exposed to the same exposure that the animals had, he cannot help absorb lead. Whether the symptoms become marked enough for the average scientific man to recognize the symptoms is a question.

"For fear that we might have made a mistake somewhere in our lead chamber, and so forth, just a couple of weeks ago we took an iron pan, about thirty inches in diameter, and with a false bottom made of one-half inch mesh on the bottom, and in that iron pan we put a litre and a half of gasoline, and on the top of the false bottom we placed white rats, leaving the animals exposed to just the natural evaporation of the gasoline.

Evaporation Tested

"The litre and a half evaporated practically all inside of twenty-four hours and the animals were exposed twenty-four hours, except for two hours we took them out in order to give them a chance to get water and food, and it also gives us a chance to wash out the bottom of the pan so no dust from the evaporated material, or any concentrated lead, shall cause an addition to the gasoline.

"The rats did not die. We killed the two on purpose to determine the lead contents of the rats after seven days' exposure. At the end of seven days we found that the rats contained on the average four milligrams of lead, the rats weighing on the average fifteen grams, showing that lead can be accumulated by the ordinary, natural evaporation of gasoline."

Autopsy Indicates Death Due From Lead Poisoning

Chemical examinations of parts of the viscera of Anatose Levanus, said to have been a laborer at the Bayonne docks of the Standard Oil Company, indicated yesterday that he had died from lead poisoning, according to Dr. Alexander O. Gettler, city toxicologist at Bellevue Hospital. Other parts of the viscera are still under examination.

"We don't know whether he absorbed this lead through tetraethyl or not," Dr. Charles Norris, Chief Medical Examiner, reported last night. "Thus far we have found no evidence of volatile lead, prevalent in cases of tetraethyl poisoning, and therefore we can't say whether the lead found in this man's kidney and spleen was derived through working with tetraethyl."

Levanus, who was thirty-eight and lived at No. 67 Cherry Street, was taken to Reconstruction Hospital at No. 395 Central Park West, April 22 last, and complained of straining of the back. Examination revealed no such strain, and moroseness and inability to make himself understood elicited little information for the hospital authorities. May 5 he became insane and was removed to the psychopathic ward at Bellevue, where he died May 14. Since that time Dr. Gettler has been conducting a chemical examination of his viscera.

"Dr. Gettler is not sure how much lead is present," Dr. Norris said last night. "Absorption of lead is an occupational disease. Great quantities indicate that the men have been subjected to constant absorption. The bones absorb more than any other part of the body, and so far Dr. Gettler has not examined them."

Dr. Norris said that detection of tetraethyl lead itself is only shown in the autopsy in cases where the sub-