

# ΠΡΑΚΤΙΚΑ ΤΗΣ ΑΚΑΔΗΜΙΑΣ ΑΘΗΝΩΝ

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ΣΥΝΕΔΡΙΑ ΤΗΣ 23ΗΣ ΝΟΕΜΒΡΙΟΥ 1961

ΠΡΟΕΔΡΙΑ ΙΩΑΝΝ. ΤΡΙΚΚΑΛΙΝΟΥ

ΠΡΑΞΕΙΣ ΚΑΙ ΑΠΟΦΑΣΕΙΣ ΤΗΣ ΑΚΑΔΗΜΙΑΣ

ΑΠΟΔΟΧΗ ΚΛΗΡΟΔΟΤΗΜΑΤΟΣ

Ἐγένετο δεκτὸν ὑπὸ τῆς Ὀλομελείας, κατόπιν προτάσεως τῆς Συγκλήτου, κληροδότημα εἰς τὴν Ἀκαδημίαν τοῦ **Γεωργίου Πανοπούλου** ἐκ δραχμῶν 150.000, ὅπως ἐκ τῶν τόκων, συμφώνως πρὸς τοὺς ὅρους ἐν τῇ διαθήκῃ τοῦ δωρητοῦ, προκηρύσσεται ἀνὰ διετίαν **β ρ α β ε ἴ ο ν Χ η μ ε ί α ς**. Ἡ Ὀλομέλεια, ἀποδεχθεῖσα τὴν κληροδοσίαν ταύτην, ἀνεκήρυξε τὸν κληροδότην **δ ω ρ η τ ῆ ν** τῆς Ἀκαδημίας.

ΨΗΦΙΣΙΣ ΤΟΥ ΠΡΟΫΠΟΛΟΓΙΣΜΟΥ ΤΟΥ 1962

Μετ' εἰσήγησιν τοῦ Γεν. Γραμματέως κ. **Ἀναστ. Ὀρλάνδου** ἐψηφίσθη συμφώνως πρὸς τὸ ἀρθρ. 104 τοῦ Ὄργανισμοῦ καὶ τὸ ἀρθρ. 38 τοῦ Ἐσωτερ. Κανονισμοῦ ὁ προϋπολογισμὸς τῆς Ἀκαδημίας τοῦ οἰκονομικοῦ ἔτους 1962.

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ΑΝΑΚΟΙΝΩΣΕΙΣ ΜΗ ΜΕΛΩΝ

**ΧΗΜΙΚΗ ΤΕΧΝΟΛΟΓΙΑ ΕΠΙ ΤΩΝ ΚΑΥΣΙΜΩΝ.— Dangerous vapours from gasoline engines, by Timol. Voukydis\***. Ἀνεκοινώθη ὑπὸ τοῦ Ἀκαδημαϊκοῦ κ. Κωνστ. Βέη.

A. TECHNOLOGY.

I. Since some years I have been considering the problems related with the dangerous vapours from gasoline engines. The importance of the subject has increased recently because the consumption of the automobile gasoline has increased manyfold and because refineries all over the world produce such gasoline by cracking. This method is preferred because of its low cost.

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\* ΤΙΜΟΛ, ΒΟΥΚΥΔΟΥ, Περὶ δηλητηριώδους ἐπιδράσεως τῶν καυσαερίων τῶν βενζινομηχανῶν.

2. The improperly refined automobile gasolines, particularly those obtained by cracking, have a relatively large unsaturated hydrocarbons content. This, the high content of unsaturated hydrocarbons, is the main cause of various troubles in the gasoline motors (internal combustion engines using gasoline as fuel) such as preignition and knocking, reducing the output of the engine. The defect of the product is measured in octane numbers by the motor or research methods and in such gasolines the number is low.

3. To eliminate or reduce such troubles in engines, antiknock materials are added by the refiners to the automobile gasoline. The cheaper known of such materials is the Lead Tetraethyl ( $C_2H_5)_4Pb$ ) commonly known by its trade name TEL. TEL increases substantially the octane number of the gasolines. This is important particularly in the case of gasolines that have a low octane number either because of their natural composition or because of the methods used in their production. The development of modern gasoline motors demands that the fuel has a higher octane number say 80 or 90 and sometimes 100 (NATO has specified a 91 minimum) approaching that of the aviation engines. This resulted to an increase of the TEL content which has to be added to the auto gasoline.

4. TEL is a colorless oily liquid with a pleasant aroma  $d = 1.65$ , boiling point  $198 - 202^\circ C$ , decomposes gently at room temperature, attacks the skin and is a highly toxic and «accumulative» poison. According to the treatise of the Academician Professor G. Ioakeimoglu and the Dispensary of the U.S.A. (23rd edition 1943) by Il Woodand and A. Osol, professors, page 1422, «Lead-Tetraethyl»: Air saturated at room temperature with vapours ( $C_2H_5)_4Pb$ ) contains 5 ml. of this poison per litre. This small quantity kills mice within 10 minutes. They conclude that inhalation of TEL is extremely dangerous to the human body.

5. TEL is not added as it is but as an ethyl liquid (I.T.Mix) of the following formula in proportion of 2-4 ml/Imp gallon.

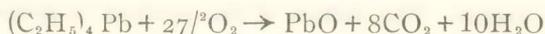
Formula of the Ethyl Liquid:

a) Lead Tetraethyl ( $C_2H_5)_4Pb$ .. ..	61.42% wt.
b) Bromide Ethyl $C_2H_5Br$ .. .. .	35.68% wt.
c) Color organic - soluble in oil ..	0.17% wt.
d) White spirit .. .. .	2.73% wt.

100.

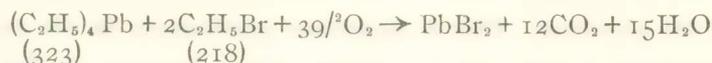
The physical and chemical reasons for which the ethyl liquid (I.T.Mix) is thus formulated and added to the gasoline are:

If TEL is added alone to the Gasoline and thus burnt in the explosion chamber of the engine, it would be converted into very small yellow scales of Lead Oxide (PbO) probably\* by equation



In such a case the deposit of Lead Oxide in the explosion chamber would block the piston rings, the sparking plugs and other accessories with the result that the engine will stop and the cylinders possibly may crack.

By adding however  $C_2H_5Br$  to the Ethyl Liquid, PbO is not produced; instead  $PbBr_2$  is produced probably by equation



i. e. for about 100 parts  $(C_2H_5)_4Pb$ , are needed 67,49 parts  $C_2H_5Br$  (wt).

Lead Bromide ( $PbBr_2$ ) is far more poisonous by many units than Lead Tetraethyl  $(C_2H_5)_4Pb$ , especially because it is soluble in water and steam.

#### B. MAIN THEME

6. The Lead Bromide, thus formed in the explosion chamber of the motor is discharged through the exhaust to the atmosphere together with the exhaust gases produced while the engine is running. During the heavy traffic of automobiles on the roads, the production of Lead Bromide is abundant and the atmosphere is polluted to an extent extremely dangerous to the people who breath it.

As mentioned already Lead Bromide is soluble in water and steam. It therefore dissolves easily in the water vapours of the lungs and thus enters into the body. The consequences are not readily detected because it enters in very small proportions at a time, but because of its accumulative character, its slow effects are very dangerous on the human body, a subject to be considered by specialized doctors.

7. I have written to the following authorities:

- a) The Ministry of Health, Committee of Ethyl-Petrol, London.
- b) Ministry of Civil Aviation, Department of Scientific and Industrial Research, London.

- c) The Surgeon General, Public Health Service, Washington DC.
- d) World Health Organization, Geneva, and various other institutions, but could not find whether any other research work has already been done on the effects of Lead Bromide poisoning.

8. It is recorded that in 1956 Mr. Samuel T. Yuster, professor of Engineering and Principal Extension, Representative of the University of California, presented to the Technical Chamber of Greece a paper on the subject of Air Pollution. He described an apparatus named «afterburner» which was intended to burn the exhaust gases. In my opinion this apparatus will not solve the problem of Lead Bromide poisoning, because Lead Bromide cannot be further burnt in any type of apparatus such as Mr. Yuster described.

9. To study the subject properly the following factors should be examined:

- a) Number of vehicles circulating in a specified unit of time and in a specified part of a road.
- b) Approximate average output of exhaust gases per engine.
- c) Lead Bromide content in the exhaust cases.
- d) Cubic meters of the space of the specified part of the road.
- e) Average speed of wind.
- f) Height of buildings etc.

10. On basis of the above, the undersigned believes that the recent increases in the heart diseases and cancer may very probably be due to the inhalation of the exhaust gases (i. e. the Lead Bromide contained therein) of the auto gasoline engines.

#### Π Ε Ρ Ι Λ Η Ψ Ι Σ

1. Πρὸς ἐξουδετέρωσιν τῶν ἀνωμαλιῶν (προαναφλέξεις, κτυπήματα, χαμηλὸς ἀριθμὸς ὀκτανίων κλπ.), αἱ ὁποῖαι προέρχονται ἐκ τῆς χρησιμοποίησεως εἰς τὴν κίνησιν τῶν αὐτοκινήτων οὐχὶ καλῶς διυλισμένης βενζίνης, ἢ ὁποῖα περιέχει οὕτω ἀκορέστους ὕδρογονάνθρακας, προστίθενται ἀντικροτικά οὐσίαι ἐξ ὧν ἡ πλέον εὐθηνῆ καὶ ἀποτελεσματικὴ εἶναι ὁ τετρακινθυλιοῦχος μόλυβδος  $(C_2H_5)_4Pb$ , φερόμενος ὑπὸ τὰ στοιχεῖα T.E.L.

Οὗτος καιόμενος μετατρέπεται εἰς ὀξειδίου τοῦ μολύβδου (PbO), κιτρίνην κόνιν εἰς λέπια, πιθανὸν κατὰ τὴν ἐξίσωσιν  $(C_2H_5)_4Pb + 27/2O^2 \rightarrow PbO + 8CO_2 + 10H_2O$ . Εἰς τὴν περίπτωσιν ταύτην ἡ ἀπόθεσις τῆς κόνεως ταύτης εἰς τὸν χῶρον ἐκρήξεως τοῦ κινητήρος, θὰ ἀπέφρασσε τὰ ἐλατήρια τοῦ ἐμβόλου, ἀναφλεκτήρας καὶ λοιπὰ ἐξαρ-



πρωτοβουλίας κατέβαλεν ἀπὸ τετραετίας περίπου μεγάλους κόπους διὰ τὴν μελέτην τοῦ εἰρημένου θέματος.

Δηλῶ δὲ πρὸς τοὺς κ. Συναδέλφους ὅτι προτίθεμαι νὰ υποβάλω πρὸς τὴν Ἀκαδημίαν Ἀθηνῶν πρότασιν, ὅπως, συμφώνως πρὸς ὃ ἔχει δικαίωμα, εἰσηγηθῆ πρὸς τὴν Κυβέρνησιν τῆς χώρας τὴν σύστασιν εἰδικῆς Ἐπιτροπῆς, ἥτις νὰ προγραμματίσῃ τὰ ληπτέα μέτρα πρὸς ἀποφυγὴν τῶν εἰρημένων κινδύνων.

ΜΑΘΗΜΑΤΙΚΑ.— **An analysis of the Euler-Lagrange equations\***, ὑπὸ *Max Herzberger\*\**. Ἀνεκοινώθη ὑπὸ τοῦ Ἀκαδημαϊκοῦ κ. Ἰωάνν. Ξανθάκη.

Dedicated to the memory of Professor Constantin Caratheodory, the author's revered teacher and friend.

### Abstract.

The Euler - Lagrange equations in different fields of mathematics and physics can be transformed into the form given in optics by adding one more variable. The author gives to these equations a normal form which lends itself to the determining of the extremals, if the point and the direction are given. It is emphasized that the form of the equations is independent of the choice of variables.

### I. Theory.

Let  $\ell$  be a function of position and direction,  $\ell(x_i, \dot{x}_i)$ , where  $\ell$  is homogeneous in the first order in the  $\dot{x}_i$ , so that  $E = \int \ell ds$  is independent of the curve parameter. This parameter can therefore be taken as the arc length along the path, which is equivalent to stating that  $\dot{x}_i^2 = 1$ \*\*\*. The curves for which Euler's differential equations,

$$\frac{d}{ds} \left( \frac{\partial \ell}{\partial \dot{x}_i} \right) = \frac{\partial \ell}{\partial x_i} \quad (1.1)$$

hold will be called *world lines*.

\* Communication No. 2227 from the Kodak Research Laboratories.

\*\* **MAX HERZBERGER**: Ἀνάλυσις τῶν ἐξισώσεων **Euler - Lagrange**.

\*\*\* Starting with this equation, we shall use the Einstein convention of summing over any index appearing twice in the formula and leaving out the summation sign.