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Prolonged Delusion

G.V. Skornyakov

SUMMARY

The failure of some concepts taken roots in thermodynamics is established. The Second Law of thermodynamics is true only for all single- parameter or for fully integrated multi- parameter systems. The concept of entropy of a non-integrated system is illusory one.

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I. INTRODUCTION

The second century of existence of one of the most important branches of science - thermodynamics - ends. It is hardly an exaggeration to claim that its foundations were laid by Sadi Carno [1]. Thermodynamics is often compared to geometry. Like geometry, it is built on an axiomatic basis. In terms of the breadth of the coverage of phenomena, thermodynamics is not equal among physical theories. In this connection, in the mid-20th century, A.Einstein wrote [2]:

"The theory gives the greater impression the simpler its premise, the more diverse the subjects it binds, and the wider the scope of its application. Hence the profound impression that classical thermodynamics has made on me. It is the only physical theory of general content on which I am convinced that within the applicability of its basic concepts it will never be refuted (to a special note of principled skeptics). "

What did A.Einstein see as the most attractive features of thermodynamics? Recalling the creation of the theory of relativity, he emphasized [2]:

"Only the discovery of a general formal principle can lead us to reliable results. The sample was thermodynamics. There the general principle was given in the sentence: the laws of nature are such that it is impossible to build an eternal engine (the first and second kind)... The general principle of the special theory of relativity is contained in the postulate: the laws of physics are invariant regarding Lorentz transformations... This is a restrictive principle for the laws of nature that can be compared to the underlying thermodynamics restrictive principle of non-existence of the eternal engine. "

The question of compatibility of both axioms underlying thermodynamics and their compliance with the laws of nature did not even arise. The task of thermodynamics from the very beginning was not so much to find ways to convert heat into work, but to explain the mechanism of action of long-existing thermal machines and improve their characteristics. It put an indelible imprint on her. The presence of a heater and a cooler is a characteristic feature of such processes.

II. PFAFF EQUATIONS AND ENTROPY

An attempt at general analysis of thermal processes based on Pfaff equations describing their course was made by C.Caratheodory [3]. Probably, he did not know that the conditions of integrability of Pfaff equations in general long before him were established by G.F.Frobenius [4] and devoted to the proof of lemma from the theory of Pfaff equations a separate section of his article. In his understanding, heat migration occurs solely as a result of thermal conductivity and always from the hot body to the cold. Thus, acoustics were excluded from consideration. The visibility of the commonality of C.Caratheodory's

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approach can create the set of all possible processes introduced by him between any two points of the space of thermodynamic variables, to which he attributed the property of connectivity without any reason. Accepting the dependence of the energy produced on the transition path, he tacit suggested that all other quantities he used were unambiguous. As a result, C.Caratheodory concluded that the Pfaff equations of all thermal systems at any number of variables are integrable.

Such a strong claim fell on favorable ground and gave additional weight to the arguments of supporters of the broadest interpretation of the concept of entropy. The illusion of the existence of entropy was not completely groundless. The number of independent variables of the thermodynamic system by one exceeds the number of its external parameters. Over the years, the vast majority of cases have considered different systems with a single external parameter. Regardless of their nature, the corresponding Pfaff equations have an integrating multiplier.

For the case of three independent variables, the condition of existence of the integrating multiplier of Pfaff equations was also known by L.Euler. With the increase in the number of independent variables, the number of integrability conditions grows much faster than the number of independent variables, which makes the very possibility of integrability of Pfaff equations quite exceptional [5].

However, you do not need to increase the number of external parameters to build a non-integrated system. They have long been known - thermally non-uniform systems of two gases separated by a movable heat-tight partition [6]. The condition of existence of the integrating multiplier of Pfaff equations for them, and therefore entropy, is the coincidence of specific heat capacities of gases. Guided by the additivity property of entropy, the author "pre-defined" the entropy of the system as the sum of the entropies of its parts. This "pre-definition" of non-existent magnitude, along with the equally meaningless use of known entropy properties, brought her to the conclusion that thermally non-uniform systems and conventional axioms of thermodynamics were compatible. For many years this clumsy of ridiculous things not only met no objections, but also entered into a number of textbooks of thermodynamics. In fact, the author "held in her hands" the eternal engine of the second kind, but without knowing how to use it, "proved" its inoperable ability. The solution of the issue literally lay on the surface [7].

III. BAROMETRIC FORMULA

The processes of converting heat into work are an important but far from the only area of mismatch of thermodynamics findings with facts. First of all, this applies to the barometric formula for gases. According to it, the pressure of the Earth 's atmosphere falls exponentially with altitude, but the temperature does not depend on altitude. Of course, the Earth 's atmosphere does not belong to thermodynamically equilibrium systems, and it is only possible to talk about its local characteristics as average in a sufficiently long period of time, but snow in high-mountain areas is an indispensable fact. The centrifugal force field has a similar effect on the gas temperature.

Based on the unlimited decrease of gravitational interaction with the distance to the planet they were guided to the conclusion that the atmosphere of planets dissipate [8]. Taking into account the dependence of gas temperature in the gravitational field on altitude results in a sharp boundary of the atmosphere of the gas held by the planet [9].

IV. CONCLUSION

Numerous examples of different nature, which do not fall within the limits of conventional axioms of thermodynamics, are given by V.A.Etkin [10]. One can only hope that by its two-century anniversary thermodynamics will get rid of the illusion of the impossibility of completely converting heat into work and gain an adecvate understanding of the problems before it.

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