CORRECTING THE FIRST LAW OF DYNAMICS

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Abstract. According to the first law of dynamics the sum of the forces working on in regular intervals moving body, is equal to zero. However, the body ignores this law and continues movement which is possible only under action of force. To this fundamental contradiction 322 years were executed. We eliminate it.

Bases of classical dynamics have been incorporated by Newton in him «The Mathematical beginnings of natural philosophy», published in 1687. The first law of dynamics says, that if on a body any external forces do not operate, it goes rectilinearly and in regular intervals with constant speed $\overline{V}_0 = const$ (fig. 1, poses. 0).

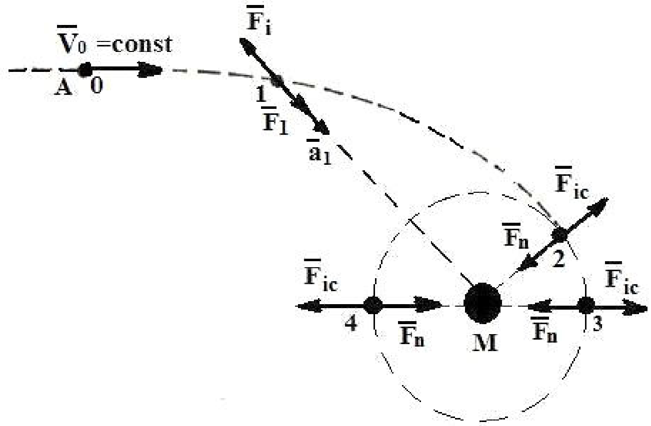

Fig. 1. Occurrence of force of external influence $\overline{F}_1$ and force of the inertia $\overline{F}i$, working on an asteroid A, at its approach to a planet M

The first of all, we shall note, that the condition of rest of a body is considered in section "Statics", therefore there is no necessity to include it in section "Dynamics". Then in the first law there is a condition of uniform rectilinear movement of a body. We cannot agree that the sum of the forces working on in regular intervals moving body equal to zero as the body can move only under action of force. To understand essence of contradictions of the first law of dynamics, we shall look after change of the forces working on an asteroid, coming nearer to a planet of M with constant speed $\overline{V}_0$ (fig. 1, poses. 0).

As soon as there is an external influence $\overline{F}_1$, for example, as force of gravitation of a planet (M) the body starts to move with acceleration $\overline{a}_1$ (fig. 1, poses. 1). Newton postulated, that the direction of force $\overline{F}_1$ of external influence on a body with mass m coincides with a direction of its acceleration $\overline{a}_1$ and pays off under the formula (fig. 1, poses. 1)

$$\overline{F}_1 = m\overline{a}_1 . \qquad (1)$$

It is the mathematical model of the second law of Newton. Dalamber has added to this law in 1743, having specified, that during each given moment of time for accelerated moving body force of inertia $\overline{F}i$ which size is equal $m\overline{a}_1$ and directed opposite to acceleration $\overline{a}_1$ (fig. 1, poses operates. 1)

$$m\overline{a}_1 = -\overline{F}i . \qquad (2)$$

In result it appears, that on a body moving with acceleration, two operate simultaneously equal on size and opposite forces on a direction (fig. 1, poses. 1)

$$\overline{F} = -\overline{F}i \ . \tag{3}$$

Their sum is equal to zero

$$\overline{F} + \overline{F}i = 0 \ , \tag{4}$$

but the body ignores it and continues to move (fig. 1, poses. 1, and 2).

Thus, idea of Dalamber has expanded borders of contradictions and has distributed them to the second and third laws of dynamics. These obvious contradictions constrained development of classical mechanics and as we shall see, essentially braked scientific progress. How could happen, what mechanics - theorists have lost the force driving a body in regular intervals?

The episode of a meeting with the pilot which demanded is recollected to explain: why the sum of the forces working on his in regular intervals flying plane, is equal to zero? Absence of the precise answer to this question periodically returned this scientific idea to its analysis. So the understanding of essence of the marked contradictions was born. We shall describe them in detail.

First of all, we shall specify idea of Dalamber about force of inertia. Force of inertia is equal to mass of a body on acceleration of its movement and is directed opposite to acceleration only at absence of all external forces interfering movement of a body. Therefore it is possible to measure true size of this force only at movement of a body in vacuum or by subtraction from the common active force working on a body, all other forces of resistance. We shall consider it by the example of the accelerated movement of the automobile (fig. 2).

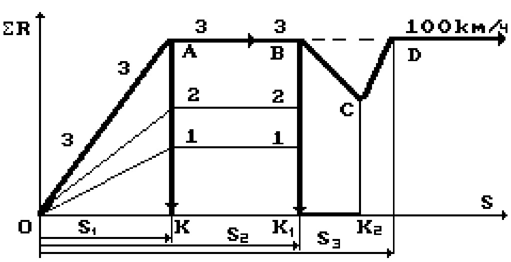

Fig. 2. The circuit to the analysis of dispersal of the automobile and its movement on inertia

On fig. 2 the circuit of change of resistance $\sum R$ is shown movement of the automobile at its dispersal from speed $\overline{V}_0 = 0$ till the speed $\overline{V} = 100 km/h$. As force of inertia $\overline{F}i$ is equal to product of acceleration of a body on its mass and is directed opposite to acceleration it is force of resistance to movement and consequently develops with other forces $\sum\overline{R}$ of resistance to movement. The equation of the accelerated movement of the automobile in this case will be written down so

$$\overline{F} = \overline{F}i + \sum\overline{R}. \tag{5}$$

Or

$$m \cdot \overline{a} = m \cdot \overline{a}i + \sum\overline{R} \ . \tag{6}$$

Apparently (6) automobiles $\overline{a}$ full acceleration not equally to its inertial acceleration $\overline{a}i$. And it is natural, otherwise the sum of all other resistance $\sum\overline{R}$ to movement of the automobile would be equal to zero. The force of inertia working on the automobile at its dispersal, is equal

$$\overline{F}i = m \cdot \overline{a}_i = \overline{F} - \sum \overline{R} \ . \qquad (7)$$

On fig. 2 S_1 - distance of dispersal of the automobile. At transition to uniform movement force of the inertia $\overline{F}i$ interfering accelerated movement of the automobile, automatically changes the direction on opposite and turns valid, promoting its movement. Therefore the equation (5) becomes such

$$\overline{F} + \overline{F}i = \sum \overline{R}. \qquad (8)$$

The essence of this equation consists that uniform movement of the automobile is provided with force of inertia $\overline{F}i$, and the force $\overline{F}$ generated by the engine of the automobile, overcomes all other external resistance $\sum \overline{R}$. This equation (8) describes uniform movement of the automobile on a site $K.....K_1$ (fig. 2). If to switch off the mobile the transfer force $\overline{F}$ will disappear, and force of inertia $\overline{F}i$ appears insufficient to overcome external resistance $\sum \overline{R}$ and speed of the automobile will start to decrease. If during the moment when it will decrease till 50 km / hour (fig. 2, poses. C) to include transfer and to start to increase speed till 100 km / hour the force of inertia $\overline{F}i = -m \cdot \overline{a}_i$ directed opposite to movement of the automobile and its movement again will appear will be described again the equation (5).

When the automobile will reach speed 100 km / hour and the driver will make the decision to move further in regular intervals the force of inertia $\overline{F}i$ will automatically change a direction on opposite and movement of the automobile will be is described by the equation (8).

Apparently (5, 8), at uniform movement of the automobile the sum of the forces working on it, is not equal to zero and at us the opportunity to calm pilots who are indignant of belief of theorists that at uniform flight of their plane the sum of the forces working on it, is equal to zero has appeared. Yes, many years have passed to clean this fundamental contradiction and correctly to formulate the first law of dynamics:

if the body goes or rotates, on it operate the forces or the moments of forces and if it rotates and goes, so on it operate both forces and the moments of forces always.

There is a natural question: what force promotes economy of fuel at movement of the automobile? The answer is obvious - force of inertia. At once there is also other question: whether it is impossible to use the force of inertia arising at rotation of a body, for economy of the electric energy consumed by the electric motor?

If to take into account, that at rotation of a body on it centrifugal force of inertia which does not change the direction at cancellation of the external active moment of forces it can be used not only for economy of the electric energy having the electric motor, but also for generating in its drive of additional power operates. Realization of this theoretical, not so obvious, consequences appeared uneasy business. Nevertheless, it is realized by Russian **engineer Linevich Edvid Ivanovichem.** He has proved experimentally, that presence in mechanical transfer of the electric motor disbalance results mass in increase in mechanical power at its shaft, which repeatedly exceeds electric power on a drive of the electric motor (fig. 3, 4) [1].

There were, that pulses of the mechanical moments generated by disbalances, it is possible to transfer to a shaft of the consumer with the help outrun muff 7 (fig. 3) which action is familiar to everyone who twisted pedals of a bicycle. The author of the analyzed generator of pulses of the mechanical moments (fig. 3, 4) also it has achieved. Now it is necessary to describe this process analytically.

The equation of change of angular speed ω of the electric motor at its accelerated rotation at the moment of start will be written down so

$$\omega = \varepsilon_1 \cdot t , \qquad (9)$$

where ε_1 - angular acceleration.

At the moment of transition of rotation from accelerated to uniform, the equation (9) becomes such

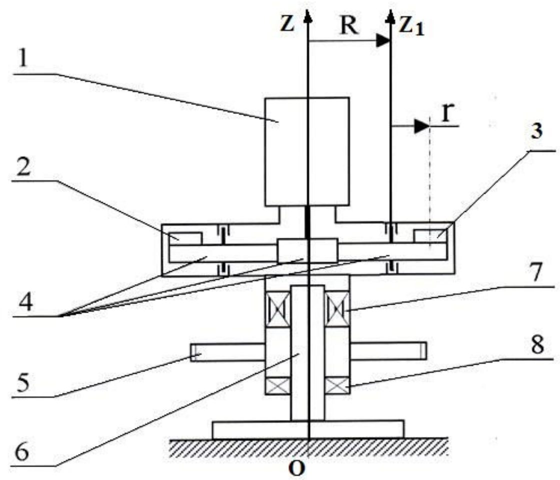

Fig. 3. The centrifugal store of energy and power: 1 – the electric motor;
2 and 3 – disbalances; 4 – gears, 5 – a cogwheel; 6 – a motionless axis;
7 – outrun muff; 8 – the bearing; r – radius of rotation of the center of mass of disbalance;
R - distance from axis Z up to an axis Z_1 of rotation of disbalance

Fig. 4. Model of a drive of a rotor of the electrogenerator (on the right) power of 6 kWatt the electric motor (at the left) power of 500 Watt (Austria, January 2009.)

Results of experiment of the invention are submitted in tab. 1 [1].

Table 1. Results of measurements entrance P(input) and P(output) of Powers

№	U, Volt	I, Amp.	P(input)., Wt	P(output), Wt	K effect, %
1	**19.10**	**18.00**	**344**	**6131**	**1782**
2	**19.30**	**20.00**	**386**	**6080**	**1575**
3	**19.60**	**22.00**	**431**	**6160**	**1429**

$$\omega = \omega_i + \varepsilon_1 \cdot t \,. \tag{10}$$

Here ω_i - average angular speed of the accelerated rotation of the electric motor till the moment of transition to uniform rotation. It is the central moment eliminating a mistake as the size ω_i allows to take into account the moment of forces of the inertia, saved up by rotating parts by the moment of the beginning of uniform rotation of a shaft of the electric motor. Earlier it was not taken into account.

Differentiating the equation (10) and multiplying of its both parts for the total moment of inertia $\sum I_Z$ of all rotating parts, we have

$$I_Z \cdot \varepsilon = I_Z \cdot \varepsilon_i + \sum I_Z \cdot \varepsilon_1 . \quad (11)$$

This equation of the accelerated rotation of the electric motor at presence of all of its loading. It is similar to the equation (6) and at transition of the engine in a mode of uniform rotation becomes similar to the equation ($8 \Rightarrow 12$)

$$M_Z + M_i = \sum M_1 . \quad (12)$$

Here M_Z - the twisting moment generated by the electric motor, due to electric energy; M_i - the inertial moment of all rotating parts generated during dispersal of the electric motor; $\sum M_1$ - the sum of the moments of all forces of resistance. If in system of a drive is not present disbalances at uniform rotation of a shaft of the electric motor the sum of the moments $M_Z + M_i$ is constant (fig. 5).

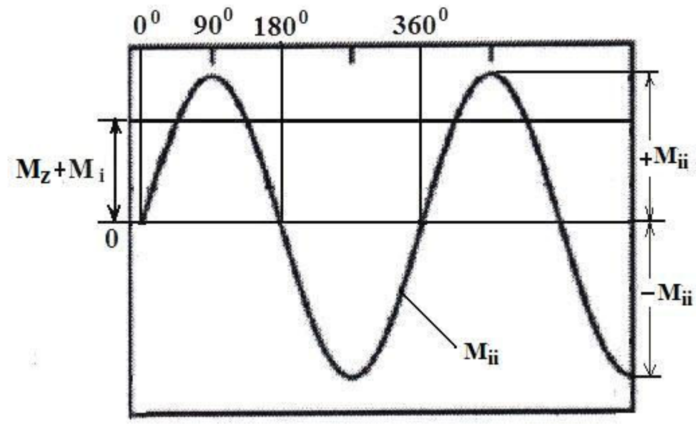

Fig. 5. The circuit of the constant sum of the moments $M_z + M_i$ working on a shaft of the electric motor, and sine wave pulses of the inertial moments M_{ii} of disbalances

Presence at the left part of the equation (12) moments M_Z generated by the electric motor, and the inertial moment M_i formed by all rotating parts, specifies that both they participate in overcoming the sum of the moments $\sum M_1$ of all resistance. It means, that there is an opportunity to increase a share M_i in the left part of the equation (12) and to reduce a share M_Z in overcoming the moments of resistance. To achieve it it is possible by generating such pulses of the inertial moments M_{ii} which amplitude will be more sums $M_Z + M_i$ (fig. 5). It is quite natural, that the positive amplitude $+M_{ii}$ will disperse a shaft of the electric motor and pulse to release it from the loading going from the consumer. The negative amplitude $-M_{ii}$ will brake a shaft of the electric motor and cumulative effect of the moments $+M_{ii}$ and $-M_{ii}$ will be equal to zero. That it did not occur, it is necessary to put in system of a drive outrun muff which would cut off negative values of the moment $-M_{ii}$. Then the positive part of the inertial moment $+M_{ii}$ will submit pulses of the moments on a shaft of the engine and if these pulses will be more sums of the moments $M_z + M_i$ (fig. 5) they will be transferred the consumer through out-run muff and thus to unload a shaft of the electric motor. In result on its shaft there will be basically a loading of idling that will lead to to sharp reduction of the charge of the electric power by its drive.

On fig. 6 the circuit for a conclusion of the equation of a pulse of the moment of forces of the inertia, generated by disbalances D_1 is shown and D_2. The inventor tried to describe theoretically process of reception of additional power, but he did not manage to make it correctly [1]. He has written down the oscillogram of pulses of the moments of centrifugal forces of inertia by дисбалансов. The result appeared unexpected. In the sine wave law of change of these pulses the extremum has appeared at a corner of turn disbalances, equal 135^0 (fig. 7).

To understand the reason of occurrence of an extremum at a corner of turn disbalances on 135^0 (fig. 7), it is necessary will receive the equation describing the law of change of pulses of the moments of centrifugal forces of disbalances. For this purpose we shall take for a basis the circuit of the author submitted on fig. 3. As rotating gears 2 and 3 are balanced, they do not generate the phenomenon of disbalances.

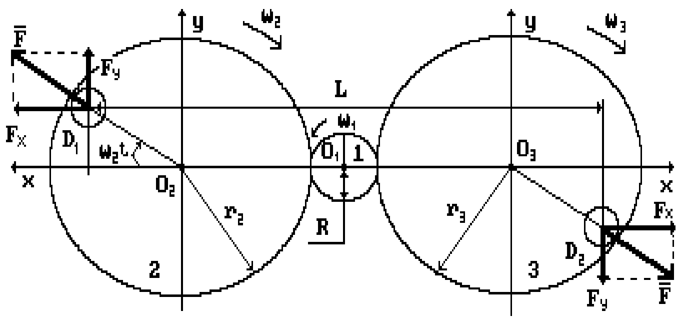

Fig. 6. The circuit for the analysis of action of force of inertia $\overline{F}$ on disbalances D_1 and D_2

Let's pay attention to that central gear 1 on a shaft of the electric motor and two gears 2 and 3 with disbalances D_1 and D_2 represent uniform mechanical system, therefore projections F_x and F_y centrifugal forces of inertia $\overline{F}$ of both disbalances form pairs with the moments (fig. 6):

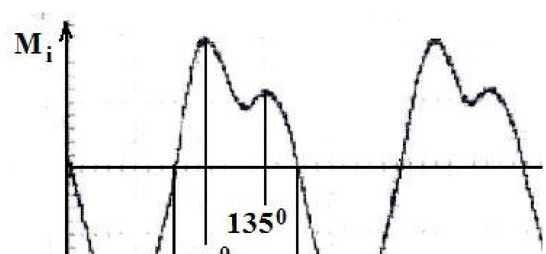

Fig. 7. The oscillogram of change of pulses of the moments of centrifugal forces of inertia of disbalances

$$M_1 = F \cdot \sin\omega_2 t \cdot L = m\omega_2^2 (r - r_0)^2 \cdot (2R + 2r + 2r\cos\omega_2 t - 2r_0 \cos\omega_2 t)\sin\omega_2 t;. \qquad (14)$$

$$M_2 = -F \cdot \cos\omega_2 t \cdot (r - r_0)\cdot \sin\omega_2 t = m\omega_2^2 \cdot (r - r_0)^2 \sin\omega_2 t \cdot \cos\omega_2 t.. \qquad (15)$$

Let's pay attention and to that (fig. 6), that during the initial moment M_1 promotes rotation of a shaft of 1 electric motor, therefore it is taken with plus is familiar, and - M_2 interferes with rotation, therefore is taken with the minus is familiar. Law of change of the moments of these pairs also will form additional influence on a shaft of 1 electric motor.

As the moments of forces – sizes vector law of change of the total moment M_C of pulses of centrifugal forces of disbalances should be defined under the formula

$$M_C = \sqrt{M_1^2 + M_2^2} \quad . \tag{16}$$

For calculation the parameters offered by the inventor have been taken: $R = 0.0625m$ $r = 0.0375m$ $r_0 = 0.02m$ $m = 0.20kg$ $n_1 = 6100 rotationsper \min$ $n_2 = 3652.69 rotationper \min$, transfer number $k = 1.67$ $\omega_1 = \pi \cdot n_1 / 30 = 3.14 \cdot 6100 / 30 = 638.47 rad/s$ $\omega_2 = \pi \cdot n_2 / 30 = 3.14 \cdot 3652.69 / 30 = 382.31 rad/s$.

Calculation under the formula (17) shows, that M_C has maxima at $\omega_2 t = 45^0$ and $\omega_2 t = 135^0$, and at $\omega_2 t = 90^0$ accepts the minimal value, that obviously contradicts experiment (fig. 7). Law of change only M_1 (14) gives result at which the maximum corresponds to a corner $\omega_2 t = 90^0$, and law of change only M_2 (15) gives a maximum at a corner $\omega_2 t = 135^0$, and at a corner $\omega_2 t = 90^0$ the size M_2 is equal to zero. If M_1 and M_2 to put as scalar sizes

$$\begin{gathered} M = F \cdot \sin\omega_2 t \cdot L = m\omega_2^2 (r - r_0)^2 \cdot \sin\omega_2 t \cdot (2R + 2r + 2r\cos\omega_2 t - 2r_0 \cos\omega_2 t) - \\ - m\omega_2^2 (r - r_0)^2 \sin\omega_2 t \cdot \cos\omega_2 t \end{gathered} , \tag{17}$$

that law of change of their sum appears such as it is submitted on fig. 8.

$$\begin{gathered} M = F \cdot \sin\omega_2 t \cdot L = m\omega_2^2 (r - r_0)^2 \cdot \sin\omega_2 t \cdot (2R + 2r + 2r\cos\omega_2 t - 2r_0 \cos\omega_2 t) - \\ - m\omega_2^2 (r - r_0)^2 \cdot \sin\omega_2 t \cdot \cos\omega_2 t = \\ = 0.20 \cdot (379.49)^2 \cdot (0.0175)^2 \cdot 0.71 \cdot (2 \cdot 0.0625 + 2 \cdot 0.0375 + 0 - 0) - \\ - 0.20 \cdot (379.49)^2 \cdot (0.0175)^2 \cdot \sin 135^o \cdot \cos 135^o = 7.513 N \cdot m \end{gathered} . \tag{18}$$

The size of a pulse of power appears such

$$N = M \cdot \omega_1 / S = 7.513 \cdot 638.47 / 2 = 2398.41 Watt. \tag{19}$$

As the pulse of Power considerably more average power of the electric motor it is transferred to a shaft of the electric motor and thus releases it from loading. Thus outrun muff cut the bottom, negative part of amplitude of a pulse (fig. 8, DE) also releases a shaft from braking action of this part of a pulse.

The analysis shows, that with increase in frequency of rotation of a shaft outrun muff backlashes in system of a drive and deformation of its elements start to carry out a role. The inventor has confirmed reliability of this theoretical consequence experimentally.

Thus, for the working mechanical moment on a shaft of 1 electric motor pulses of the moment M of centrifugal forces of the inertia, formed by two disbalances D_1 and D_2. will be imposed. If the size of the moment M of this pulse will be more than the working moment of forces of resistance $\sum M_1$ it will be transferred a shaft of the consumer through outrun muff and to release a shaft of the electric motor from external loading, translating it in a mode of single rotation.

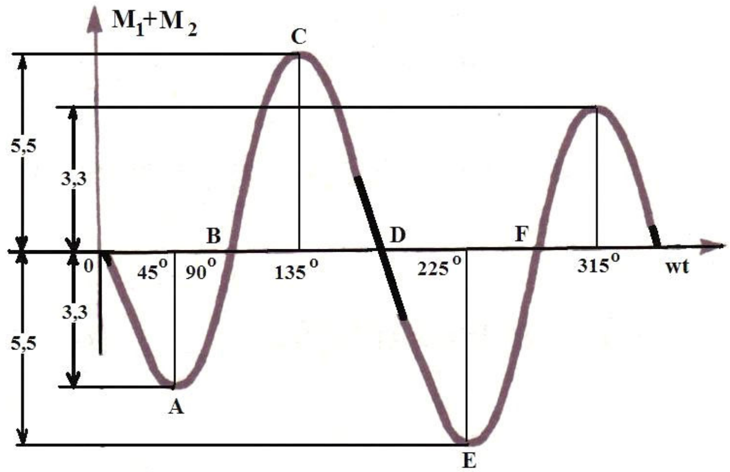

Fig. 8. Theoretical dependence of change of the sum of scalar sizes of pulses components M_1 and M_2 the moments of centrifugal forces of inertia of disbalances

The law of formation of a pulse of the moment of inertia of disbalances (18) clearly shows ways of increase in power of a pulse. First of all, due to quantity of revolutions of the engine ($\omega = \pi \cdot n / 30$) and distances of disbalances from an axis of rotation $(r - r_o)$.

The analysis of the formula (18) shows also, that the minus part (M_2) a pulse of the moment of disbalance changes a sign on opposite at $\omega_2 t > 90^0$ (fig. 8, point B), and at $\omega_2 t = 135^0$ reaches the maximal positive value (fig. 8, point C), as the oscillogram (fig. 7) confirms with distortion of the form of a sinusoid of a pulse of the moment of forces of inertia at $\omega_2 t \approx 135^0$.

THE CONCLUSION

266 years for an establishment of transformation of force of the inertia interfering accelerated movement of a body, by virtue of inertia driving this body were required at its transition to uniform movement. The reason of so long establishment of this fact - an inaccuracy of the first law of classical dynamics.

The literature

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