hardness was observed at 6-8%, i.e. weakening of metal took place. For the high-carbon alloys (steel of У-8 kind, cast iron) the increase of hardness took place at 27.0-35.0%, which is the evidence of occurred hardening.

Thus, it was stated that AR influences the atomic- crystalline state of ferricarbonic alloys, and it was proved by the change of hardness.

/Signed/
L.A.Dachno
The chief of laboratory of metal - management and plastic deformation

The characteristic of a sample of metal	Value of microhardness, kg/mm^2 * H%, H (relative change of microhardness)				
	Initial condition	Source AR-FeO	Source AR-Mn	Source AR-C	Source AR-Se
Steel 08J (C=0.08% of weight, annealed, sheet)	161.2±2.4	151.6±3.0 (-0,6%)	148.2±5.3 (0.8%)	164.8±5.4 (+2.0%)	151.7±4.8 (-6.0%)
Steel U-8 (C=0.8 of % of weight)	636.6	60.5±30.8 (+35.0%)		810.4±17.4 (+27.0%)	
Cast iron (C>2.5%)	361.4±9.8	521.3±68.7 (+31.0)			

Inertial Propulsion Drives

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Introduction

The notion "inertial propulsion system" or device, which is moved by means of inertia forces, requires an exact definition. Usually the "drive" is a wheel, track, propeller or gas flow reaction. By means of "drive" the moving device is attracted or repulsed to the support, which exists outside the device.

Inertial drive does not interact with any support outside the device, but it interacts with the body of device by means of inertia force.

So, it is more true to name the inertial drives as an "inertioid" according to inventor Tolchin, Perm city, Russia. He has been made such sort of systems for more than 30 years [1]. His book about mechanics of 1969 was the cause for critical attacks on inertioids. For example, Dr. Gulia [2] states that unidirectional motion by means of inertia forces is impossible. But other scientists [3] like Dr. Levinson L.B., for example, wrote that all calculations in techniques take into consideration real inertia forces.

So, the notion of inertioid depends on the notion of inertia. Theoretical researches have a conclusion: reality of inertia forces follows from Newtonian mechanics, but the fictitious inertia forces are the effect of Einstein's relativity theory.

According to Newton, there are three real inertia forces: second law force, centrifugal force, Coriolius force. Let's consider the notion of space and forces.

Space

According to modern concept, the space is a closed material medium (Ether), which expands. All bodies are connected by gravitation field and they move. Magnetic, electric, electromagnetic and gluon fields also exist in vacuum. The space does not exist without a physical vacuum, which is a material medium, like river and sea cannot exist without water. Physical vacuum consists of moving virtual particles. The geometry of the space is Euclidian.

The Gravitation Field

The value for intensity and distance of propagation of gravitational field in space depends on the value of mass, numbers of atoms; those consist of particles (protons, neutrons, electrons). Each particle has its own gravitational field and it conforms to the fact: air atmosphere of the Earth (atoms and molecules) is kept near the planet by gravitational field. From Mendeleev's periodical table it is obvious that atom, which has more protons, neutrons, electrons, has greater mass and gravitational field. So, gravitational field of any body is a joint, total field of all neutron, proton, electron

gravitation fields, but we suppose that it is not the curved space geometry according to Einstein's relativity theory.

Gravitational fields penetrate all space of the Universe. Gravitational field of any body is motionless relatively to its surface. The Earth rotates and its gravitational field rotates also. It is the main aspect for determination of the Earth inertial system.

Newton's Law

The first Law is a law for inertia by Galilee - Newton. Newton's formulation is: Any body keeps its rest state or even rectilinear motion before the applied forces make it to change this state [4, p.36]. Conclusions: 1. Space doesn't prevent even the rectilinear motion. 2. Space order and define the rectilinear trajectory for motion of the body since space geometry is Euclidian.

The third law. Newton's formulation: For action there is always an equal and opposite reaction, or interaction for two bodies on each other is equal and directed in opposite sides [4, p.38].

The second law. There are different modern formulations for this law. One of them: Force is the product of mass and acceleration, which force creates for this body [5]

$$F = ma$$

where **F** is force, **m** is mass, **a** is acceleration.

Yablonsky A.A. describes this law in more exact version. According to Yablonsky, "ma" is a reaction force, or inertia force according to the third law. It is a real force [6, p.10]. According to Newton, inertia force is "Inborn force" of matter, which has a property to resist acceleration; due to this force any body keeps its rest or even rectilinear motion. This force is always proportional to the mass. Inborn force can be named as inertia force. It is demonstrating itself when other force makes changes in the body state. Demonstration of this force can be considered in two versions: as a resistance and *as a pressure.* It is a resistance since the body tries to keep its state and it is a pressure since the body yield to the force of resisting barrier and tries to change the state of this barrier [4, p.24, 25].

So, Newton named the inborn matter force as inertia force and he divided its manifestation into resistance and pressure. Modern mechanics classifies forces to be active (those can make the work) and passive (inertia, friction, reaction...). So, in modern understanding, resistance is a passive force action and pressure is an action of active inertial force from the body to other bodies. Newton's inertial forces, both passive and active are volumetric forces since they consist of the proton, neutron, and electron inertia forces sum. Proofs of this fact are Galilee's and Newton's experiments for different masses, different material bodies drop; and also the proof is a weightlessness state of the body. Active inertia forces (according to Newton) have been using

from the ancient times: stones, arrow and bullet... These forces are great and we cannot call them fictitious. Some inventors use Newton's active inertia forces for motion of inertioid.

Centrifugal Inertia Forces

There is a contradiction for centrifugal forces notion in mechanics: in one case it is a real force but in other case it is not a real force.

There is a formula

$$F = \frac{m\upsilon^2}{R}$$

where m is the mass of the body, υ is linear velocity of the body, R is radius of the circumference. The properties of the force, which change the direction of the motion, are not taken into consideration here. For example, Dr. Gulia explains the fictitious nature of the centrifugal force: Circular motion is forcible, since the centripetal force should be applied to the body by means of a thread. In the difference to centrifugal force, this force (centripetal) is real... Centripetal acceleration, according to Dr.Gulia, is directed to the centre. Centrifugal force is directed from the centre. But the real force cannot be directed in opposition to the created acceleration. So, according to Dr. Gulia, centrifugal force is not real but fictitious [2, p.18, 19]. Academician Ishlinsky also agrees with this conclusion [2, p.4, 5].

Logically it is true, but it leads to a paradox: there is acceleration, but velocity does not change. The kinetic energy of the body must also change, since force makes the body to accelerate; but kinetic energy does not change.

There are no paradoxes in Nature. So, some notion is wrong in this case. In contradiction to Dr. Gulia's conclusion, there is Max Born's and Landau's proof of reality of the centrifugal acceleration, and the proofs of both centrifugal and centripetal forces [7, p.33, 83-86] and [8, p.64]. Einstein also recognised the reality of the centrifugal force and he introduced the notion of the centrifugal field [9].

There are many applications of real centrifugal forces: separation of particles in centrifuges, in washing machines, in pump... Centrifugal forces compensate gravitational force on the planet orbit of the satellites. Inventors can use centrifugal forces for motion of the devices.

So, what is the mistake in the notion of the even circular motion? The answer is simple: For even motion of the body along the circumference trajectory the deviation from rectilinear motion is a result of the reaction of the connection, but it is not a result of the active external force. This reaction force don't make the work and it don't produce the acceleration. So, centripetal acceleration is fictitious instead of centrifugal force. The formula $\omega = \upsilon^2/R$ is not a description of the centripetal

acceleration, and the formula $F=mv^2/R$ is not an expression of the Newton's second law. Let's note that Newton explained: The change of direction of the motion along circumference is produced by reaction force.

Coriolius Inertia Forces

This force is created, when the body moves along the curve-line trajectory and curvature radius changes. The angular velocity is constant in this case and there are two velocity components: linear (tangent) and radial (normal) components. If body moves spirally and it approaches to the centre, then the angular velocity should increase (if there is no resistance to motion) and some deceleration is necessary to keep constant angular velocity. So, Coriolius active force of inertia is created as a reaction to this deceleration force and its vector is co-ordinated with linear velocity vector.

If the body moves spirally from the centre, so it is necessary to use some force to keep the constant angular velocity. This force is co-directed to the linear velocity vector and reaction for this force is a Coriolius passive force.

Such sort of forces is demonstrated in Nature: rivers move from the North to the South or from the South to the North undermine their left and right riversides differently. Inventors can use Coriolius active force in inertioids.

Fictitious Inertia Forces

Fictitious inertia forces are used for simplification of calculation for the relative motion in the non-inertial system, i.e. in systems, which move with acceleration.

According to Yavorsky B.M. and Pinsky A.A.:

1. Inertia forces have some properties, which are different from interaction forces (elastic, electric, gravitation, and friction forces). The main differences are:
a) Inertia force is not a result of the body's interaction but a result of accelerated motion of the system itself; so the third law of Newton is not available for inertia forces.
b) Inertia force acts to the body in non-inertial reference frame only, there is no such sort of force in inertial system.
c) For any bodies there are non-inertial reference frame, for which the inertia forces are external forces, so there are no closed systems here and conservation law is not available in this case.
d) Note, that inertia force like gravitational force is proportional to body mass so in the inertia force field (like in gravitational force field) all bodies move with the same acceleration, which does not depend on the mass of the body.
2. There is no inertia force in the inertial reference frame. So, the application of inertia forces for such sort of system is a mistake. In the inertial reference frame the notion "force" is available only in Newtonian sense, and it is a measure for interaction between bodies. In non-inertial frame of reference the inertia forces are acting by the same way like interaction forces. So, sudden deceleration of the car produces inertia force, which throws you forward, and you feel this real force like gravity force [5, p.251].

These explanations of inertia forces properties allow us to make the following conclusions:

The above-mentioned notion of inertia is tangled, contradictional and it does not correspond to reality in some aspects. But in the points a) b) c) the fictitious inertia properties are described. In the point 2 a real Newtonian force of inertia is described.

The main difference between fictitious and real inertia forces is a reference frame. Special reference frame is necessary for fictitious forces. Real forces act in inertial or non-inertial frames. All living world feel such sort of forces in the process of motion, when the velocity changes.

The statement of Yavorsky and Pinsky number 2 about the absence of inertia forces (for inertial reference frame) is wrong. In this case only fictitious inertial forces are absent. For example, motion of the piston in motionless device is the motion in inertial reference frame if co-ordinate system is considered to be related with this device. So, the changing linear velocity of this piston is a reason for inertia forces. But forces are also acting for the piston independently from our consideration of the co-ordinate system. The choice of inertial or non-inertial reference frame is necessary only for design and calculation purposes.

What is the source of "fictitious inertia force" notion? We explained the nature of fictitious centrifugal and Coriolius forces above. Now let's consider the nature of fictitious inertia forces for the case of rectilinear motion. Inertia forces are created when the velocity of motion changes. The motion is described by different ways: Newton's motion is absolute; according to Einstein it is relative. Newton's explanation of absolute and relative motion is: True absolute motion can be produced or changed only as result of force action, which is applied directly to the moving body; relative motion can be produced or changed without application of the force to this body and in this case it is enough to apply the force to other bodies. In relation with these bodies, motion of the body is determined [4, p.33].

Einstein's explanation of motion: Any motion is relative by definition. A car moves relatively to the road and the road moves relatively to the car. In the first case, reference frame is a road; in the second case the reference frame is a car. For simple description of motion there is no difference in principle, what is the reference frame for motion [9, p.196].

But in reality there is the difference. If force is applied to a car and it moves with acceleration. According to classical mechanics, the car increases its kinetic energy

as well as quantity of motion. If the car stops, this energy will be transformed by means of friction. In another case, the road, station and the entire world move with acceleration if the reference frame is a car. According to classical mechanics, the road, station, etc. have an increasing kinetic energy as well as quantity of motion from nothing. If the car stops, this energy and quantity of motion must vanish in nothing.

This is the reason for fictitious nature of inertia forces. To separate it from the real forces, Newton used the notion "absolute" for true motion and "mathematical" for relative motion. But in more general sense, the absolute motion takes place in material medium, i.e. in physical vacuum, relatively to gravitational field. Accelerated, even rectilinear motion and even motion along the circumference are the absolute motion.

Einstein considered the **true** and **mathematical** motions as one relative motion.

Inertial Drives Description

Inertial drive is a mechanism, which moves unidirectionally by means of active inertial force produced by moving inner support to the body of the device. Several inner supports can be used in devices of one type. The inner support creates a closed cycle of action on the body of the whole device. Unidirectional motion of the body is a result of created non-balanced pulse inertial force action in one period (cycle) of the inner support action. Solid body or liquid can be used as inner support, which moves in return-forward way, or it oscillates around the axis, or it rotates around the axis, which is connected with the body of the device.

The Newton's, centrifugal and Coriolius inertial forces or superposition of all these forces can be used for inertial drive.

By means of different schemes the author of this paper created many devices. Energy of motion is transmitted from electromotors or from solenoid (electromagnets) or from other electrical devices. Unbalanced inertial force impulse for most devices is created by means of partial compensation of the negative force pulse of the inner support.

The demerits of the inertioids devices created by the author are small velocity and small propulsion power, which is not sufficient to fly up and move the device in space.

The merit of inertioids is the possibility of reactionless motion, which allows creating an accelerated motion without reactive fuel. Also devices have high efficiency factor.

On Space Application of the Inertioid Drive

Human came to space by means of the powerful reactive propulsion drive. Next step in cosmos assimilation is interplanet spacecraft. Reactive drives are not available in this spacecraft since it uses a lot of fuel and its efficiency is very small. So, the interplanet flight needs a non-reactive type drive. Academician Korolev S.P. and Kurtchatov I.V. understood this aspect clearly and they made a requirement on government resolution of 23 June 1960 #715/296 on the new principles for reactionless propulsion [10].

There is the question: what is the pre-condition for inertial drive? Many scientists stated that accelerated motion in space is impossible without any external support since it contradicts to the law of momentum conservation. For example, Dr. Gulia, expert on inertial mechanisms of the State Inventions Department of Russia, wrote that there is no support in space, so in empty space movement is possible only by means of reactive systems [11, p.22].

Do inertial drives really cannot be used in space? To move space apparatus in vacuum with some acceleration it is necessary to increase the quantity of motion and its kinetic energy (if the velocity increases)... So, we can assume that inertial drive leads to violation of the law of momentum conservation. But this law also is not valid in the case of ordinary rocket. For example, momentum created for rocket is more than momentum of fuel and the difference depends on the design of the rocket nozzle [2, p.24] and [13, p.20]. Also, conservation of the moment is violated and cosmonaut V. Lebedev makes his body to rotate by means of inner forces in the weightlessness state [14, p.68].

So, the claim that "it is impossible to make motion by means of inner forces" is not connected with inertioids, since inertia forces are external forces. *(Editor's: these forces are external because they are produced not by the body, but by space itself, which reacts on the accelerated motion of the body).* Inertia forces are the result of change in velocity or direction of motion in physical vacuum but for physical vacuum there are no closed systems. So, inertial drive can move itself by means of active inertial forces. It is not a reactive but active type of motion. *(Editor's: it is necessary to note that this term "active motion" was introduced at first by the author in 1996. The Scientific Congress "New Ideas in Natural Science", Saint Petersburg).*

It is necessary to remove the mistakes from mechanics and to organize serious researches on inertial drives. In this case it is possible to create an inertial drive, which can be used for spacecraft propulsion. It is necessary to solve one problem to find a closed cycle of the inner support, which has the unbalanced inertia force moment.

What are the pre-conditions for it?

1. It is an application of the difference between momentum and kinetic energy of the moving inner support, that mathematically is shown as the difference between $p = mv$ and $W = (mv^2)/2$. To change the momentum of some body it is necessary to act on the

body with the force F during some time $F t = mv$. But to pass kinetic energy it is necessary to make the work of the force F on the way of length *l,* i.e. $F l = (mv^2)/2$

This difference allows creating different inertial drive cycles, taking into account the transformation of kinetic energy into other energy forms.

2. There is an inadequate between momentum and kinetic energy due to the factor of velocity (v or v^2), which increases if the inner support makes translational motion plus rotational motion. *(Editor's: Thus, we get a helical trajectory of motion. This type of motion is commonly used in Nature).* In this case the force is created of two components: translational and rotational

$$\frac{mv^2}{2} + \frac{I\omega^2}{2}$$

where *I* is the inertial moment of the body, ω is the angular velocity. Inertial drives of several types cycles can be created by means of this principle.

3. Repulsion between two bodies (for the case of different masses) leads to the equal momentums, but different energies, which are reverse proportional to the mass value according to the law of momentum conservation: $m_1 v_1 = m_2 v_2$

$$\text{but } \frac{m_1 v_1^2}{2} \text{ is not equal to } \frac{m_2 v_2^2}{2}$$

This property of the interaction between the bodies also can be used to create inertial drive cycles of different types.

4. Acad. E. Alexandrov made a very interesting discovery: new (after Newton) correction of theory of collision, since the momentum and kinetic energy are transmitting to the body of the device from the inner support of the inertial drive by means of collisions [15].

5. The author didn't investigate the liquid-steam closed cycles to create reactionless motion. Calculations show that in this case there is some discordance between the law of energy conservation and the law of momentum conservation. Specialists, who calculate thermal cycles (isobar, isothermal and adiobatical), usually don't take into account the law of momentum conservation. There is a wide area, which is not investigated yet in aspect of reactionless motion. There is an idea to close the single reactive process in the closed cycle without mass wasting. *(Editor's: We should note that this topic was considered in details in "Reactionless Propulsion and Active Force" by Alexander V. Frolov. At first it was reported in 1996, The Scientific Congress "New Ideas in Natural Science", Saint Petersburg. Development of this idea was started in 1994 in close collaboration with Acad. Vladimir I. Zubov).*

6. Newton's laws are presented in physics textbooks in superficial way. These laws describe the properties of material world, but its basis lies in quantum mechanics, i.e. in the microworld but not in classical mechanics. Due to this reason all industry, transport and space techniques is created according to these laws, and nobody can refute Newton's laws.

Some enigma is hidden in the second and the third Newton's laws. A body moves with acceleration in space under the action of the force (the second law) but for any acting force there is some opposite and equal inertial force (the third law). These forces are in equilibrium and resultant force is equal to zero that means a static situation, but really the body moves with acceleration. The motion can be called dynamical motion, if forces are in equilibrium. In another case the even motion of the body along circumference is also static, since these balanced forces act to the body. But this motion is named as inertial motion, but not dynamical. This enigma is a property of space and it is hidden in the microworld.

The author made an attempt to use the difference between dynamical motion and inertial motion to create the experimental systems to demonstrate reactionless motion. It is necessary to continue this research.

7. Besides the research on inertial drives, the author made some investigations on correctness of Einstein's special relativity principle. Instead of the known Newton's experiment with a pail of water, the author made an experiment with rotating de-balances. Results showed that relativity principle is questionable, since the motionless body and the moving body in the gravitational field are in different conditions. Reliable results can be obtained in the simplest experiment for the cases of even rectilinear motion of the transport and motionless transport.

Practical Application of Inertial Drives

Inertial drives for space apparatus can be applied both for long distance space flights and for satellites, or for the space stations. For satellites it allows to increase the period of operation on the orbit. Fuel is saved and ozone of the planet is not demolished in this case. Active drives can be used as a personal haversack propulsion drive of a spaceman and in future as a drive to correct the orbit of the space stations. Also inertial drives can be used in ground transport for North region or for desert regions since the high velocity is not required for these cases.

Conclusion

Inertial drive is not a single way to create non-reactive space propulsion. Magnetic and electrical fields can be used for motion in space also. Earth have magnetic field, so Lorenz forces can be used to create repulsion from the Earth magnetic field even in the area of orbital space. There is a question: are Lorenz forces sufficient for practical application in this case.

Besides, it is necessary to develop R.G.Sigalov's research [16] to create **space propulsion drive by means**

of non-linear elements of electric currents in metal conductors, which are bent at some angle.

A valuable information about antigravitational device according to Ph.D. Dokutchaev V.T., was published in 1989[17]. This device had weight less than one gram and it used electromagnetic waves to create propulsion force of about a milligram. It is not the limit for the devices of such type, and a more powerful result can be created. *(Editor's: See the above article "Design of an Engine for Free Space based on the Pondemotor Effect" by Acad. Gennady F. Ignatyev, who got a propulsion force about 60 N, i.e. equivalent to 6 kg-force).*

Space has different reaction on translational motion and rotational motion. Gyroscopes use this property. Member of Byelorussian Academy of Science, Albert I. Veinik discovered these effects during his experiments.

Prof. Kaznacheev made an analogous experiment using the rotating gyroscope and he explained weight changes as a result of the inner lifting force [18].

There are a number of proofs on possibility to create the reactionless space propulsion drive. This problem requires a serious State research program.

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Experimental Investigations Based on the Model of Electromagnetic Solitary Waves (Solitons)

(It is published here in short version)

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Using transceiver of electromagnetic solitary waves [1] and mathematical idea on the nature of electromagnetic (EM) solitary waves (solitons) [9] there were made experimental attempts to find interaction of artificially generated EM solitary waves and natural formations, which contain the same solitary waves. To do this the experiments on influence of EM solitary waves radiation on objects, which have various nature, were made, in particular, on biological processes and biophysical objects (processes of bioplast fission and neurostructure of brain and others), on ultrahigh frequency plasma, on the process of atomic nucleus decay as well as gravitation. In all of them **we found specifically soliton effects**, which were due to the fact that the mentioned effects and processes contained **coherent spiral structures**. These structures were stipulated by the presence of multilinked (many-sheeted) EM solitary waves.

For example, an effective influence of EM solitary waves was observed on the following biological objects. Growth of food barm in solution of honey kvass increased two times (in comparison with process in standard solution) during radiation by solitary waves of positive polarization (by electromagnetic component). It was made by two transmitting magnetic antennas (MA) shifted relatively each other at 90-degree and 90-degree phase delay. The same barm slowed their reproduction during radiation by solitary waves of negative polarization. Obviously, such effect is related with the change of spiralization threshold. Change of this threshold stimulates the excitation of electron-vibron field (it is some component of triune field of many-sheeted EM solitary wave). At that electromagnetic component of EM solitary wave field (biofield) was observed before as luminescent filaments of mitogenetic (ultraviolet) radiation for process of the cell fission.

In another experiment a single (for the time of less than 1 second) radiation by EM solitary waves on simple