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The Mechanism of Hail Formation and a Method to Prevent it

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In contrast to the previous well-known theory of hail showers, in this paper we propose an original and simple method to prevent hail with the use of a lightning rod. Lightning rod in turn, can prevent together with hail and lightning discharge.

Keywords: *hailstone; zero temperature; evaporation; cold; lightning, storm.*

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I. Introduction

People are often confronted with terrible natural phenomena of nature and constantly fight against them. Natural disasters and the consequences of catastrophic natural events (earthquakes, landslides, lightning, tsunamis, floods, volcanic eruptions, tornadoes, hurricanes, hail) attracted the attention of scientists from all over the world. It was not by chance, when UNESCO had established a Special Commission on account of UNDRO disaster (disaster response of the United Nations, the United Nations). Knowing the objective world and acting in accordance with it, the man subdues nature forces them to serve their purposes and turns from a slave to nature in the Lord of nature and ceases to be powerless before nature, becomes free. One of those scourges is hail.

The fall of the hail, first of all, destroys cultural combines of plants, kills livestock, as well as the man himself. The fact of the matter is that a sudden and large influx of offensive hail eliminates protection against it. Sometimes the surface is covered with minute read barrage with a thickness of 5-7 cm. In the area of Kislovodsk in the 1965 year was hail, covering the ground layer in 75 cm. Normally hail covers the 10-100 km distance. Let us remember some terrible events of the past.

In 1593, in one of the provinces of France due to the raging winds and lightning knocked out the sparkling hailstones with a huge weight of 18-20 pound! This has caused great damage to crops and destroyed many churches, castles, houses and other structures. The victims of this terrible event began and the people themselves. *(Here it is necessary to consider that in those days the pound as a unit of weight has several meanings).* It was a terrible natural disaster, one of the most disastrous hailstones that hit France. In the eastern part of the State of Colorado (United States) annually about six hailstones, each of them brings great losses. Hail most frequently occur in the North Caucasus, Azerbaijan, Georgia, Armenia, in the mountains of Central Asia. With 9 on June 10, 1939, in the city of Nalchik fell hail size about an egg, accompanied by strong rain. In the result has been destroyed more than 60 thousand hectares of wheat and about 4,000 hectares of other crops; killed 2,000 sheep. When it comes to hail, first of all, pay attention to the size of it. Hail, as usual, vary in size. It is interesting to know about absolutely fantastic hail. In India and China it was found falling from the sky ice blocks weighing 2-3 kg. Even say that in 1961 in North India heavy hailstones killed an elephant. 04.14.1984 In the small town of Gopalganj district of Bangladesh hail fell 1 kg, which killed 92 people and several dozen elephants. Even this hail entered the Guinness Book of Records. In 1988, 250 people in Bangladesh were victims hail. And in 1939, the hail was found with a weight of 3.5 kg. More recently (20/05/2014) in Sao Paulo, Brazil, large hailstones, many of which were recovered from the streets with the help of heavy machinery. All these data show that life with a barrage important than the nature of the unusual phenomenon. On this basis, a comprehensive study of the causes and finding his formation using modern physical and chemical methods of research, as well as the fight against this terrible natural phenomenon is the primary problem facing humanity around the world.

II. What is the Mechanism of Hail Formation

In advance, I note that there is still no proper and positive response to this question. Despite the creation of the first hypothesis about this back in the first half of the 17th century with Descartes, however, scientific theory hail processes and practices impact on Physics and meteorologists have developed only in the middle of the last century. It should be noted that even in the middle ages and in the first half of the 19th

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century there have been several assumptions of different researchers, such as, Bussengo, Swedes, Klossovskiy, Volta, Rayee, Ferrell, Gan, Faraday, Zonke, Reynold, etc. Unfortunately, their theory did not receive their confirmation. It should be noted that recent views thereon do not constitute scientific validity, and there is still no comprehensive views on the mechanism of hail formation. The presence of numerous experimental data and a set of literary materials, dedicated to this topic were given the opportunity to assume the next formation mechanism of hail, which was recognized by the World Meteorological Organization and continues to operate so far *(to avoid controversy, we literally give these arguments)* [1, 6, 21]:

"Rising from the Earth's surface on a hot summer day, the warm air cools with height, and the moisture is condensed, formed a cloud. Cooled liquid droplets in the clouds are found even when the temperature is –40 °C at a height of about 8-10 km). But these drops are very unstable. Raised from the Earth's surface the smallest particles of sand, salt, combustion products and even bacteria with super cooled drops disturb the fragile balance. Cooled liquid drops that came into contact with solid particles, turn into an ice embryo of hailstones.

Small hailstones are in the top half of almost every cumulonimbus clouds rain, but most often such hailstones when approaching the Earth's surface are melting. So, if the speed of the upward flow in a cumulonimbus cloud rain reaches 40 km/h, they cannot keep the hailstones formed, therefore, passing through a warm layer of air at a height of 2.4 to 3.6 km, they fall out of the clouds in the form of small soft hail or rain at all. Otherwise, the updrafts lift the small hailstones up to layers of air with temperature from-10° c to-40° c (height between 3 and 9 miles), a diameter of hailstones begins to grow, reaching sometimes several centimeters. It should be noted that in exceptional cases the speed of ascending and descending cloud flows can reach 300 km/h! And the higher the speed the upward flow in a rain cloud, cumulonimbus, the larger the hail.

For the formation of hailstones the size of a golf ball more than 10 billion needed super cooled water drops, and hailstone cloud must remain at least 5-10 minutes to reach such a large size. It should be noted that a single drop of rain is about a million such small super cooled droplets. Hailstones with a diameter of more than 5 cm in cumulonimbus clouds, which are very powerful rising air currents. It is thunderstorms produce tornadoes, heavy downpours and gusts.

Hail usually falls when severe thunderstorms in the warm season, when the temperature at the Earth's surface not is below 20 °C ".

It must be stressed that even in the middle of the last century, or rather, in 1962; p. By Ludlam also proposed a similar theory [16] provides the education prerequisite hailstones. They also discussed the formation of hailstones in the super cooled part of the cloud of small water droplets and ice crystals by coagulation. Last operation must be strong lifting and lowering of the hailstones several kilometers, passing a null isotherm. On the type and size of hailstones and modern scholars say that the hailstones during his life repeatedly to get up and down the strong convection currents. As a result of the collision with the super cooled drops of hailstones increase their size. The World Meteorological Organization in 1956 gave a definition of what a hail*: "Hail-precipitation in the form of spherical particles or pieces of ice (hailstones) with a diameter ranging from 5 to 50 mm, sometimes more, falling separately or in the form of incorrect complexes. Hailstones consist only of transparent ice or of a number of layers with a minimum thickness of 1 mm, alternating with translucent layers. Hail is observed usually in strong thunderstorms ".*

Almost all of the former and contemporary sources on the subject indicate that the hail is formed by a powerful concentrate the cloud at strong upward air flows. This is true. Unfortunately, most forgotten about lightning and thunderstorms. And the subsequent interpretation of the formation of hailstones, in our view, It is not logical and pointless.

Professor Klossovskij carefully reviewed the appearances of hailstones and discovered that they also have a number of spherical form other geometric forms of existence [8]. These data indicate the formation of hailstones in the troposphere on a mechanism. After reading all of these theoretical perspectives, caught our attention several intriguing questions:

1. Composition of the clouds, found at the top of the troposphere, where temperature is approximately — 40 °C operating system already contains a mixture of super cooled of water droplets, ice crystals and sand particles, salts, bacteria. Why not disturbed the fragile power balance?

2. With the recognized modern general theory [1, 6, 21], hailstone could emerge and no lightning or thunder storm. For the formation of hailstones with a larger size, small ice must climb a few kilometers up (at least 3-5 km), and fall down, passing a null isotherm. While this should be repeated until it was formed in a sufficiently large amount of hail. Still the same, the greater the upward flow velocity in the cloud should get, the bigger the hailstone (from 1 kg to several kg) and for the consolidation of it should remain in the air for 5-10 minutes. Interesting!

3. In general, it is difficult to imagine that in the upper atmosphere will focus as huge ice blocks weighing 2-3 kg? It turns out that the hailstones were still large in cumulonimbus cloud rain than seen on earth because of it melted when falling through the warm layer of the troposphere.

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4. Because meteorologists often confirm: ". ... hail usually falls when severe thunderstorms during summer, when the temperature at the Earth's surface is below 20 °C ", however, does not indicate the cause of the phenomenon. Of course, the question is: what is the effect of a lightning storm? Hail almost always falls to the shower or at the same time with him and never after. He falls for the most part in the summer and during the day. Hail at night - a very rare phenomenon. The average duration of hail - from 5 to 20 minutes. Hail as usual, going to the place where there is a strong bolt of lightning, and is always associated with a thunderstorm. *Without lightning hail does not happen!* Hence, the reason for the formation of hail, we need to look for in it. The main drawback of all existing mechanisms for the formation of hail, in our opinion, is the lack of recognition of the dominant role of the lightning discharge.

Studies of the distribution of hail and thunderstorms in Russia, produced A.V. Klossowski [8] confirm the existence of a particularly close link between these two phenomena: hail with thunderstorms usually happens in the south-eastern part of the cyclone; he often where most thunderstorms. North of Russia is poor cases of hail, in other words, hail, the cause of which is explained by the lack of strong lightning. And what role is played by lightning? No explanation several attempts to find a connection between the hail and the storm still were in the middle of the 18th century. [9]. Guyton de Morvo Chemist, rejecting all the existing ideas, offered his theory: electrified the cloud better conduct electricity [20]. But Nolle [23] put forward the idea that water evaporates faster when she electrified and reasoned that it must amplify the chill and the fantasized that couples can become the best conductor of heat, if you put electricity on them. Guyton criticized Jean Andre Monsey and wrote, [22]: it is correct that electricity increases evaporation, but electrified drops must mutually repel and not merge into large hailstones. The electrical theory of hail was offered another famous physicist Alexander Volta [25]. In his view, the electricity was used as the root causes of the cold, and to explain why hailstones remain suspended for so long, that manage to grow. Cold is the result of very rapid evaporation of clouds, which contributed to the strong sunlight, rarefied dry air, lightness of volatilization of bubbles, which are made of clouds, and the estimated effect of electricity, which helps evaporation. But as the hailstones are kept in the air for sufficient time? For this reason Volta to look only for electricity. Well, how?

Anyway, to the 20 years of the 19th century there was a general belief that the combination of hail and lightning simply means that both of these effects occur when the same weather conditions. This was clearly expressed in 1814; the view of von Bush [17] and in 1830 it was strongly asserted Olmsted of Denison Ielâ [24]. Since then, the theory of hailstones was mechanical and based more or less steadily on perceptions of ascending air flows. On the theory of Ferrell [18], each hailstone may repeatedly fall and rise. The number of layers in the hailstone, which are sometimes up to 13, Ferrell′ judged the speed of hailstone. Circulation occurs until the hailstones do not become very large. By his calculation, rising current speeds of 20 m/s is unable to hail in 1 cm in diameter, and the speed for tornadoes is quite moderate.

There are a number of relatively new scientific research [11, 13, 14], devoted to the issues of formation of hail. In particular, argue that the history of the hail is reflected in its structure: large hailstone, cut in half, is similar to the root: it is composed of multiple layers of ice. Sometimes hailstones like pie, where alternate ice and snow. And this is his explanation for such layers, you can calculate the number of times a piece of ice was on a journey from the rain clouds in the supercool layers of the atmosphere. It is hard to believe: Grad with a weight 1-2 kg could jump back up to distances of 2-3 km? The layering of ice (hailstones) can appear for a variety of reasons. For example, the difference between the ambient pressures will cause such a phenomenon. There have already talked about the snow. Where is the snow? Unclear.

In a recent site http://tornado2.webnode.ru/-obrazovanie-grada/YegorChemezov puts forward his idea and tries to explain the formation of hail and his ability to stay for a few minutes in the air with the advent of the "black hole" in the cloud. In his view: "The hailstone has a negative charge. The greater the negative charge of the object, the less the concentration of ether (physical vacuum) in the site!? And the less the concentration of air in the material object, the more anti-gravity he possesses. On Chemezov, the black hole is a good trap for hailstones. Once, lightning, is a negative charge, and start falling hailstones.

Analysis of the literature shows that in this area of science has a lot of flaws and often speculation.

On completion of the all-Union Conference in Minsk in 13.09.1989, devoted to the theme: "Synthesis and investigation of prostaglandins," we are in the middle of the night with the staff of the Institute were returning by air from Minsk in Leningrad. A flight attendant reported that our plane flies at an altitude of 9 km. We watched the monstrous spectacle. Below us from us in a distance of about 7-8 km (just above the surface of the Earth) that was a terrible war. These were powerful storm level. While the above our cloudy and shining star. And when we were over Leningrad, reported to us that an hour ago in the city the hail fell out with the rain. With this episode I want to emphasize, that the strong lightning often sparkles closer to the ground. For the occurrence of hail and lightning did not necessarily raise the flow of cumulonimbus at the height of 8-10 km. And there is no need to move the clouds above a zero isotherm. Huge ice blocks are formed in the warm layer of the troposphere. For such a process

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does not require freezing temperatures and high altitude. Everyone knows that without lightning hail does not happen. Apparently, for electrostatic fields don't have collision and friction for small and large crystals of solid ice, as often write, although the phenomenon of friction hot and cold enough clouds in the liquid state (convection). For the formation of thundercloud requires plenty of moisture. When the same relative humidity, warm air contains more moisture than cold air. Therefore, Thunder and lightning, usually occur during the warm seasons-spring, summer, autumn. The mechanism of electrostatic field in the clouds also remains an open question. There is much speculation on the subject [9]. In one recent reported [5] that the rising moist air flows along with not charged cores are always present, positively and negatively charged nucleus. Any of them could be condensation. Found that the condensation of moisture in the air, the first begins to negatively charged nuclei, than neutral or positively charged nuclei [10.12]. For this reason, at the bottom of the clouds accumulate negative particles, and the top is positive. Therefore, inside the clouds is created a huge electric field intensity which is 10^6-10^9 V and the current 10^5— 3 • 10^5 A. such a strong difference of potentials, in the end, leads to a powerful electric discharge. Lightning can last 10-6 (one millionth) of a second. When discharge lightning releases enormous thermal energy, and temperature reaches – 30 000 °K. This is about 5 times greater than the Sun's surface temperature. Of course, this huge energy area particle must exist in the form of plasma, which after recombination becomes neutral atoms or molecules.

III. What can Cause this Terrible Heat

Many know that when a strong lightning discharge neutral molecular oxygen air is easily converted into ozone, and felt his peculiar smell:

$$2O_2 + O_2 \rightarrow 2O_3\uparrow \quad (1)$$

In addition, it is established that in these harsh environments simultaneously reacts chemically inert nitrogen with oxygen to form mono-NO and nitrogen dioxide NO_2:

$$N_2 + O_2 \rightarrow 2NO + O_2 \rightarrow 2NO_2 \quad (2)$$

$$3NO_2 + H_2O \rightarrow 2HNO_3\downarrow + NO \quad (3)$$

Formed NO_2 nitrogen dioxide in turn, aligning him with water, becomes a nitric acid HNO_3, which in the sediment falls to the ground.

Previously thought that containing in cumulonimbus clouds of table salt (NaCl), carbonate (Na_2CO_3) alkaline and alkaline earth metals ($CaCO_3$) react with nitric acid and eventually is formed nitrates.

$$NaCl + HNO_3 = NaNO_3 + HCl \quad (4)$$

$$Na_2CO_3 + 2\,HNO_3 = 2\,NaNO_3 + H_2O + CO_2 \quad (5)$$

$$CaCO_3 + 2HNO_3 = Ca(NO_3)_2 + H_2O + CO_2 \quad (6)$$

Nitrate when mixed with water leads to cold. Adhering to this, Gassendi fantasized that the upper layers of air are cool, not because they are far away from the source of heat reflecting from the Earth, and because of the "corpuscles" nitrogen (nitrate) out there that are very numerous. In winter the less and they generate only snow, but in summer there are more, so there may be hail [19]. Subsequently, this hypothesis has also been subject to criticism by his contemporaries.

IV. What Might Happen to the Water in Such a Harsh Environment

In the literature, there is no information. Heating to a temperature of 2500 ° C [2], or the water passing through the non-alternating electric current at room temperature, [7], it is decomposed into its constituent parts and the heat of the reaction is shown in equation (7):

$$2H_2O\,(liq) \rightarrow 2H_2\uparrow(g) + O_2\uparrow(g) - 572\ kC \quad (7)$$

$$2H_2\uparrow(g) + O_2\uparrow(g) \rightarrow 2H_2O\,(liq) + 572\ kC \quad (8)$$

The decomposition reaction of water (7) is an endothermic process and energy to break the covalent bonds must be introduced externally. In this case, the energy comes from the system (in this case the electrostatic polarized – water). This system resembles an adiabatic process, after which there is no gas heat exchange with the environment, and such processes are very fast (lightning).

In short, in an adiabatic process (the decomposition of water into hydrogen and oxygen) (7) is internal energy and hence it starts to cool itself. Of course, when the balance shifts toward the right side to form a gases - hydrogen and oxygen by the action of the electric arc instantly snap ("explosive mixture") reverse reaction occurs between the hydrogen and oxygen (8). This reaction is performed in the laboratory. Despite a decline in volume of reactive components in this reaction, the result is a strong rumbling. The speed feedback based on Le Chatelier's principle affects favorably received by reaction (7) high pressure. The fact of the matter is that and direct reaction (7) should be strong with a roar, as liquid water modular condition instantly formed gases (most authors attribute this to intense heating and expansion within or around the channel of air created by a discharge of Lightning). It is possible that the sound of thunder, therefore, is not monotonous, that is, not to mention the sound of an explosive or weapon. First comes the decomposition of water (first thunder), followed by accession of hydrogen

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with oxygen (the second thunder). However, these processes are occurring so quickly, they discern not everyone.

V. As is Formed Hail

When the discharge of lightning happen because of the huge amount of heat, the water in lightning channel or around his intensely evaporates as soon as stop flashing lightning, water begins to freeze. In the well-known law of Physics: a strong evaporation leads to cooling. It is noteworthy that the heat during discharge of lightning is not imposed from the outside, on the contrary, it derives from the system itself (in this case system: polarized electrostatic water). The process of evaporation is the kinetic energy of the polarized water system. In this process, a strong and instant evaporation of water causes a sharp its solidification. The stronger the evaporation, the more intense is the process of solidification of water.

For such a process is not necessary that the ambient temperature was below zero. When lightning flashes produced the hailstone in different sizes. A dimension of hail depends on the power and intensity of lightning. The stronger and more intense lightning are, the larger the hailstone. Typically residue hailstones quickly stop as soon as will cease flashing lightning.

Similar processes operate in other areas of nature. Here are a few examples.

1. Refrigeration systems work on this principle. That is, the artificial cold (sub-zero temperature) in the evaporator is formed by boiling of liquid refrigerant that is fed back through the capillary tube. Due to the limited capacity of the capillary tube, the refrigerant enters the evaporator is relatively slow. Boiling refrigerant – usually about 30 ° C. Getting in warm evaporator, the refrigerant boils instantly, strongly cooling evaporator wall. The refrigerant vapor generated as a result of its boiling point, fall from the evaporator to the suction pipe of the compressor. Evacuating the gaseous refrigerant from the evaporator, the compressor pumps it under high pressure to the condenser. Gaseous refrigerant in the high pressure condenser cooled gradually condenses in the gas passing from the liquid state. Re-liquid refrigerant from the condenser is fed through the capillary tube into the evaporator and the cycle is repeated.

2. Chemists are well known to produce solid carbon dioxide (CO_2). Carbon dioxide is usually transported in steel cylinders in liquefied liquid aggregate phase. With slow passage of gas from the cylinder at room temperature passes to a gaseous state, if it produce intense, it immediately goes into the solid state, forming a "snow" or "dry ice" having a temperature of sublimation of –79 to –80 °C. Intensive evaporation leads to solidification of the carbon dioxide, passing the liquid phase. Obviously, the temperature inside the container above zero, however, this highlighted by solid carbon dioxide ("dry ice) has a sublimation temperature of about –80° C [15].

3. Another important example regarding this topic. Why does a person sweats? Everyone knows that in normal conditions or on exertion, as well as in nervous excitement person sweats. Pot - liquid secreted by the sweat glands and containing 97.5 - 99.5% water, small amounts of salts (chlorides, phosphates, sulphates), and several other compounds (organic compounds - urea, uric acid salts, creatine esters, sulfuric acid) [3]. However, excessive sweating may indicate the presence of serious diseases. May be several reasons: colds, tuberculosis, obesity, violation of the cardiovascular system and etc. However, more importantly, sweating regulates body temperature. Increased sweating under the hot and humid climate. We usually covered with sweat when we are hot. The higher the ambient temperature, the more we sweat. The body temperature of a healthy person is always equal to 36.6 ° C and one of the methods of maintaining a normal temperature - is sweating. Through the enlarged pores is an intensive evaporation of moisture from the body - a person sweats heavily. A moisture evaporation from any surface, as indicated above, it promotes cooling. When the body is in danger to the health of overheating, the brain triggers sweating and evaporating from our skin sweat cools the body surface. That's why people sweat in the heat.

4. Furthermore, water may also be converted into ice in a conventional glass laboratory setup (Figure 1) under reduced pressure without external cooling (at 20 ° C). You need only connect to this setting the deep vacuum pump and trap.

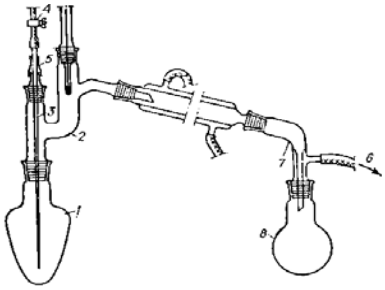

Figure 1 : Laboratory vacuum unit for distillation

Figure 2 : The amorphous form of ice inside a hailstone

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Figure 3 : Aggregation of hailstones

In conclusion, I want to address a very important question regarding the layering of hailstones (see Fig. 2-3). What causes turbidity in the structure of hailstones? The authors report that [5, 13, 14]: *"To be hailstone diameter of about 10 centimeters, the ascending air stream in the thundercloud must have a speed not less than 200 km / h, and thus it includes snowflakes and air bubbles. Such layer looks turbid. But if the temperature is higher, the ice freezes slowly and included snowflakes have time to melt, and the air escapes. Therefore, such a transparent layer of ice. The rings can be traced, in which layers of clouds visited-air before falling to the ground".* Of Fig. 2,3 clearly shows that the ice that makes up the hailstones, really, is not uniform. Almost every hailstone is pure and in the center of a muddy ice. The opacity of the ice may be caused by various reasons. In large hailstones sometimes alternating layers of transparent and opaque ice. In our opinion, the white layer is responsible for the amorphous and the transparent layer of ice - the crystalline form. In addition, the amorphous form of ice aggregate is obtained by extremely rapid cooling of liquid water (at a rate of about 10^{7o}K/sec), as well as the rapid increase in the ambient pressure, so that the molecules do not have time to form a crystal lattice [4]. In this case this is a discharge of lightning, which is fully in line with the favorable condition of formation of metastable amorphous ice. From Figure 2-3 shows clearly that the huge boulders were formed from clusters of relatively small hailstones. Both of these factors suggest that the formation of a transparent or opaque layers of hail, caused by exposure to extremely high pressures generated during lightning.

The hail is one of the most terrible natural disaster causing damage to mankind. In the United States the hail destroyed an average of 1 to 2% of crops. In some areas the figure is 6%. Damage is 1-1.5 billion United States Dollars [26]. Extremely great damage from hail in North America was registered in May 1995 in Texas (about $ 2 billion). May 14, 2001 in Stavropol region of Russia hail damaged 4,500 homes, killed the agricultural crops area of 1000 sq km and perennials on the area of 30 sq km, the damage reached $ 17 million USA. The Midwest United States hit by storm. 12 Tornadoes recorded in the states of Nebraska, Iowa, Wyoming, and Kansas. In Blair town suffered 4,500 cars dealer network Woodhouse Auto Family. The total value of the damaged property is $ 152 million [27]. About the formation of hail and its of negative consequences are given detailed information in the recently published articles [28_35].

It should be noted that, the reason for the formation of hail have been determined incorrectly, the false views and the theories put forward till today. That is why, these scientists have been unable to prevent or avoid it. The major trends in this research are not to prevent hail, but to diminish it from a large part of the mass [36-42]. Thus, to this end, were used the various chemical reagents (eg, CO_2, AgI, NaCl, tetraalkilamoniumun in freon solution, and so on) the rockets and the projectiles, as carriers. The aim of this difficult operation was: to create a large number of crystallization centers, with this way replaced hail with large mass with smaller particles and thus reduce the amount of damage caused.

In February 2010, the newspaper RIA "News" reported that the Moscow scientists have developed a new modified aircraft or so-called "multi-functional aviation complex" Nart ", designed to prevent catastrophic natural weather events, such as hail, torrential rain, tornadoes and typhoons, through active impacts on meteorological processes. According to the developers, the range influence of the complex is 300-350 kilometers and has passed several tests in the south of Russia. Nevertheless, the use of this device produced no tangible results; Moscow and its region again are showered of hail with the size of the Greek walnut.

In the review [42] emphasize that there is a relationship between the parameters of the number of days with hail and thunderstorm. The authors clearly recognize that the hail is almost always falls during a thunderstorms and it is interesting to compare the parameters of the number of days with hail and thunderstorms. The comparison shows that there is quite a distinct and strong correlation between these parameters. Found that it in the years before the defense was 2.5:26.4 = 0.095, and in the years protect 1.5:31 = 0.048. However, recognize that, despite the continuous improvement of technical equipment and technological schemes impact hail albeit reduced, but each year brought significant damage to the protected areas in all regions where the work was carried out. On this basis, it can be concluded that the current methods of influence on hail processes exhausted its possibilities. It should come up with a new type of protection hail.

On the formation of hail and its negative consequences described in detail in the recently published studies [28-35], and we strongly emphasize

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that in this context, the use of chemicals as a protective agent against the hail will not give positive results.

We believe:"When the lightning begins due to the tremendous amount of heat, the water in the channel of lightning or around his intensely evaporates as soon as stop flashing lightning, the water starts to freeze. In accordance with the known law of Physics: the strong evaporation causes cooling. It is noteworthy that the heat during discharge of lightning is not imposed from the outside, on the contrary, it derives from the system itself (in this case system: polarized electrostatic water). In this process, a strong and instant evaporation of water causes a sharp its solidification. The stronger the evaporation, the more intense is the process of water solidification. For such a process is not necessary that the ambient temperature was below zero. The lightning discharge generates a variety the size of the hailstones. The hailstones depend on the power and intensity of lightning. The stronger and more intense lightning are, the larger the hailstone. Usually the hail stops as soon as quickly stops flashing lightning."

VI. How to Prevent Damage by Hail

From the point of view of the authors of [42], developed in the sixties, scientists and specialists of several institutes and other academic institutions world missile way to impact on sedimentation processes of hailstorm voted the world's most efficient. According to them, the method is most appropriate to the modern concepts of physics and hail precipitation and management in order to prevent the growth of hail and increase rainfall. Its development has been invested efforts of large teams of scientists and much money. In addition, the implementation of this method requires an extremely high cash costs, to use of sophisticated equipment (radars, missiles, computers, etc.), the highest level of training and work organization. Nevertheless, even if all these conditions are realized often hail destroys crops and planting of large areas.

The above requirements it extremely difficult to implement. Need for new science-based, effective, but less complex and less expensive methods of process control in the clouds.

Methods are based on the influence on cloud processes with the aim of suppressing the growth processes of hail. Works on the effects of clouds with a view to their scattering attenuation hail, precipitation increase are conducted in many countries for over 50 years. Nevertheless, the problem is so complex that their level of efficiency so far is controversial according to theorists and experimentalists.

In our opinion, the only way ofhail prevention to overcome the lightning discharge or at least mitigate it. We suggest using the following construct for this purpose (Fig.4.):

It is known that the only way to protect against lightning first developed in 1750, the American scientist, Benjamin Franklin. He showed that electric charges or a bolt of lightning can be easily and safely escort to the ground through the metal wires. The latter is called "lightning rod" and is actively used today. Regarding to this, his invention helps prevention of hail.

In this sense, this invention can help in the prevention of hail. So, one end of the cable connects to the protected ground ("grounding") and the other end fastened balloon, filled with helium.Then the balloon is released into the air. The greater the distance between the balloon and the Earth (1-2 miles), the better the efficiency of the installation. In this case, the lightning rod closer to the cumulonimbus clouds and its effective conical effect will be even greater. Absolutely, electrical charges accumulated in the cloud will descend through a metal wire is easier than through the airspace or water layer. Here is the principle.

As for the engineering, construction and Assembly, this question gets their decision in other more specific professionals.

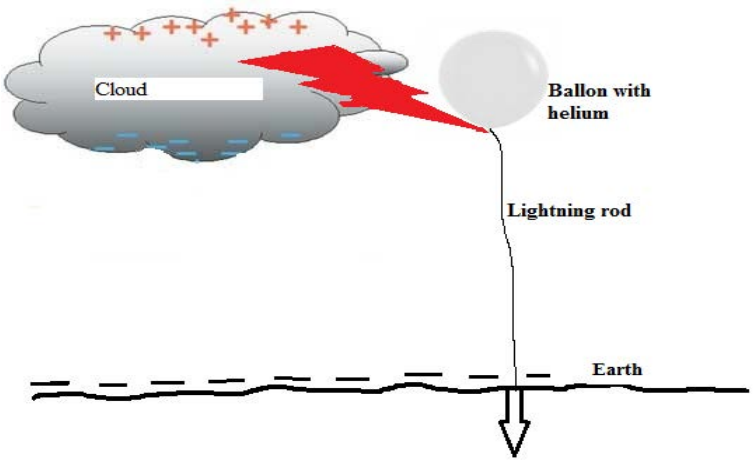

Figure 4 : Construction to prevent lightning and hailstone

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VII. Conclusions

- Without the lightning and strong thunderstorms not grad. A thunderstorm accompanied by hail.
- The cause of hail is instant and massive amounts of heat lightning discharge in the cumulonimbus clouds. The mighty heat produced leads to strong evaporation ofwater in the channel and around the lightning. Strong water evaporation is rapid cooling ice formation, respectively.
- The process does not require the need to shift the zero isotherm atmospheres, with negative temperatures, and can easily occur at low and warm troposphere.
- The process is essentially close to adiabatic process, since the thermal energy generated is not entered into the system from the outside, and it comes from the system itself.
- Powerful and intense lightning provides the condition for the formation of large hailstones.
- On the basis of our theory thelightning rodis original tool to prevent of the hail.

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