"CROP CIRCLES": The Physics of Stalk Lodging of Cereals in Genuine "Crop Circles".

Nataliya Anatolievna Solodovnik · Anatoliy Borisovich Solodovnik
(Solodovņika Nataļja·Solodovņiks Anatolijs)
Riga, Latvia
http://www.nyos.lv/

Introduction

"Crop circles" - a phenomenon, about which was written many articles and books.
"Crop circles" - popular themes of Web sites and of other media's.
Academic science does not wish or incapable explain phenomenon of nature – "Crop circles".
If academic science does not wish or incapable explain phenomenon of nature, in media it phenomenon of nature usually is declared as a hoax or result action of extraterrestrials.
The media has very successfully are creating the opinion, according which the grounded answering to mystery the "Crop circles" in that, all of "Crop circles" are or the result of hoaxes (human) - " pranks with planks", or are the result of action of extraterrestrials.
Nevertheless, there is no compelling evidence that all "Crop circles" are results of hoaxes or action of extraterrestrials.
A version, which accepted for basis in this article, consist of that, *some of "Crop circles"are the result of action of natural physical forces of terrestrial origin*. Some of authentic "Crop circles" are a result of affecting of forces of lifeless nature on plants.
The action of the physical forces, which is creating a "Crop circles", are caused the natural phenomenas, the physical properties of which are known to science.
The **mystery** of "Crop circles": ***What mechanism lodging of stalks of plants creates the pictures, consisting of the lodging stalks and of the vertical stalks of plants?***
The irretrievable displacement of plant stalk from the vertical, is known as **lodging**.
Two forms of lodging are recognized: **stalk lodging** (when the stalk base have bending) and **root lodging** (when the root-soil system fails).
When takes place the stalk lodging, axis of stalks plants are shifted irrevocably against the original position (vertical).
The position the roots plants, when takes place the stalk lodging , are not shifting.

Fig.I .
Picture "Circles in the fields" in Switzerland. (*Jabberocky*; *Wikipedia*)

The stalk lodging , occurs when overdose of fertilizer, when fungal diseases, with the destruction of the stalk by insects, with heavy watering, and under the influence of mechanical and another equipment used by man, and with a strong wind, with heavy rain and hail, with a strong densified of crops, with large numbers of weeds.
At the stalk lodging of cereal, abnormally will be filling grain, grain formed weak, with lower nutrient content, are reduced his weight.
Sometimes, when takes place the the stalk lodging , from the stalks of plants are formed a picture of "Crop circles" which very clear discernible if a observer has the flight above it (**Fig. I.).**
Pictures "Crop circles", emerging with participation of the man, are known as **man-made "Crop circles"**.
Pictures "Crop circles" which emerged without human intervention, has name - **genuine pictures "Crop circles"** (or **authentic** pictures "Crop circles").
Among the signs of genuine pictures "Crop circles" are mentioned *Weaving*, *Elongated nodes*, *Blown nodes*, *Dried ground* and another (10.1, 13).
Overdosing of fertilizer, fungal diseases, the insects, which destroy the stems, heavy irrigation, heavy rains and hail, strong densified plant and a large number of weeds typically do not occur during the lodging stalks of plants in the pictures "Crop circles", which many years are described on the pages of the media.
The actions of the man and using of a mechanical and another equipments (boards, rollers, fans, heat, etc.) does not create the lodging of stalks the plants in the pattern with signs, which found out in genuine pictures "Crop circles".
The mechanism of the lodging of stalks of plants in the man-made pictures of "Crop circles" is not the puzzle.
Lodging of stalks under the influence of wind on plants - the object of theoretical and experimental study (2, 3, 24).

The Stalk.

Under the influence of a wind's gust the stalks of the healthy plants are have bend.
If during a gust of wind the tensions (mechanical), have emerged in materials of the stalk, do not exceed the critical value, the stalk of plant is straightened after a wind's gust.
If a during of gust, the values of the tensions (mechanical), have emerged in materials of stalk, exceeds a critical value, then the stalk of the plants is not straightened up and irrevocably is shifted from the original position(vertical), i.e. to be the lodging.
Irrevocable the shift with the bending the stalk of plants can occur either as a **fracture** (**Fig. II**.) (with full or partial destruction of the material stalk) or can occur as a form **irreversible bend** (**Fig. III.)** (when takes place the elastic - plastic deformation of the material stalks).

Fig. II .
Fracture stalk cereals.

Fig. III .
Irreversible bending of stalk cereals.

The stalk of cereals consists of the nodes and internodes (sections the stalks between neighboring nodes) (**Fig. IV.**), *biomechanical parameters of which (including, among other, the critical value of tensions) are different.*
Lower part of stalk is connected to the root system of plants.
External shells of internodes and of nodes creates the external shell at the stalks.

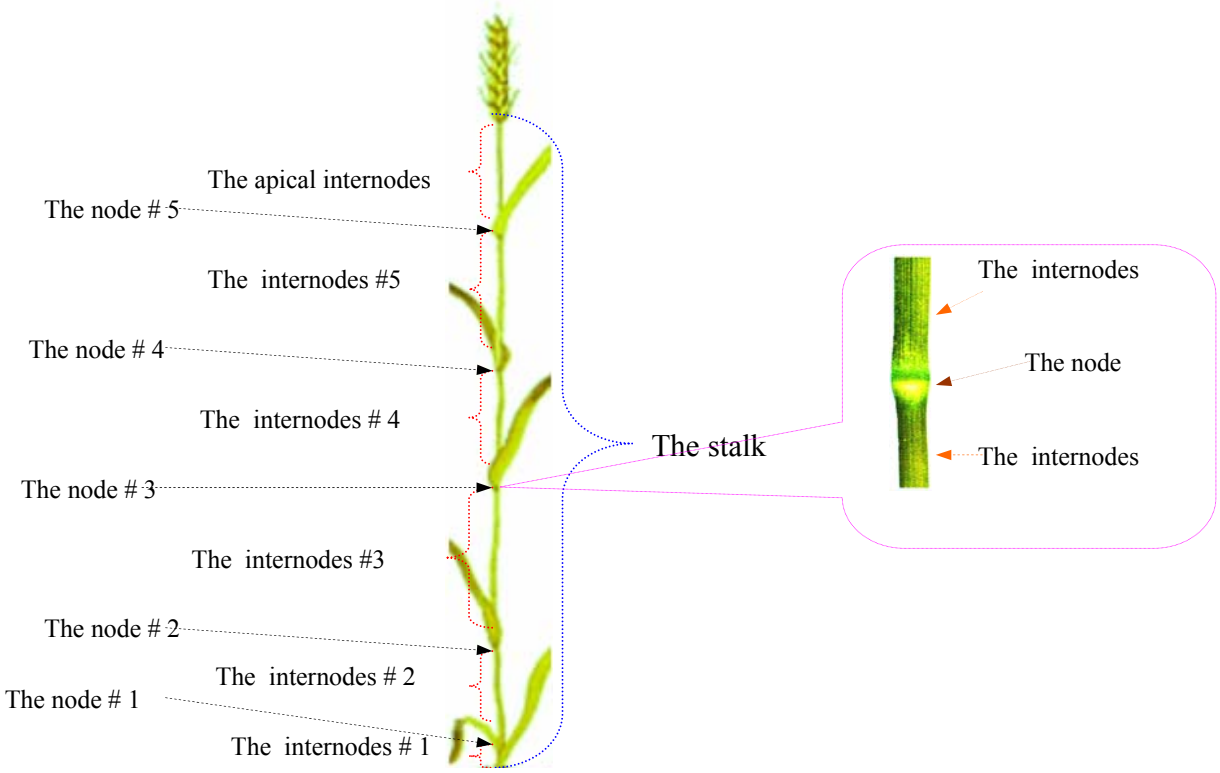


Fig. IV .
The stalk of cereals

External shells internodes cereals consists of cell, whose walls impregnated by silica.
Impregnation the external shell internodes by silica attached to material of internodes the properties such as properties of elastic body.
The nodes cereals consists of the elastic-plastic the external shells and the internal volume, which filled with:
cells sensitive to the position in the space;
cells capable to stretching;
cells (capable to the swelling and to division) with a large intracellular (**2 ... 5 atm**.) pressure (**turgor**), with the compressible intracellular content and with the flexible shells of cells, which is capable to rapid substantial extension.
The joint action the elastic-plastic external shells, the cells, which are capable to stretches, and cells with high intracellular pressure (turgor) the compressible material attached to the intracellular content of the node the properties of the elastic-plastic body.
*Elastic-plastic parameters of nodes are changing in direction from the node # **1** to the node # **5**. Elastic's and strength's parameters internodes are changing in the direction from internodes # **1** to the apical internodes.*
In addition, the elastic-plastic parameters of the node (as well as elastic parameters and strength parameters the internodes) vary with changes in the age of the plants.

From the standpoint of mechanics, *the parts of the stalks are composed from different (relatively composition and properties) the composite materials,* formed by using the external shells the internodes and the nodes, the flexible shells of cells the nodes, a combination of liquid and solid components of intracellular the compressible content of cells the nodes.

Elasticity, elastic-plasticity, strength of materials in different parts of the stalk - the result of the combined action of elastic and elastic-plastic external shells of stalk, action the cells, capable to stretching, and strike a balance between the intracellular pressure (turgor) and sum backpressure flexible cell shells and the external (atmospheric) pressure on this shell, as well the capability of flexible shell to the irreversibly deformations in reply to the changing external or intracellular pressure on these flexible shells.

Pressure (atmospheric) ambient air, wind gusts and actions other external forces from outside operates on external shells the stalks.

The occurrence of fracture, or irreversible the bends of the stalk - is directly dependent on the size, duration (time interval) action, the distribution of external forces on the external shell the stalks, and the physical and mechanical properties of materials of different parts the stalk.

If the value of stresses (mechanical) in the material internodes the stalk exceeds a critical value, is usually, in such place the stalk, the fracture occurs.

If, the value of stresses (mechanical) in the material node the stalk of cereal exceeds a critical value, depending on the distribution of stresses on volume of node, in this node may be either irreversible extended node lengths(**Fig. V.**), or irreversible bend (**Fig. VI .**), or breaking of node , or the swelling of node(**Fig. V.**), or creation expulsion cavities in the
nodes of the plant stalks (**Fig. V.**), or event consisting of several of the phenomena.

Accordingly, or the length stalk will become (irreversibly) longer (**Fig. V.**), or will be the bend of stalk (irreversibly) (**Fig. III**.), or will be the fractures (breaking) of stalk (**Fig. II.).**

Fig. V .
Irreversible swelling (a), elongation (b) of the node cereal, creations the expulsion (g) cavities in the shell nodes of the stalks cereals.

Fig. VI .
Irreversible bending of the node cereals.

Stalk lodging.

Stalk lodging healthy plants occurs within less than an hour, if are taking place gust of wind, the speed of air in which at least **15 … 20 m / sec**.
The duration of the impact of wind gusts at the plants, necessary for lodging plants, decreases substantially with increasing air velocity.
Under the influence of one-way gust of wind (in which air moves in one direction at a speed of at least **15 ... 20 m / s**) the stalks cereals have irreversibly moves down(are turning round a top part of the first aboveground internode) and next stalk lies down a top of previous stalks in one direction, forming a unidirectional the wind stalk lodging of the cereals (without creating the image) (**Fig. VII.**).

Fig. VII .
A unidirectional the wind stalk lodging of the cereals.

Under the influence of vortical gust of wind (air in which moves in all directions at speeds of at least **15 ... 20 m / s**) the stalks cereals have irreversibly moves down(are turning round a top part of the first aboveground internode) and creates the displacement irreversible in different directions, forming the wind matted stalk lodging of the cereals (without creating the image) (**Fig.VIII.**).

Fig. VIII .
Wind stalks matted lodging of the cereals.

About wind gusts are reporting the eyewitnesses (10.1., 17, 37, 38), which saw the stalk lodging of the plants in the event creating of some genuine "Crop circles".
Wind gusts , which are creating the stalk lodging of the healthy plants, can be caused by weather conditions, by technical equipment (fans, helicopters, etc.), by the sudden movement of the earth's surface (an earthquake), as well as sudden the formation of underground cavities (cracks) with network, consisting of air permeable micro - canals, which connect the underground cavity with the atmosphere (15).

Man-made pictures.

Man-made pictures "Crop circles" created by using the stalk lodging plants under the influence of man-made mechanical or other equipments , is result of the work of artists (hoaxers) who, replaced easels on a field with wheat and other cereal plants.
Artists shown (8,10,30) some of mechanism for the creating man-made pictures "Crop circles" .
The possibility of further perfection the man-made mechanisms of lodging stalk plants is not in doubt.
Creating a man-made pictures "Crop circles" , at some countries, has become a profitable industry.
Number and complexity a man-made pictures of "Crop circles" is continuously increasing.
The annual appearance in the England great numbers of man-made pictures "Crop circles" - the reason that (according to the **Nancy Talbot**), a well-known organization «**BLT**», to study genuine pictures, prefers (1) samples from **Canada**.

Genuine pictures.

Relatively to nature of mechanism of creation pictures of genuine "Crop circles" - there are different opinions.
The range of opinions (5,6,8,10 ,..., 40) on the nature of genuine "Crop circles" extends from the recognition of their unreal - up to the assertions about involvement in their establishment of aliens, unidentified flying objects (**UFO**s), plasma, energy earth (**GAIA**) or other unknown forces.
Part of described in the media pictures "Crop circles" consists of lodging stalks of cereals, on which were found (13) the irreversible elongation a nodes (Elongated nodes), as well as the characteristic swelling and a expulsion cavities (holes blown out at the plant stalk nodes) in a stalk shell (Blown nodes). The plants in genuine circles are weaved (Weaving) together in a particular way when they are flattened.
Is no convincing evidence that the artists (including anonymous, such as the military) have a mechanism for creating pictures from a lodging stalks of cereals with nodes, which have a irreversible elongation and bending , as well as the characteristic swelling and have the expulsion cavities on stalks of all or most of lodging plants.
In the stalks of cereals, growing close to and some distance from the pictures "Crop circles" , these numerous irreversible elongation a nodes, swellings of nodes and the expulsion cavities in the nodes, and bending of nodes were not found.
In the man-made pictures "Crop circles" the mentioned irreversible elongation and swellings of nodes and a expulsion cavities in the nodes, and the bends of nodes, were not found.
In connection with the above, there is no reason to consider of pictures "Crop circles" , in which the lodging stalks of cereals have a irreversible elongation and the bending of nodes, as well as the swellings of nodes and a expulsion cavities on the shell nodes, as man-made.
Thus, the allegations, about of unreality the genuine pictures "Crop circles" , are unfounded.
Over time, artists can create the mechanism for the creation of man-made pictures "Crop circles" , in which nodes of stalks of lodging plants will have the elongated and bended nodes, swelling nodes and expulsions cavities in the shell nodes.

As long as artists do not have mastered these mechanisms, acceptable, conditionally, distinguish the genuine pictures from man-made pictures , respectively, on a presence or absence of signs: the irreversible elongation and bending nodes , swelling nodes and expulsions cavities nodes in the shell stalk of cereals.
Conventionality the differences between man-made pictures and genuine drawings means that in number of man-made pictures, according the condition, can be included the genuine pictures, in which stalks of lodging plants do not have the above-mentioned elongation and bending, swelling nodes and expulsions cavities nodes in the shell stalk.
Unfortunately, no data about the time of the appearance on the stalks the lodging plants the irreversible elongation and bending, swelling nodes and expulsions cavities nodes in the shell stalk.
Usually, by default, believed it that the irreversible elongation and bending, swelling nodes and the expulsions cavities of the nodes in the shell stalk appear on the stalks in the time of lodging the plants.

Gust Wind and *another parts* of mechanism of lodging plants.

Gust wind, at which have the air velocity (presumably) - **15 ... 20 m / s** and more, - a phenomenon that is observed when takes place the wind stalk lodging the plants (without the formation of the pictures) and when when takes place the stalk lodging the plants in the genuine pictures of the "Crop circles" .
The direction of movement and a speed (**15 ... 20 m / s** or more) air in the gust of wind, which acts on a stalks plant, is such, that are creating the genuine picture "Crop circles" , or such , that creates (without the formation of the picture) the wind stalk lodging of plants .
The structure and action a parts mechanism, which generates gust of wind and manages change in direction of motion and speed of air in the mechanism of creation the genuine drawings of "Crop circles" , is different from the structure and action a parts mechanism, which generates the gust wind and manages change in direction of motion and speed of air in the mechanism of creation the genuine wind stalk lodging of plants (without the formation of the drawing).
This difference - the reason inability of the mechanism genuine wind stalk lodging of plants create pictures of the lodging stalks of plants.
The mechanism of stalk lodging the plants in the genuine pictures of "Crop circles" , besides part mechanism, which generates a wind gust and manages the change in the direction of movement and speed of air, has ***another part*** of mechanism, which absents in the mechanism of genuine, wind stalk lodging the healthy plants (without the formation of the image).
Another part of mechanism generates of irreversible elongation and bending, swelling nodes and the expulsions cavities in nodes, discovered in the stalks of the lodging plants, which were taken from genuine pictures of "Crop circles" .
Irreversible displacement of the stalk, due to gust of wind, may be different from the irreversible displacement of stalk generated by ***another part*** of mechanism.
In numerous publications as the parts of mechanism, which create of stalks lodging plants in the genuine pictures "Crop circles" , are proposed by various phenomena, including phenomena, referred to witnessing the emergence of pictures.
Meteorological conditions, for example, are accepted, as part of mechanism , which creates the gust of wind in genuine pictures "Crop circles", (27.).
Meteorological conditions generates the wind gusts with the direction of motion and speed of air that create the lodging of plants in the form of genuine unidirectional or matted wind the stalk lodging of plants (without creating the pictures).
However, the unknown - whether capable the meteorological conditions to create irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalk.

Physical model.

Physical model *can give the reasonable rationale of composition and the action mechanism the stalk lodging of plants in genuine pictures "Crop circles".*
Attempts to create such a model are undertaken repeatedly (6).
1. The most popularity theory has gained (22) another detail , in which is supposed a short-term microwave irradiation of plants. Supposed, that short-term microwave irradiation can heat to a boil the water's component of compressible intracellular contents in the nodes of stems.
Initial pressure (under normal conditions) in compressible intracellular content (turgor) of **2 ... 5 atm**.
The temperature of boiling water's component of compressible intracellular contents at a pressure of **2 ... 5 atm** is at least **120 ... 150^{0}C**.
At the temperature of boiling water's component compressible intracellular contents in the cells of the node are formed the water vapor, the pressure of which on the flexible shells the cells of node, irreversibly, extends the shell , and destroys cells in the node of stalk.
A volume of cells in the node is increased thus.
The increase volume in the set of cells in the node and the destruction of their shells creates irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalk.
However, supposition about heating of intracellular contents to the boiling point of water, is only a hypothesis, which is not confirmed by data of chemical changes in the organic material of shells and solid compressible intracellular content of cells in the nodes of stalks the lodging plants, which are inevitable at a temperature of **120 ... 150^{0}C**.
It should be noted that the opposite process, the **freezing and thawing** of stems of plants, also creates irreversible elongation and bending node of stalk cereal (25).
The assumption of short-term freezing and thawing of water compressible intracellular contents in the nodes of stalks of plants leads to the conclusion that external, irreversible changes in the stalks are comparable to findings from the assumption about heating to the boiling point.
In this theory, an irradiation of plants, that are causing heating of the intracellular content, are creating by using a hypothetical source (21), which, in accordance to hypothesis, hangs above the field of plants, flies above the field of plants, or operates otherwise.
*On the role of such a source, among others, can claim aliens, unidentified flying objects (***UFO***s), plasmas, energy is the earth (***GAIA***), and other unknown forces.*
Available data are insufficient for a clear conclusion about the involvement of mentioned a hypothetical sources to to the mechanism of stalk lodging of plants in genuine picture «Crop circles».
Mechanism*, of the supposed properties of hypothetical sources - to put down of stalks of plants the spirals, rings, intersecting segments of straight lines, as well, create complex geometric images, represents* ***an unknown phenomenon.***
Use of unknown phenomenon in the «physical model» converts it into a model, which is incapable to answer the question: What mechanism stalk lodging of plants creates picture from lodging stalk plants and vertical stalk plants?
Other obvious signs of groundlessness of this theory discussed in the works (4, 5,6).
2. ***Irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalks of lodging plants arises at such an increase (in percentage of atm.) to the difference of pressures (pressure of compressible intracellular content (turgor) (*** **2 ... 5 atm.*** ***) minus the external pressure on a flexible shell of cells in the node(*** **no more 1 atm.*** ***)), at which the lengthening of flexible shell exceeds a critical value.***
That increase the difference of pressures on a flexible shell of cell in the node causes irreversible the tensile of flexible shell of cell and increases the volume of the cell.
When takes place irreversible the tensile flexible shell, may be the break of this shell (fracture).

As a result, the increase the difference of pressure causes irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalks lodging plants. *Resistance to tensile strength and other mechanical properties material stalk of plants are reduced in* **2 ... 3** *times in direction from to a lower (above-ground) internodes to located higher internodes of stalk* (3, 3.1).
Materials of the upper nodes significantly more sensitive to the effects of increasing the difference of pressure than the material of lower nodes.
Materials of nodes in mature plants less sensitive to the effects of increasing the difference of pressure than the materials of nodes in immature plants.
To increase the difference of pressure between the pressure of intracellular content (turgor), and between external pressures on the shell of cells in the nodes of stalk not necessarily heating of the intracellular content of cell the nodes of stalks .
The freezing of plants (which oppositely to heating of plants) also is creates an increase a difference between the pressure of freezed (increase of volume of ice as compared to water) the intracellular content , and external pressure on the shell in cells of nodes of stalk.
In addition to these external influences, whose cause is the heating or freezing of intracellular content, there may be other external influences, that increases the a difference between (pressure differential) the pressure of intracellular content (turgor) and between the external pressure on the shell the cells of the nodes of stalks.
3. ***The instantaneous pressure drop in the surface layer of air, that surrounds the hard outer shell the stalk plant, is creates an increase difference between pressures in the intracellular content (turgor), and between external pressure on the shell cells in the node of stalk.***
Parts and action of mechanism, that creates an instantaneous pressure drop in the surface layer of air around the hard outer shell the stalk of plants, describes in the works (14, 14.1, 15, 16).
3.1. Layer of soil, on which plants grow (**Fig. IX.),** are located on the porous rocks (chalk, limestone, etc.). Pressure rocks, raising and lowering the level of pressurized aquifers, move of atmospheric fronts, the attraction of the moon and sun, lightning strikes and other factors is cause of compression and tension in the porous rocks (chalk,limestone, etc.).
If the values of tensile stresses in the rock are exceeding the critical level (**Fig. X**.), then in this rock is formed instantly cavity cracks.
Gas pressure (air) in cavity of crack, which instantly was formed , instantly falls in **2 ... 4** times compared to the pressure of gas (air) in gas-filled micro-cells (pores) of porous rock.
The instantaneous drop of gas pressure, in cavity of crack, which instantly was formed , instantly creates a difference (**0.5 ... 0.75 atm.)** between the pressure in the cavity of the crack and between the pressure in the net of gas-filled micro-cells (pores) in a layer of porous rock.
Instantly the appearing of drop pressure are causing breakdown of liquid microparticles (the breakdown of micro-cells),which isolating gas-filled micro-cells from a cavity of the crack.
As a result, at the cavity of the crack from micro-cells rushes gas (air), and in the opposite direction on the network micro-cells along a layer of rock spreads waves rarefaction gas (air),which break (rupture) , encountered on their way, of liquid microparticles (the breakdown of micro-cells).
Waves rarefaction of gas, spreads on micro-cells along the layer of rock, creates from these micro-cells the gas permeable micro-canals located along the trajectory of the breakdown.
Layer of porous rock, has the crossing with the micro-passages, which connect of this layer with the terrene.
Waves rarefaction of gas (air), which spreading in micro-canals along the layer of rock, creates, in transversal to layer the micro-passage, other waves rarefaction of gas , which moves transverse to layer of rock.
Waves rarefaction of gas, spreads on micro-passage, are making these micro-passage gas permeable .
Instantaneous microspacing of solid micro-skeleton of a porous rock (14, 14.1) in plane of the layer of this rock controls the direction of spread the wave rarefaction gas in a micro-cells by choosing of the direction on one of the two colliding liquid microparticles (the choose between right and left).

Liquid microparticle , on that was chosen the direction, will be torn (breakdown) at meeting with the wave rarefaction gas, propagates in a micro-cell .
The choice between two microparticles - between right or left , which carried out by using instantaneous microspacing of solid micro-skeleton, it is a variant of the binary encoding.
By affecting on such choice, microspacing of solid micro-skeleton is in layer the porous rock governs the creation of the figure the trajectory of propagation breakdown liquid microparticles (breakdown micro cell) in a layer of rock.

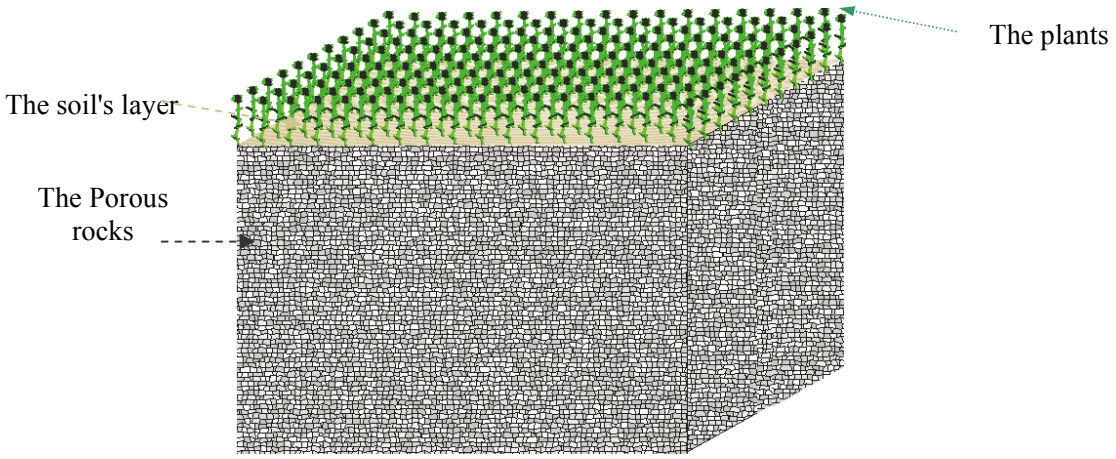


Fig. IX .
Plants, soil's layer, porous rock (chalk, limestone, etc.).

The instantaneous microspacing of solid micro-skeleton arise up as result the instantaneous formation of crack in porous rock.
A trajectory of spreading waves rarefaction of gas across micro cell along of a layer of porous rock, are copied on terrene. This copy consist of a trajectory of spreading micro holes on the earth's surface. Waves rarefaction of gas in the micro passage has direction transversally to layer rocks and are spreading to atmosphere (above than terrene) through of micro holes on the earth's surface .
At moment When waves rarefaction of gas breaks through micro passage to the earth's surface,through mentioned a micro passage into the crack's cavity rushes the micro stream of air from earth's surface layer of atmosphere , and at the opposite direction (upwards), in the earth's superficial layer of air spreads a wave of rarefaction air.
At the earth's surface along a trajectory of propagation the micro holes arises a picture consisting of lodging stalks of plants (**Fig. XI**.).
3.2. When the initial pressure drop equals **1 atm.**, speed (23) propagation of wave rarefaction of gas (air) across micro cells is **150 ... 170 m / sec**.
With decrease the rarefaction gas, i.e. with the decrease of drop pressure , the speed of wave propagation rarefaction gas (26) decreases.
At the drop pressure, which does not exceed 1 atm., dependence between of the drop pressure and between the speed of wave propagation of rarefaction gas in the micro cell can be accepted linear.

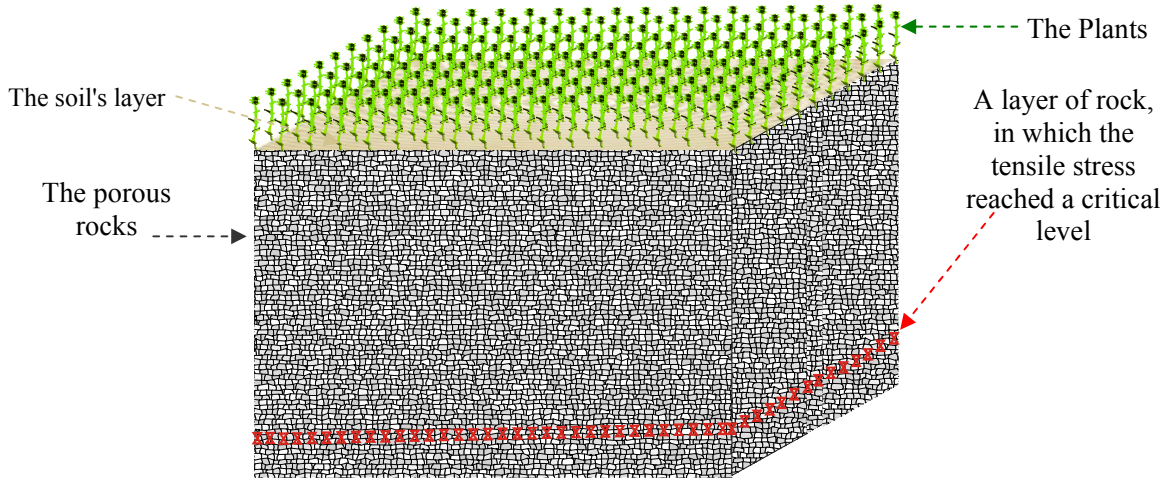


Fig. X .
The plants, the soil's layer, the porous rock (chalk, limestone, etc.) and a layer of rock, in which the tensile stress reached a critical level.

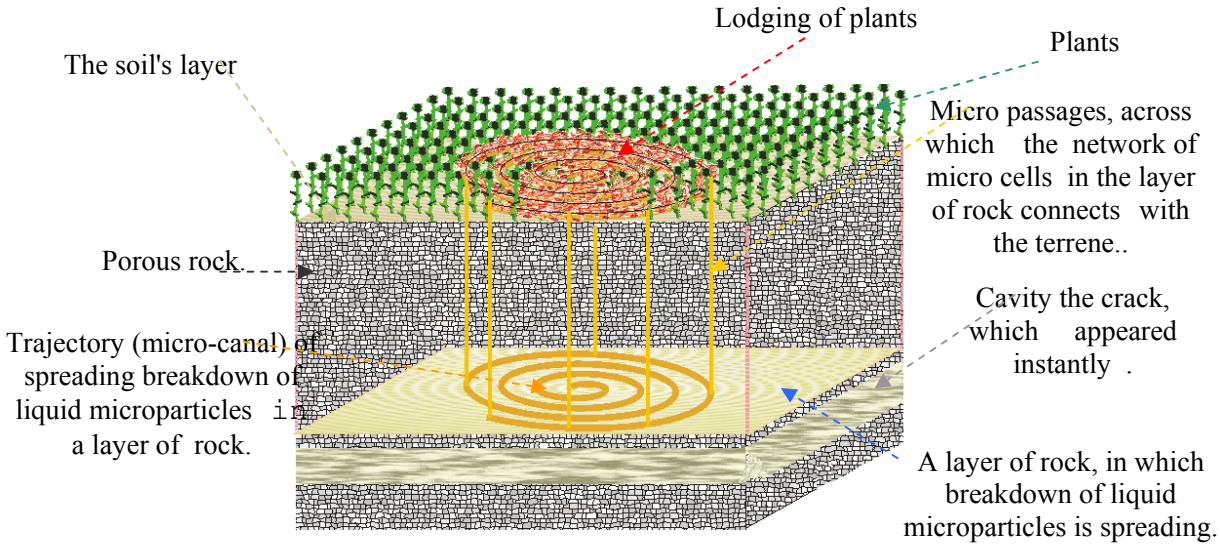


Fig. XI .
Trajectory (spiral-shaped micro-canal) of spreading of a breakdown in a layer of porous rock and picture (spiral) consisting of the lodging plants, which copies the trajectory on the earth's surface.

The speed, Taking account of linear dependence, of propagation the wave of rarefaction gas (air) and the speed of propagation the breakdown of liquid microparticles across micro cell in a layer of porous rock, in the range (the pressure drop) **0,5 ... 0,75 atm.** equals **75 ... 126 m / sec**.

3.3. Above trajectory of propagation the micro holes along the terrene, in the surface layer of the air spreads the waves of rarefaction air, that instantly reduces the external air pressure on the firm outer shell the stalk plants, encountered on its way .

The instantaneous decreasing in ambient pressure on the outer shell a stalk plants instantly increases the pressure differential between the pressure intracellular content (turgor), and between the external pressures on the shells of cells in node of stalk.

As a result, instantly disturbed balance between stretching of shell of cell and the value difference between the external pressure on this shell and the pressure (turgor) of intracellular contents in cell of the node of stalk plants .

If value of instantaneous downward of the external pressure on shell of a node cells of stalk exceeds the limit, it the shell of the cell of a node plants must be have of instantaneously irreversibly stretching.

Irreversible elongation of shell of cell is accompanied by an increase in the volume of cell.

During the instant irreversible extension of the surface of shell of cell of node plants, this shell in some places could be broken.

The irreversible elongation of shells of great number of cells of node of stalk creates an irreversible increase volume of the node.

Increased volume of node shows up outwardly in irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalk.

The values of irreversible increasing volume of set cells in the nodes of the plants more at that side of the elastic outer shell of stalk, which first encountered on way of the propagation the wave of rarefaction in surface layer of air .

Therefore nodes have irreversibly bend in the direction of the propagation the wave of rarefaction.

Part of the stalk, which is located above bending a node, turns relatively the bottom part of the stalk in the direction of the vector of propagation the wave of rarefaction .

In the case a vertical vector of propagation the wave of rarefaction, a node of stalk elongates in the vertical direction.

Swelling nodes and formation the expulsions cavities at the shells nodes of plants is maximal on that side of the stalk, which first encountered on way of the propagation the wave of rarefaction in surface layer of air.

3.3.1. The values of rarefaction air in the surface layer of the atmosphere created by the spread of the mentioned rarefaction waves, decreases with growth of distance from the earth's surface.

The durability of shells the lower nodes is more than durability of shells the nodes, located above them.

Possible variants of charts changes of critical values of rarefaction air depending on the durability of shells of nodes, in principle ,such, that: all nodes of the stalk can acquire the irreversible changes of shape and size; all nodes of the stalk may not have irreversible changes of shape and size; lower stalk nodes may undergo irreversible changes shapes and sizes, but upper nodes do not have such changes; the upper node may undergo irreversible changes of shape and size, but lower nodes do not have such changes.

3.4. The spread in the surface layer of the air waves of rarefaction creates a differential pressure of air in the surface layer air.

As a result, arises a gust of wind , which spreads along the surface of the earth, by following after spreading a rarefaction wave.

The speed and direction of gust of wind along the surface of the earth coincide with speed and direction of the wave propagation along the earth's surface rarefaction.

The trajectories of propagation along the earth's surface the gust of wind and wave rarefaction coincide.

This gust of wind is able to displace, irreversibly, encountered in his path the stalks, on which already appeared (from the wave of air dilution) irreversible elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalk, and to create of them, along the path of propagation micro holes , the genuine stalk lodging of plants in the form of the genuine picture “Crop circles”.

In a bent by gust of wind (speed of air in which more than **17.8 m / s**) a stalk of cereals, the maximum stress occurs at first node (the base of second internodes), that is located, usually, at a distance of **2 ... 8 cm** from the ground (3.1.).
And it stress is equal to value of critical stress . Under the influence of that gust of wind, first node have the bend.
The angle of bending is proportional to the durations of a wind of gust.
As a result, in the first node there appears an irreversible bending stalk.
The irreversible bending the stalk in the first node, which are created by the gust of wind, is added up with the irreversible elongations and bending node, swelling nodes and the expulsions cavities of the nodes of stalk, which before the gust of wind appeared on stalk at moment of his meeting with the wave of rarefaction (during a wave propagation in surface layer of air).
3.5. The contours picture "Crop circles", which is created by the gust of wind, are copying of a trajectory of propagation micro holes on the earth's surface (14).
In **Fig. XII**. and **Fig. XIIa.** shows the variants of trajectories of propagation micro holes, which form a spiral and star, respectively. These trajectories was created by using the computer model.

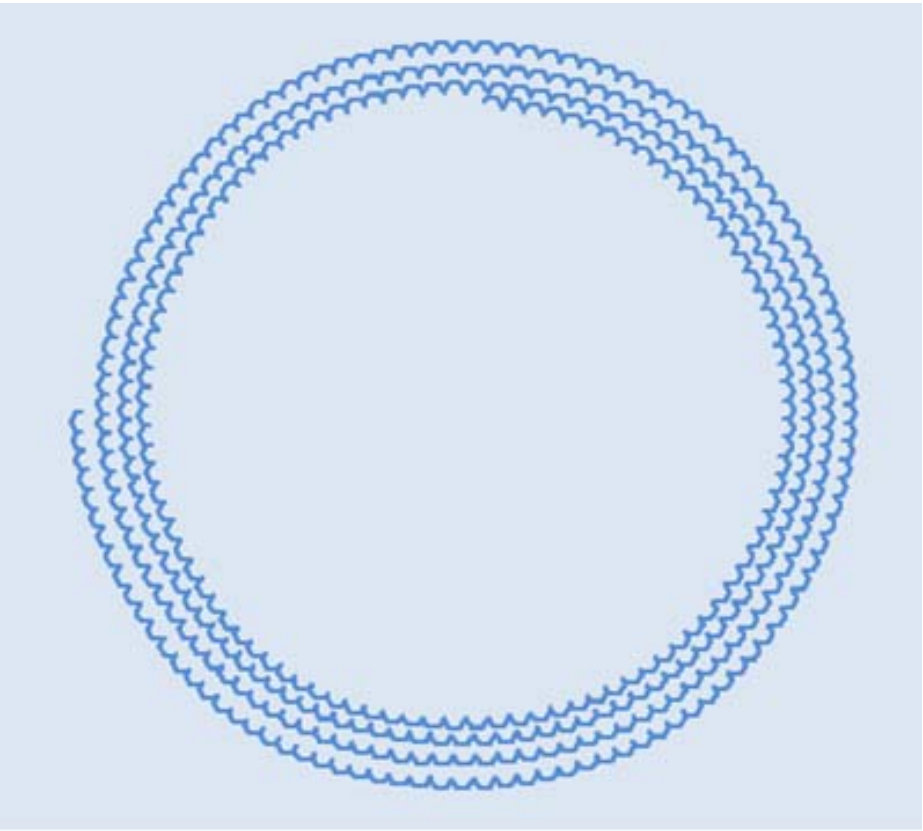


Fig. XII .
Segment of the spiral trajectory (rotating counterclockwise) of propagation micro holes on the earth's surface.

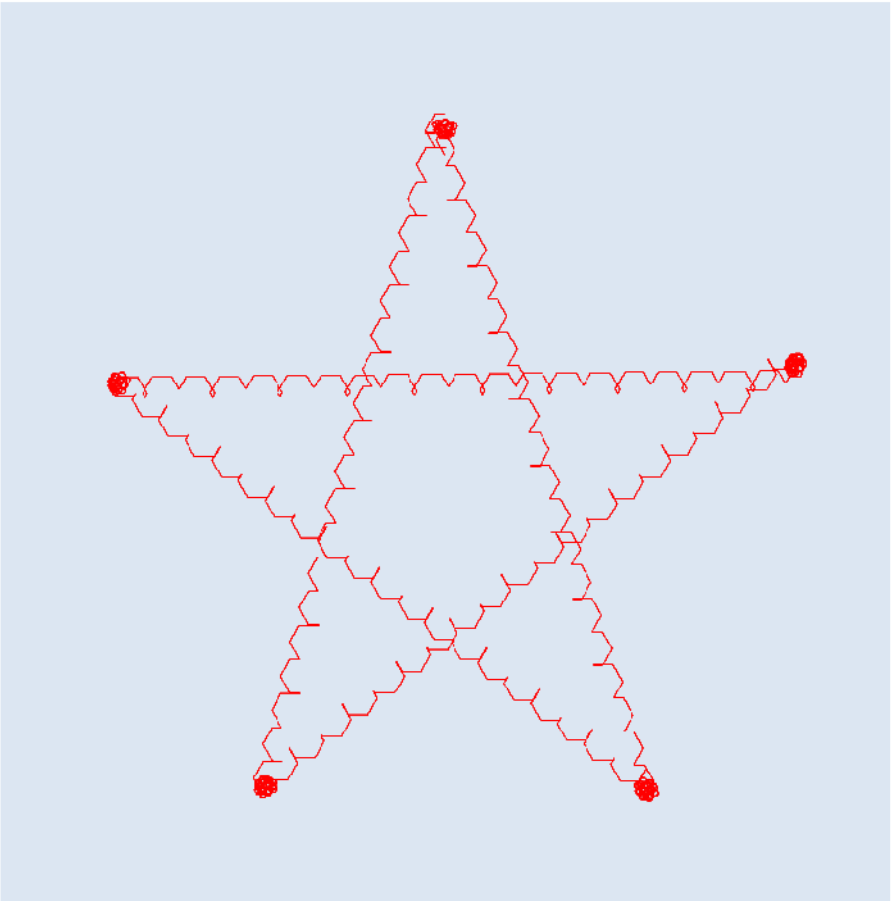


Fig. XII a .
Star - one of variants of trajectory of propagation micro holes on the earth's surface.

Segment (**Fig. XII.)** of the spiral trajectory (rotating counterclockwise) of propagation micro holes on the earth's surface, are copying of segment of the spiral trajectory of the spread the breakdown 60 000 000 micro cell in a layer of porous rock(the distance between two neighboring micro cell 0.0001 cm).
Total length of segment spiral trajectory, connecting **60 000 000** micro cell, is equals **6000 cm**.
The largest diameter of the trajectory of the spiral (**Fig. XII.) 3 m** horizontally and **2.9 m** on a vertical line .
This segment the spiral trajectory (**Fig. XII**.) of propagation micro holes on the earth's surface arises during **0.5 ... 0.8 sec**.
(The spiral trajectory of propagation the micro holes on the earth's surface , which engulfs all of surface of the circle diameter **15 ... 30 m**, corresponds - the spread of the breakdown of **1400000 000 ... 2 800 000 000** micro cell in layer of rock. This spiral arises during **12 ... 40 sec.)**
Segment of spiral trajectory (**Fig.XII.)** of propagation the micro holes on the earth's surface was formed of great number the micro images, the micro contours of which similar to the trapezoid (**Fig. XIV, XV, XVI.).**
The micro contour of the trapezoid AE (**Fig. XIV.)** is formed with using of unclosed a broken line - ABCDE.
Each micro segment of unclosed a broken line - ABCDE (**Fig. XIV.),** in turn, is formed by broken lines, the structure of which is shown in **Fig. XIII ..**
The distances between the points of the trapezoid AE (**Fig. XIV**.): AB = **2 cm**; BC = **4,3 cm**; CD = **4,15 cm**; DE = **2,3 cm**; AE = **7,3 cm**.
Greatest width (horizontal size) of the trapezoid (**Fig. XIV.)** reaches **3.98, cm.** Sum of distances between the points of corners (AB + BC + CD + DE) is equal to **12.75 cm.**
The trapezoid of AE (**Fig. XIV.)** on the earth's surface is copy of contour trapezoid of trajectory breakdown the (**150 000**) micro cells in a layer of porous rock.
The sum of lengths of the distances between for **150 000** of micro cells of contour of trapezoid is equal to **15 cm**.
Intervals of time for which are appeared contour of trapezoid in a layer of porous rock and copy of these contour on the earth's surface , are equal.
The speed of propagation micro holes on the earth's surface is **64 ... 107 m / s**, which is **1.18 times** (**15/12,75 ≈ 1,18**) smaller than the velocity of propagation breakdown liquid microparticles between the micro cells in a layer of porous rock.
Waves rarefaction, propagating from micro holes, which are incorporated by the contour trapezoid AE (**Fig. XIV.**), creates a zone of rarefaction in the surface layer of air above the figure trapezoid AE .
Zone rarefaction in the surface layer of the air from space above the figure trapezoid AE moves along the ground surface in the direction of again nascent of the contours of trapezoids FG, HI, JK, LM, etc. (**Fig. XVI**.).
Interval of time, for which the zone rarefaction moves from the space of above to one of figure of trapezoid in the space of above the figure of subsequent trapezoid, coincides with the interval of time, for which the contour of subsequent trapezoid arises .
For this interval of time, distance, on which moves the zone rarefaction, is equal to a segment of straight between the start and end points of figure of trapezoid , for example, between points A and E.
Segment of a straight AE has length of **7.3 cm.** A sum of the distances between the corner points of figure of trapezoid of AE (**Fig. XIV.**) is equal to **12.75 cm.**
According to the above mentioned, the speed of propagation micro holes on the earth's surface is **64...107 m/ sec.**
The speed movement of zone rarefaction on the earth's surface is **37 ... 61 m / s**, which is **1.75 times** (**12,75 / 7,3 ≈ 1,75**) less than the speed of propagation micro holes on the surface of the earth.
3.6. For the trajectory, which showing in **Fig. XII.**, band width (**Fig.XVII.**), in which extends the zone rarefaction, is equal **3.98 ... 5.98 cm.**
In **Fig. XVII.** numbers **1, 2, 3** pieces are marked segments of bands, for every of which corresponds one of parallel segments of the trajectory (**Fig. XII.**) propagation micro holes on the earth's surface.

Fig. XIII

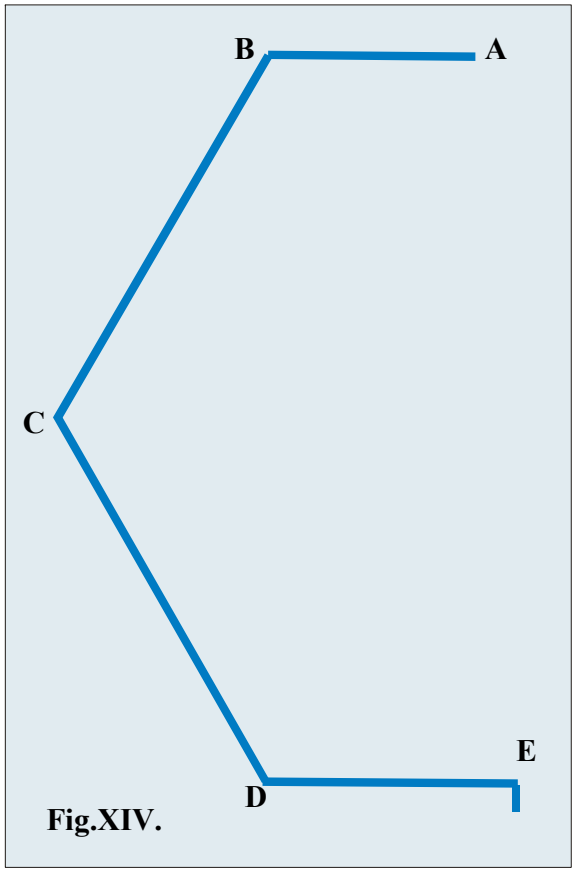


Fig.XIV.

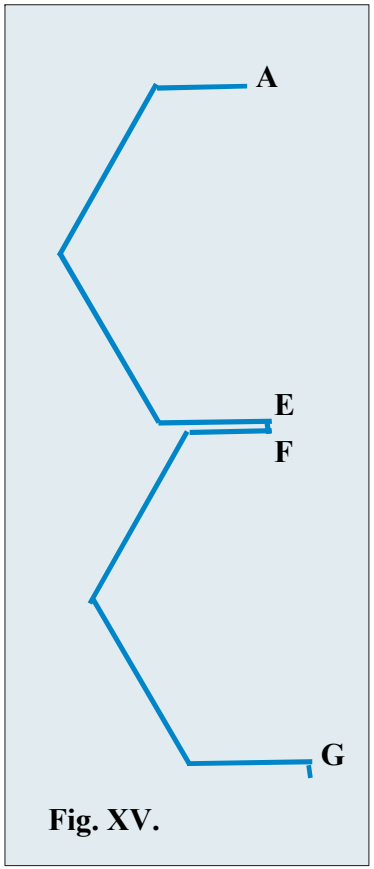


Fig. XV.

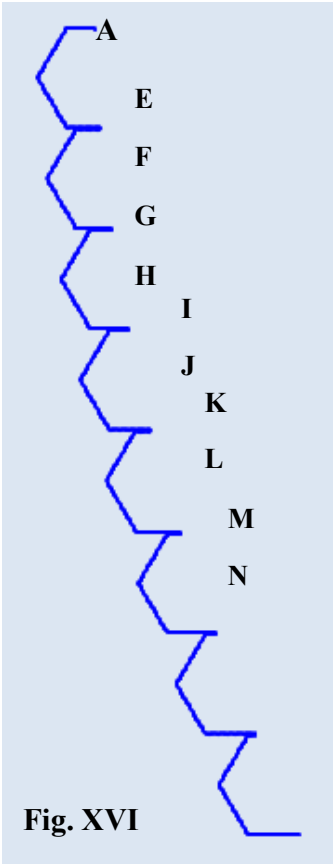


Fig. XVI

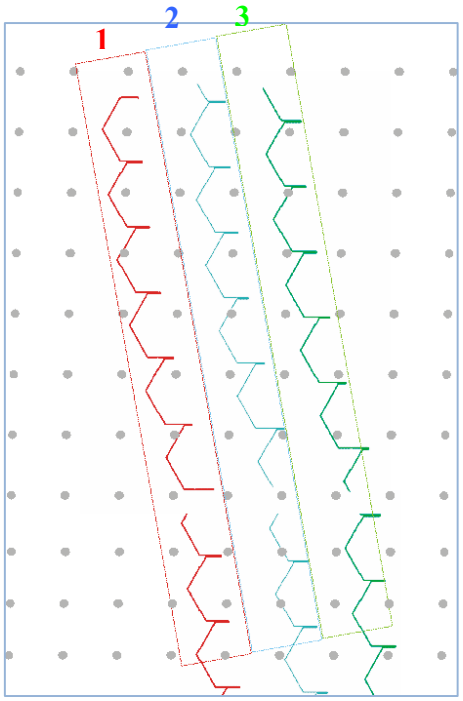


Fig.XVII .

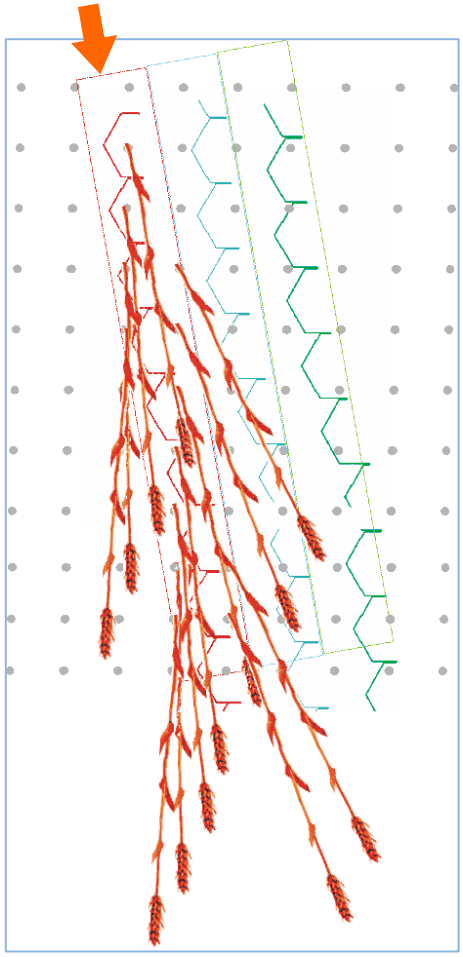


Fig.XVIII

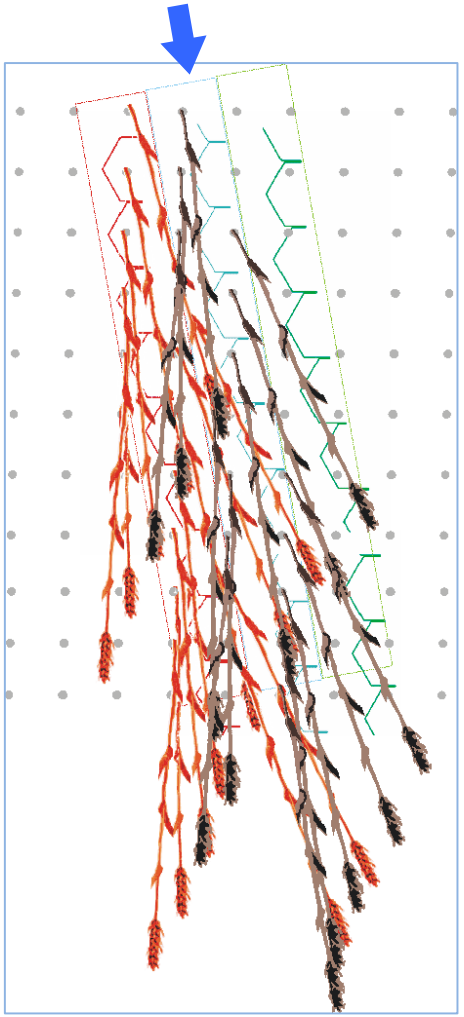


Fig.XIX.

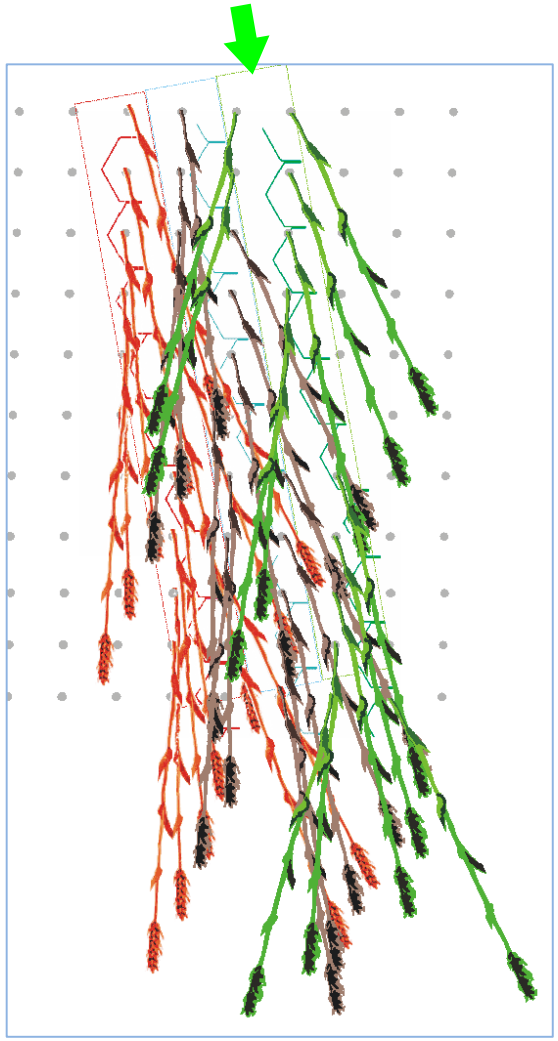


Fig. XX.

On stalks plants, which trapped in a zone rarefaction, the rarefaction waves of air are acting, creating an elongation and bending node, swelling nodes and the expulsions cavities of the nodes of stalk.
In pursuit of a zone rarefaction, which is moving along the band ,rushes gust of air at speeds of **37 ... 61 m / sec**.
Gust of wind, volant in the band width (**Fig. XVIII., XIX., XX.**) **3.98 ... 5.98 cm** (the size of the bands are different for different images), are affected on stalks, encountered on its way, at which, by the action of the preceding rarefaction of air already was created an elongation and bending node, swelling nodes, the expulsions cavities of the nodes of stalk.
That Gust of wind, in turn, creates irreversibly bending or the fracture of the stalks of plants.
In **Fig. XVIII., XIX., XX.** the pointers (arrows) indicates the direction of the wind gust at the moment the movement a zone rarefaction on bands **1, 2, 3**, respectively.
At lodging of stalks, which located to the right of the axis of symmetry of the band, the ears of lodging stalks directed in the direction of gust of wind, with some shift stalks to the right from the axis of symmetry the band, and, at lodging of stalks, which located to the left, of the axis of symmetry of the band, the ears of lodging stalks directed in the direction of gust of wind, with some shift stalks to the left from the axis of symmetry of the band (**Fig. XVIII.**).
At stalks, which located on the axis of symmetry of the band, the ears of lodging stalks directed in the direction the gust of wind.
Lodging stalks (green stalks) on the segment of third band occurs after lodging stalks (brown stalks) on the segment of second band, lodging stalks on the segment of second band occurs after lodging stalks (red stems) on the segment of first band.
Lodging stalks creates turbinal multilayer (three-layered) mat.
As a result, on the surface appears the figure “Crop circles”, in the form of a spiral, which are creating by lodging stalks under the influence of wind gusts.

Impact.

1. The external shell in nodes of stalk of mature plants may have sufficient strength, to withstand (without changing the shape and size) the instantaneous increase in pressure differential between the pressure of the intracellular content (turgor) and the external pressures on the shells of cells the nodes of stalk .
In this case, only source of irreversible the displacement of the stalk is the effect of gust of wind, which spreading along the trajectory of propagation micro holes , and which creates bending the stalk to the first node.
In moment of origin the genuine picture from such mature plants, the stalks, which lodging in the picture, will not have of elongation and the bending of node, swelling nodes, the expulsions cavities of the nodes of stalk.
However, according above-description of the conditional distinctions (conditional signs)between genuine and man-made pictures, this genuine picture will be described experts as a variant of man-made picture.
Consequently, the application of the above-described of the conditional (formal) distinctions (conditional signs) is capable to set too high amount of man-made pictures "Crop circles" and to reduce (unjustifiedly) the amount of drawings genuine "Crop circles".
2. Instant rupture porous rock is accompanied by instantaneous creation the cavity a crack and the gas-permeable network, consisting of great number of the micro-canals and the micro-passages.

2.1. Through this network from layer of air above the terrene the micro-streams of air is sucked in in a volume of arising up crack .
Sucking in in volume of crack the air micro-streams from the surface layer of the air are creating the decreasing atmospheric pressure in the surface layer of the air and are creating gust of wind.
2.2. The micro-streams of air in in the surface layer of the air,the decreasing of atmospheric pressure and gust of wind affects on plants, bending them to earth and creating from them the stalk lodging in form the genuine picture "Crop circles".
2.3. In porous rock the great number of the micro-canals and the micro-passages, on which the waves swept the rarefaction gas (air), are forming a gas-permeable and water-permeable drainage network (**Fig. XI.**).
This drainage network connects the cavity of crack (through the porous rock and soil) with a terrene under a picture "Crop circles".
Superficial moisture across the drainage system without obstacles moves into the cavity of crack, creating dry soil under a picture "Crop circles".
At the same time, this drainage system creates in the soil of favorable water-air conditions in the root zone of plants.
3. Pressure at porous rock, raising and lowering the water level of pressurized aquifers, move of atmospheric fronts, the attraction of the moon and sun, the strikes of lightning and other factors is cause of compression and tension in the porous rocks (chalk,limestone, etc.), which may be the causes of rupture porous rock and may instantaneous create of cavity a crack .
3.1. Pressure of porous rock, the water level at the pressure-aquifers, the electric digits (shots of lightning) and other factors executes regulation a volume and velocity creating of cavity a crack in a porous rocks.
When increasing of volume of crack, air of surface layer of air sucked in to the volume of cracks.
If is reducing the volume of crack, air from volume of crack rushes at the terrene, and in passing executes the tearing in of the microparticles porous rock from the wall of micro-canals or from the wall of micro-passages and takes away of microparticles into the soil on terrene under the picture "Crop circles".
3.2. Among micro-particles the porous rock, which the air stream dragged from the depths the porous rock on terrene, may be present microparticles, that was forming in the depths of the earth at high temperatures and pressures.
4. A crackle of rocks before destruction and after him, the sound of instantaneous destruction of the porous rock, high-speed movement micro-streams of air at micro-canals and at micro-passages may be the source of a wide variety of acoustic phenomena in the vicinity of picture "Crop circles".
Thus, acoustic phenomena may precede, may occur simultaneously and may occure after appearance the picture "Crop circles". The sound spectrum of the phenomena may include of frequencies, which are not felt by human ear, which, however, may to felt by animal's ear.
5. Instant rupture porous rock during formation of cracks is accompanied by heat, which raises the temperature of the surrounding rock and soil below the picture "Crop circles".
In addition, micro-stream air, which rushes at speed along micro-passages and micro-canals, is warming up through friction with walls and warms up the walls at micro-canals and at micro-passages.
As a result, the soil temperature under picture "Crop circles" during of some time may be different from the temperature of soil surrounding area of picture "Crop circles".
6. Instantaneous rupture porous rock (at moment formation of crack) generates electromagnetic radiation that interacts with the electromagnetic field of earth and with atmospheric electricity. Propagation along the micro-canals and the micro-passages waves rarefaction and the micro-stream air (gas) is accompanied by electrization the hard walls and the micro-stream air (gas), the

manifestations of these electrization are imposed on the electromagnetic radiation of porous rock, which before was mentioned.
Interactions, arising up in a porous rocks, of the electromagnetic radiation with atmospheric electricity and with the microparticles (suspended in the atmosphere) may cause visual and others unusual atmospheric phenomenas around the picture "Crop circles", and in atmosphere above of picture"Crop circles".
Arising up in a porous rock electromagnetic radiations can cause disruption of the phone, a compass and other devices.
7. Electromagnetic radiation that occurs in rocks in the formation of cracks, can have an impact on all biological objects that are in the area of its operation.
People in the zone of the picture "Crop circles", under the influence of the electromagnetic radiation, may have the auditory sensations in the form of clicks, buzz or chirp.
In the zone of the picture "Crop circles", the people under the influence of electromagnetic radiation, may feel malaise, headache, dizziness, nausea, anxiety, weakness.
The influence of electromagnetic radiation in the zone of the picture "Crop circles" on animals is manifested in the change of motor activity of animal, in an aspiration to leave this zone.
8. The instantaneous microspacing the solid micro-skeleton of porous rock(14) are managing the creation of the figure the trajectory of propagation of breakdown of liquid microparticles (breakdown micro cell) across a layer in the porous rock, and capable to create the great number of most various of figure the trajectory of the spread of breakdown of liquid microparticles (breakdown micro cells) in a layer of porous rock, including the circles, spirals, regular polygons, intersecting segments of direct and other more complex images.
Thus, is possible the genuine emergence the most various on shapes and sizes the genuine pictures "Crop circles".
Virtually unlimited number of combinations of various successive microspacing of solid micro-skeleton of porous rock makes it unlikely occurrence of two identical in shape and size genuine pictures "Crop circles".
Great number most various on geometrical forms of the calculated trajectories of propagation of the breakdown of liquid microparticles (breakdown microcells) in the layer of rock generates the stalk lodging ,the external look of which shows up as various in a due form the genuine pictures "Crop Circles" of the stalks plants.
Some idea of the variety of geometrical forms genuine pictures «Crop circles», which can be created with above mentioned the mechanism of stalk lodging plants, may arise up at consideration of drawing of trajectories of propagation the breakdown of liquid microparticles (the breakdown micro cells) in a layer of rock ,which rotined on pages **21-75** of this article.

Forms of the calculated trajectories of stalk lodging of plants at pictures "Crop circles".

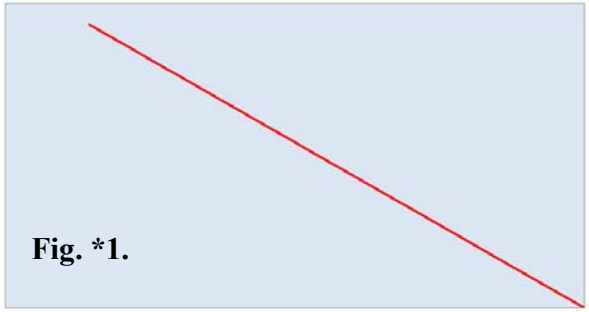


Fig. *1.

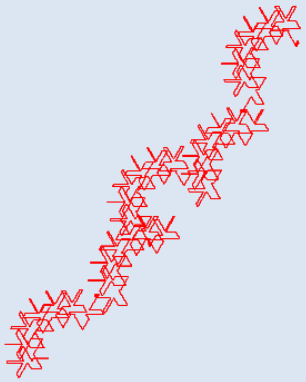


Fig. *2A.

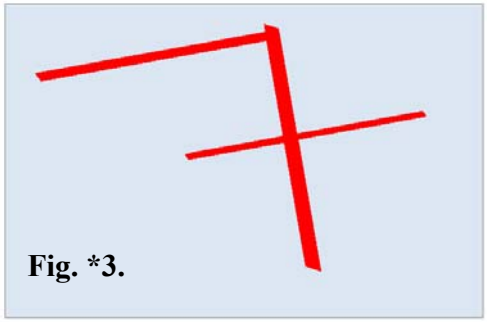


Fig. *3.

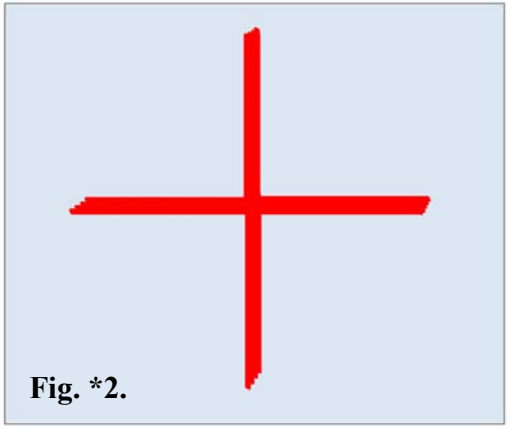


Fig. *2.

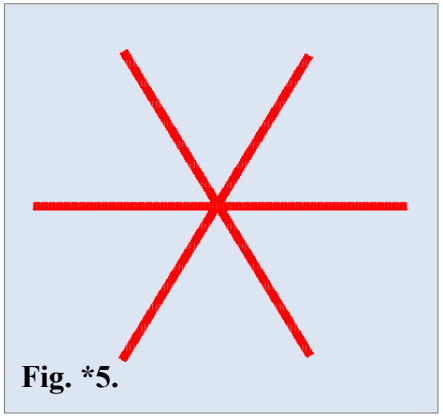


Fig. *5.

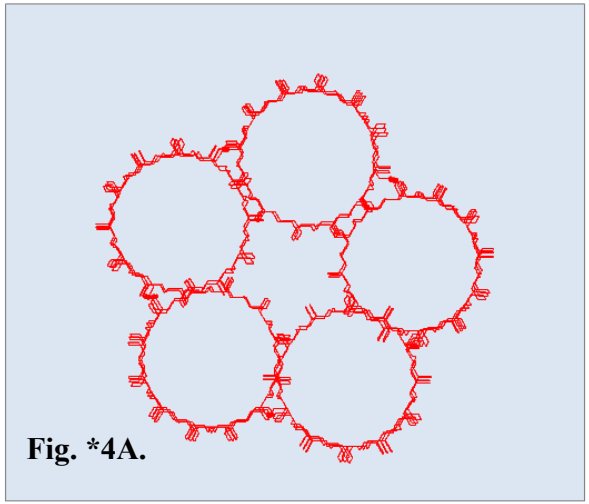


Fig. *4A.

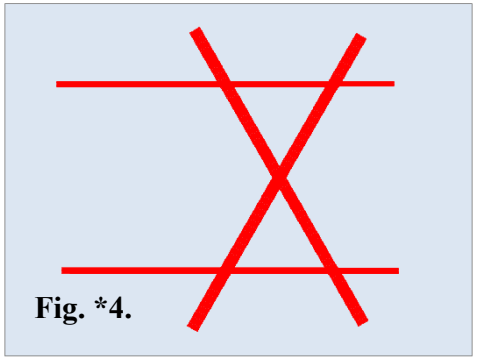


Fig. *4.

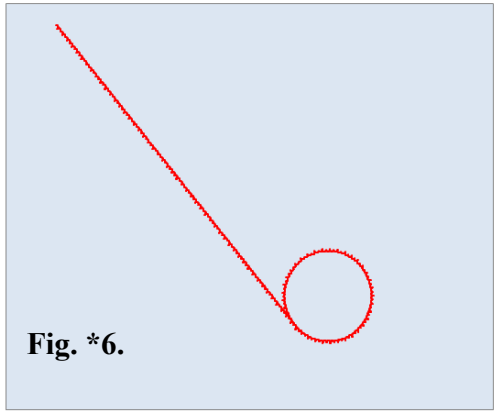


Fig. *6.

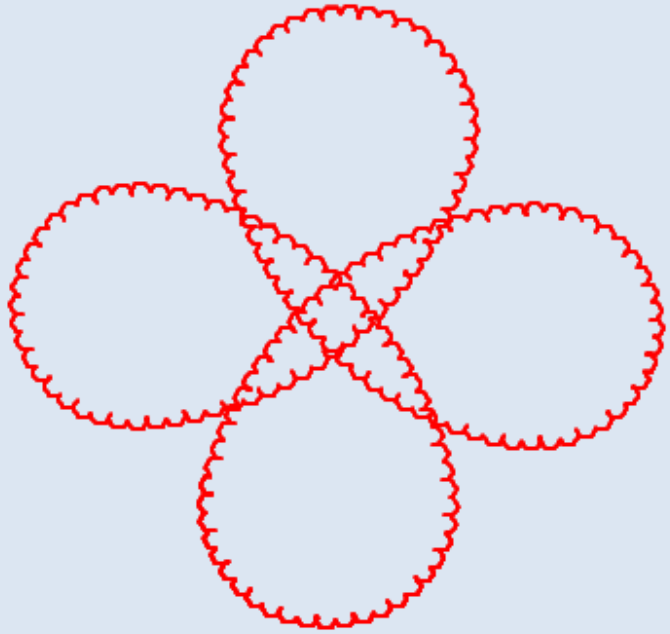


Fig. *6AA.

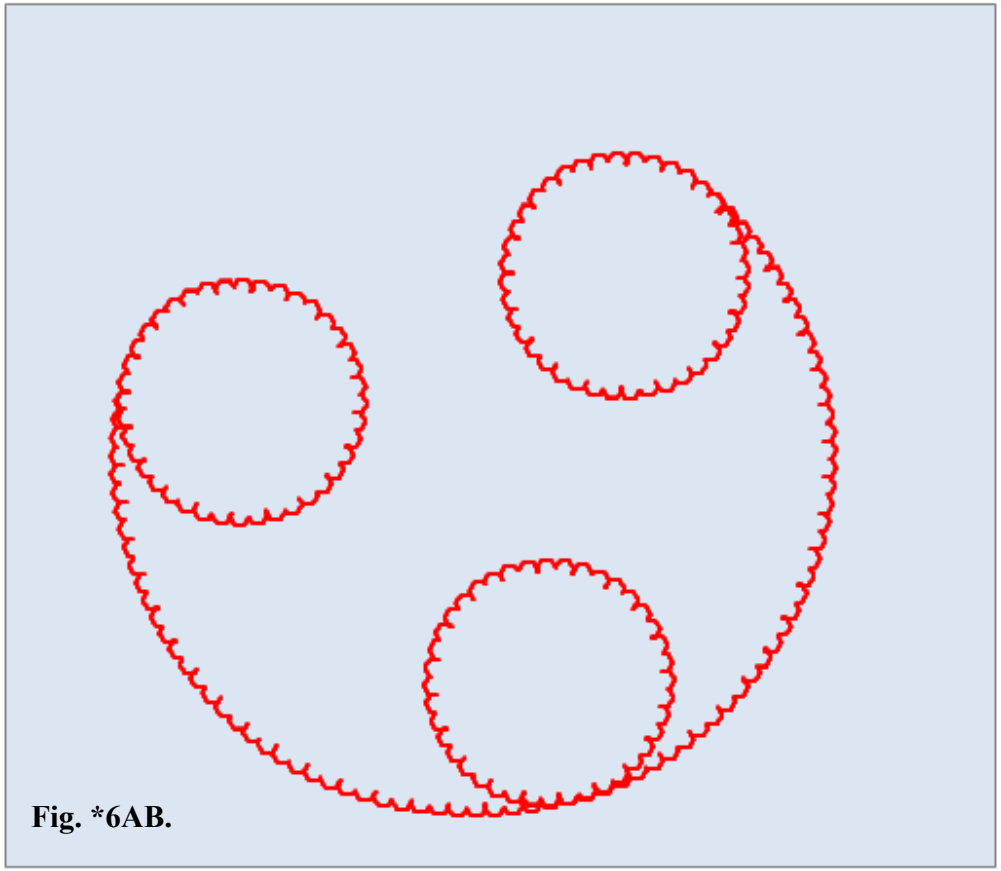


Fig. *6AB.

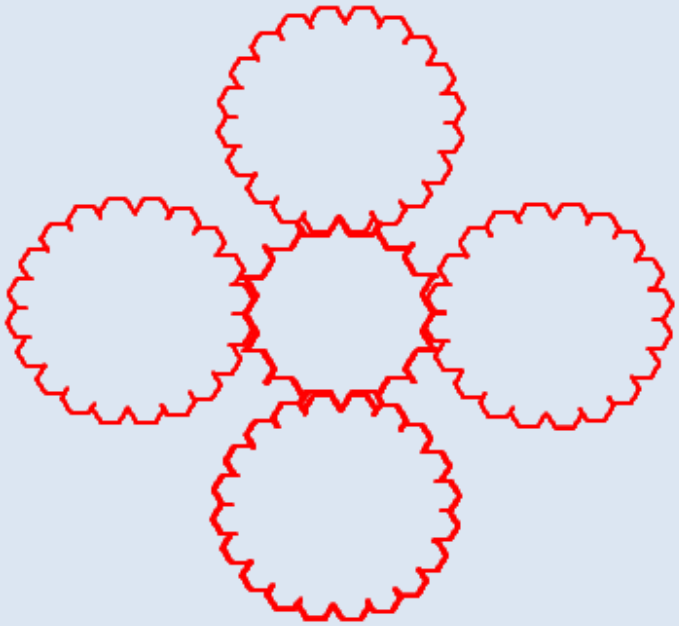


Fig. *6AC.

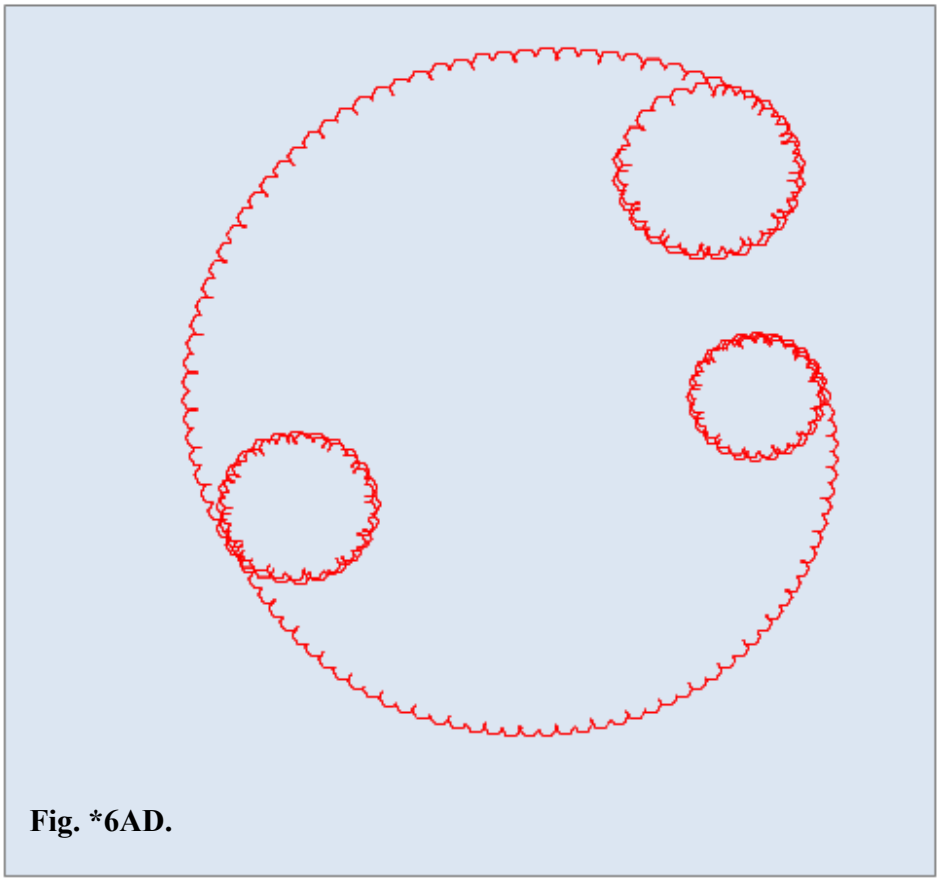


Fig. *6AD.

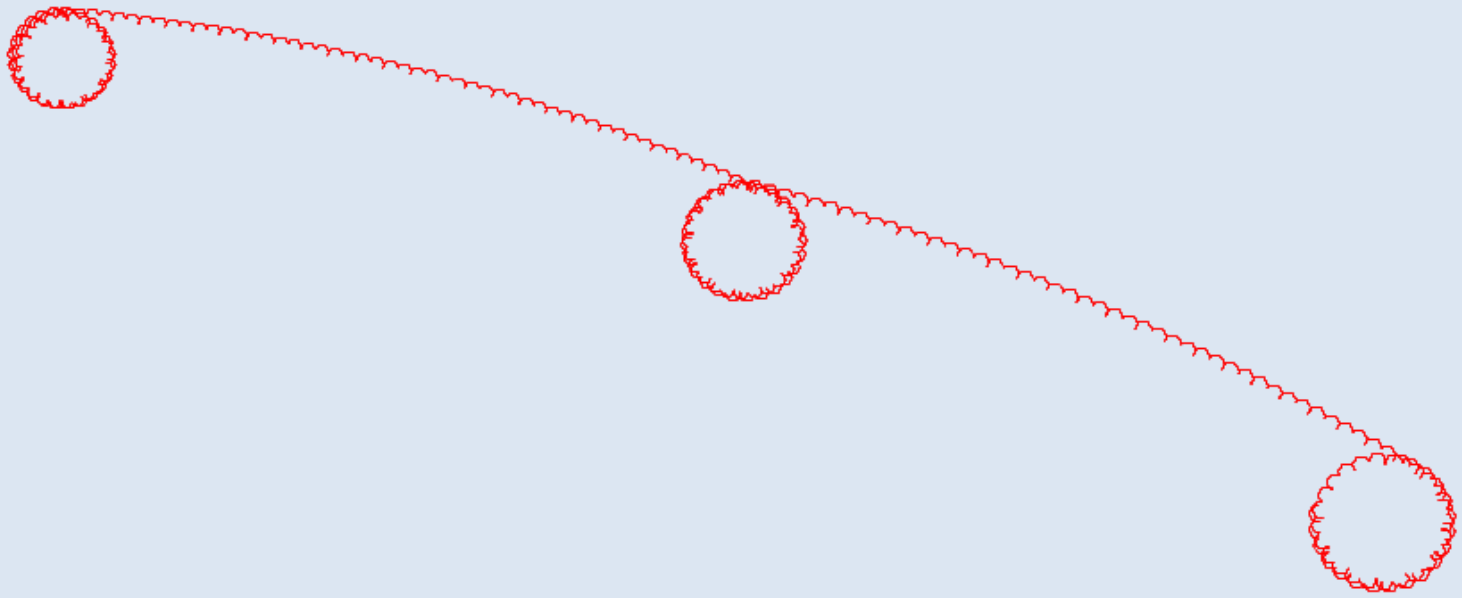


Fig. *6AE.

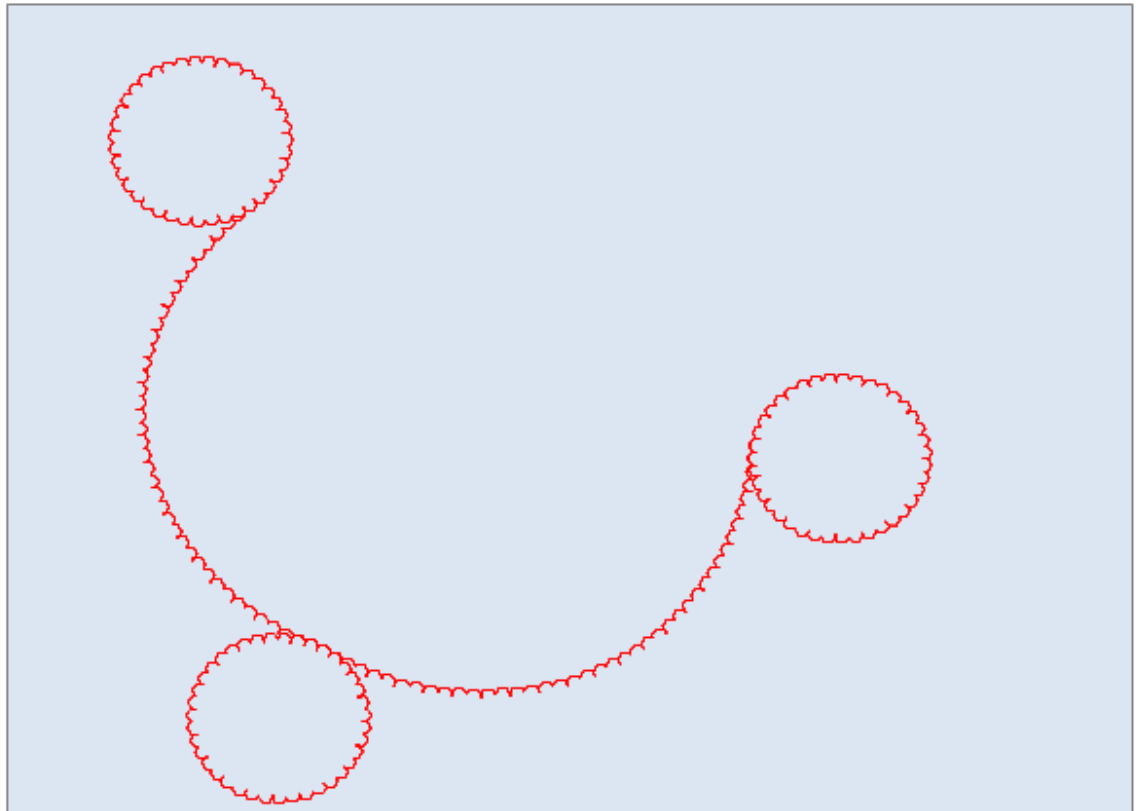


Fig. *6AF.

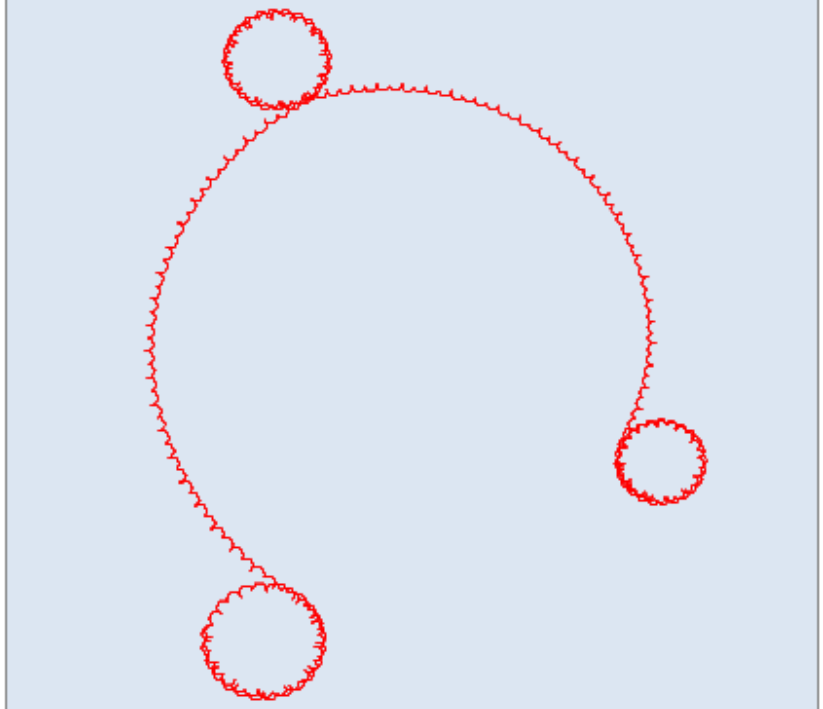


Fig. *6AG.

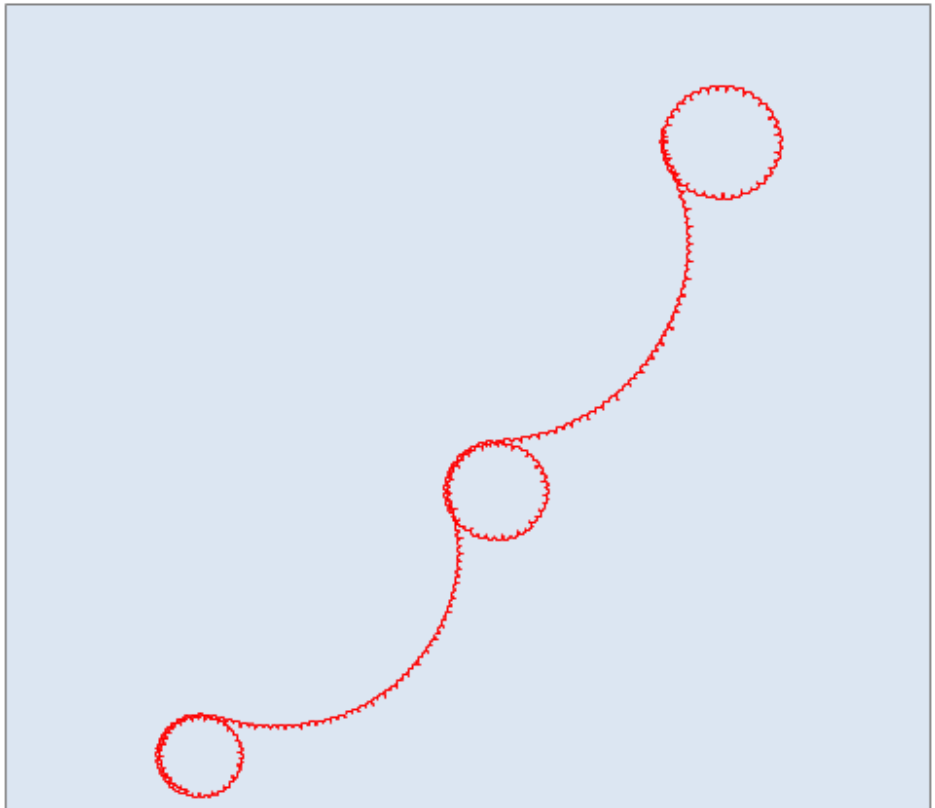


Fig. *6AH.

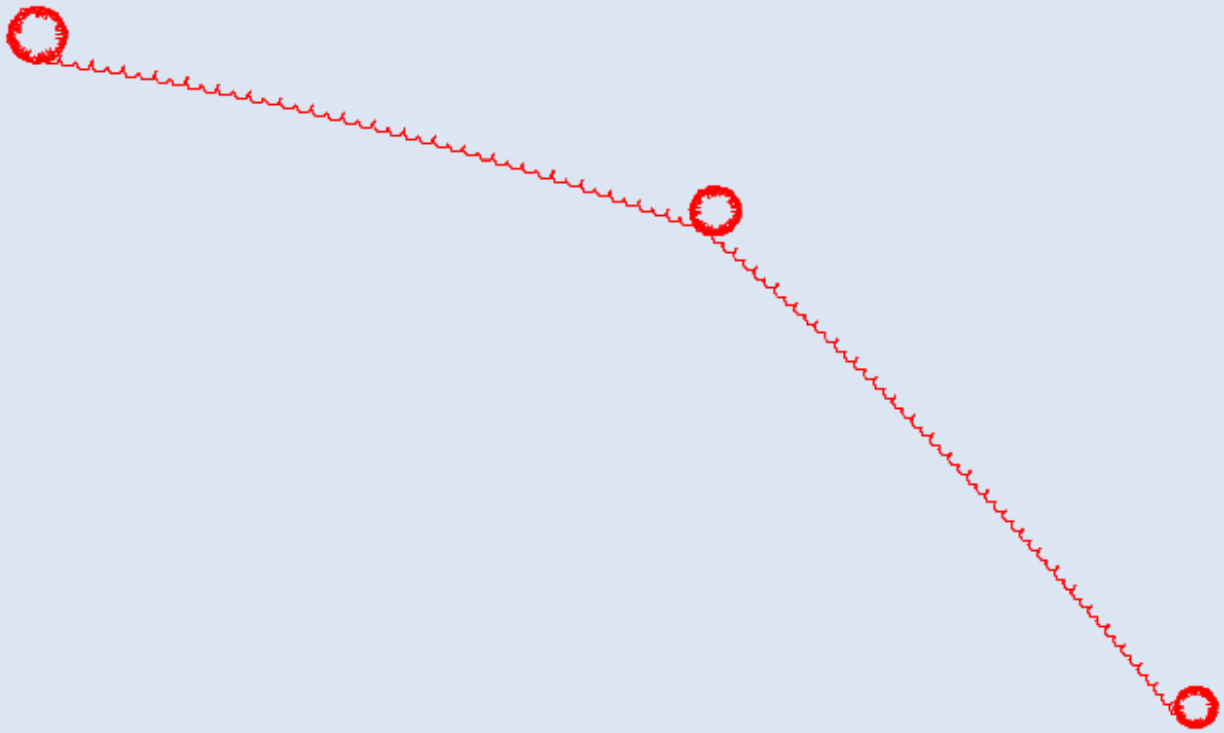


Fig. *6AJ.

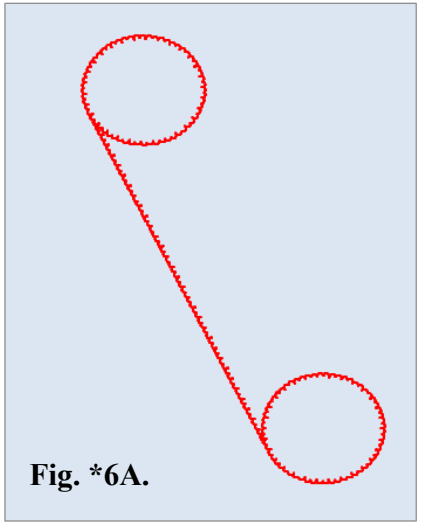


Fig. *6A.

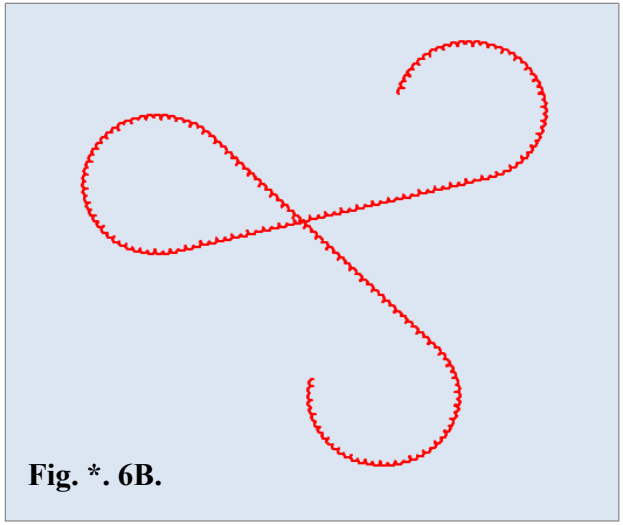


Fig. *. 6B.

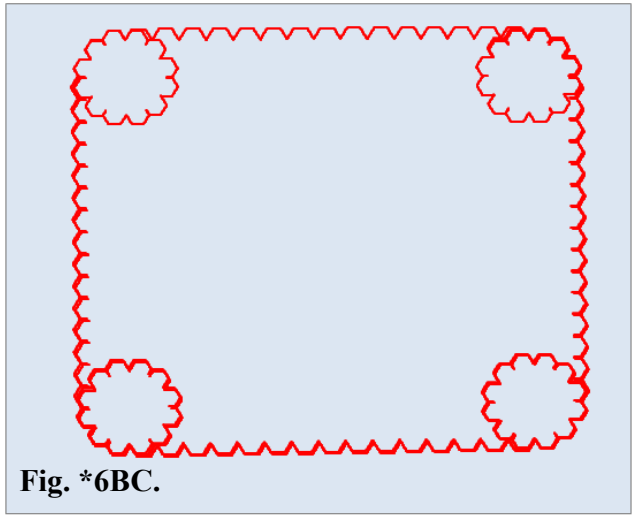


Fig. *6BC.

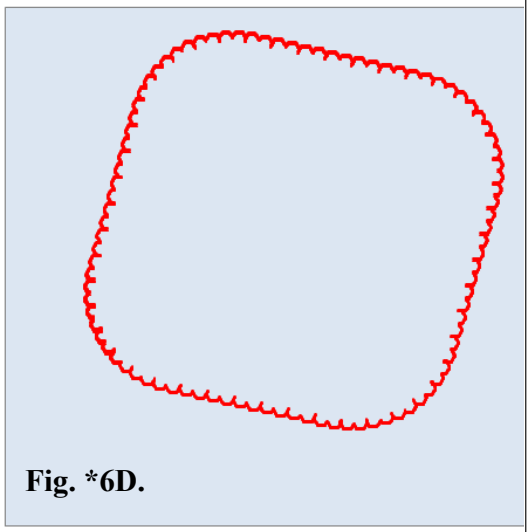


Fig. *6D.

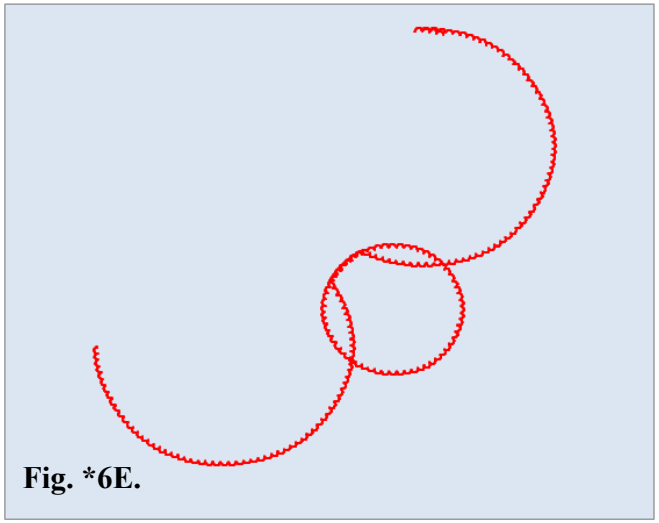


Fig. *6E.

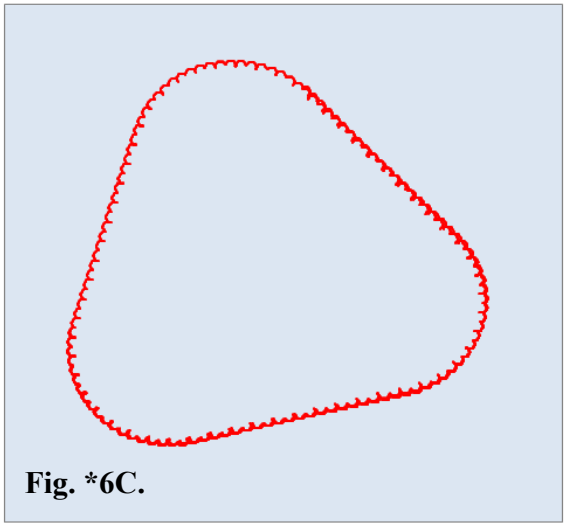


Fig. *6C.

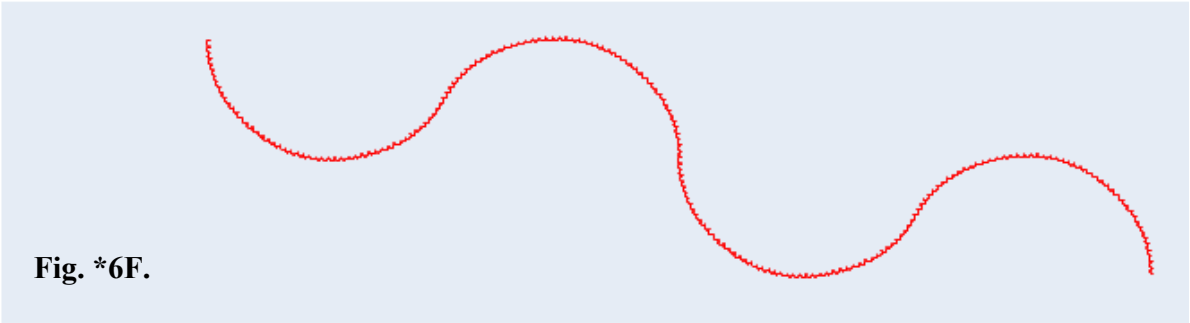
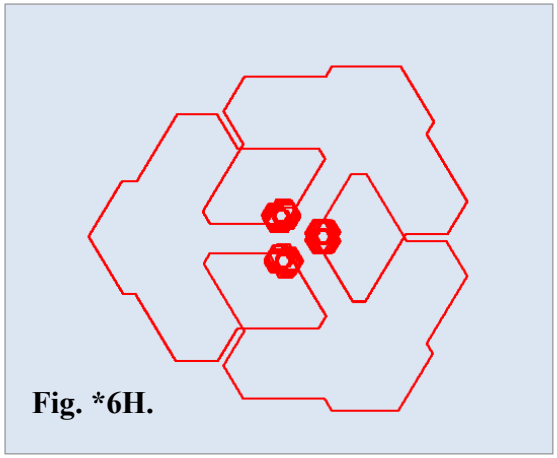


Fig. *6F.



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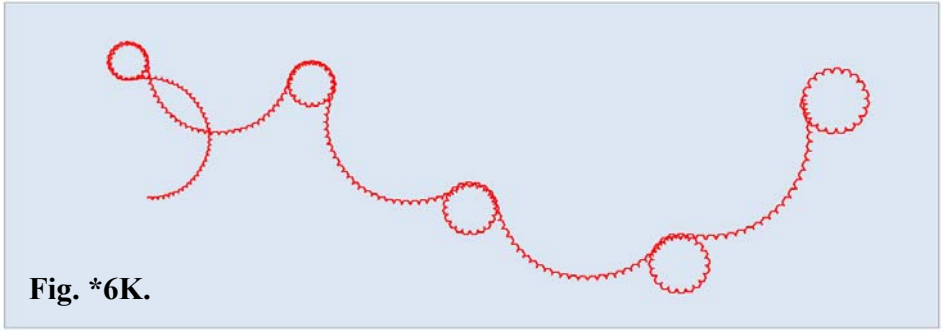


Fig. *6K.

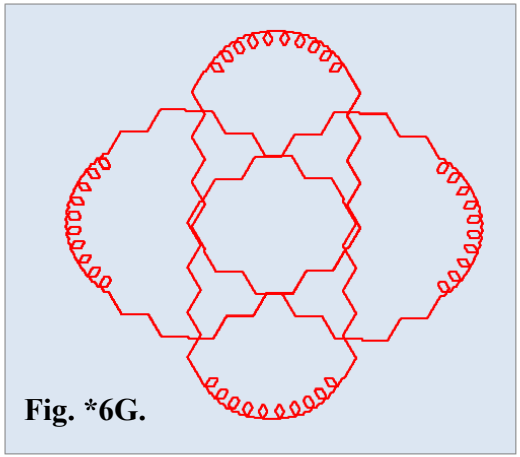


Fig. *6G.

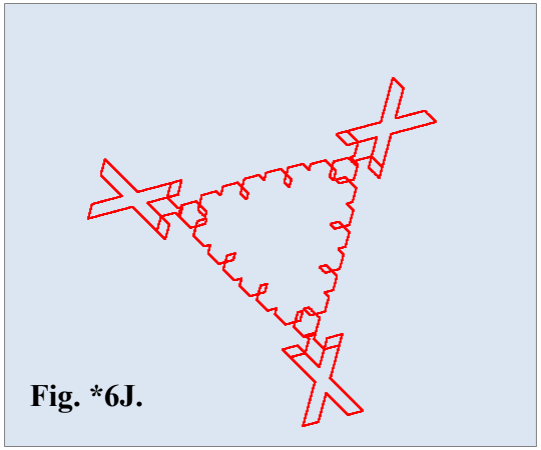
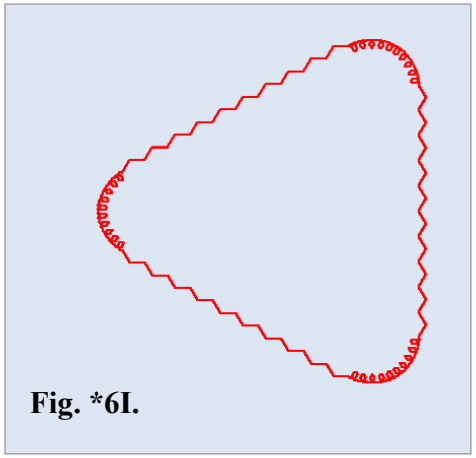


Fig. *6J.



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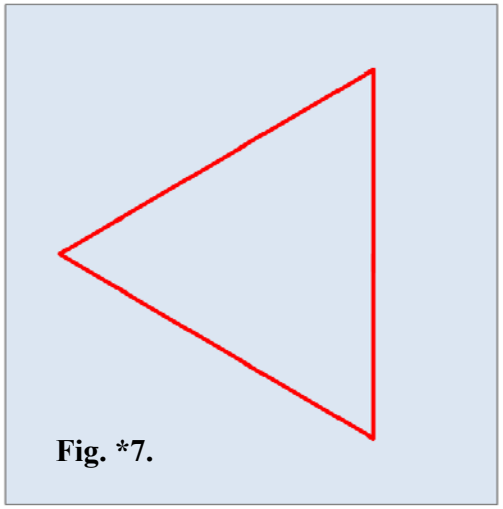

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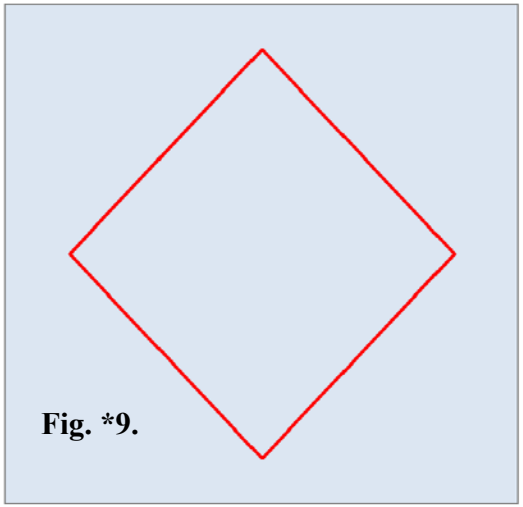

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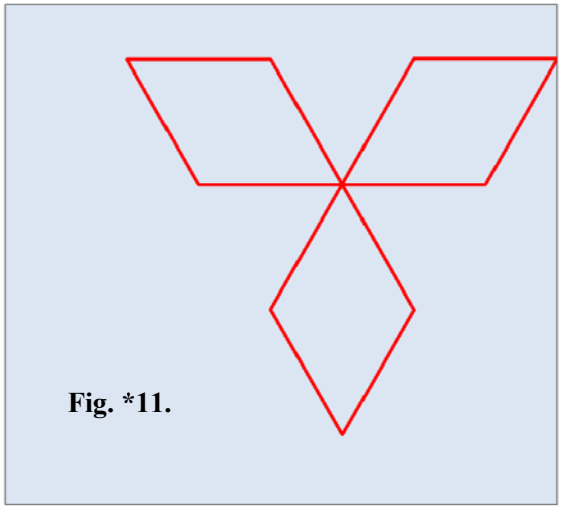

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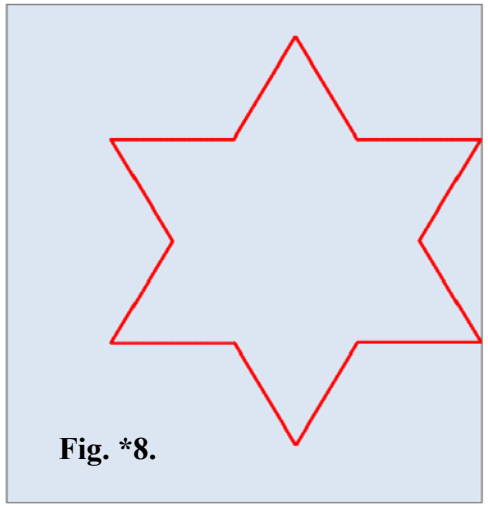

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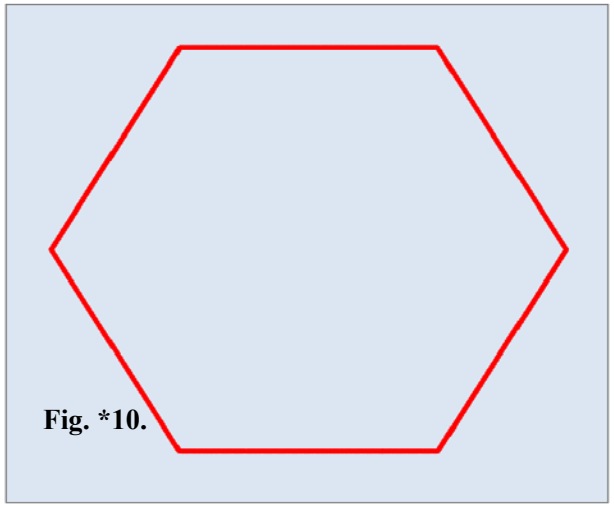

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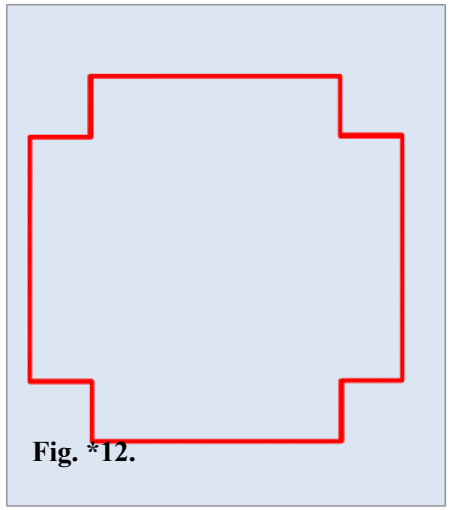

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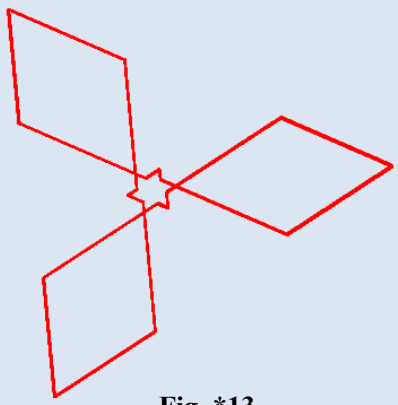

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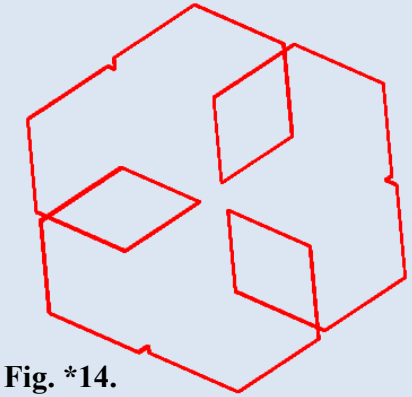

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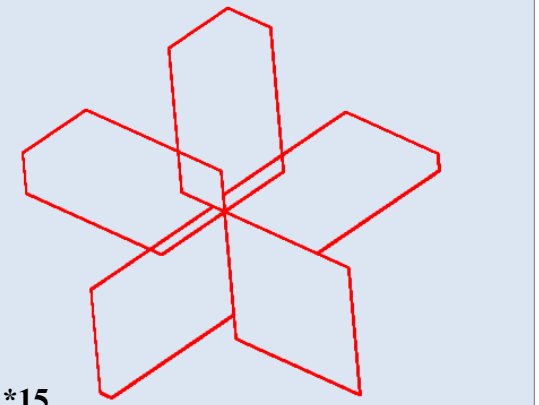

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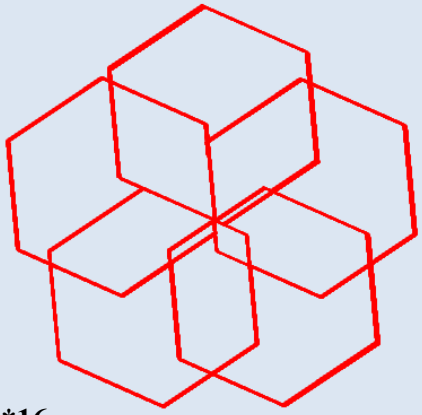


Fig. *16.

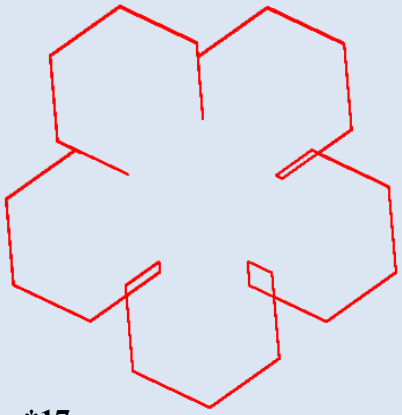
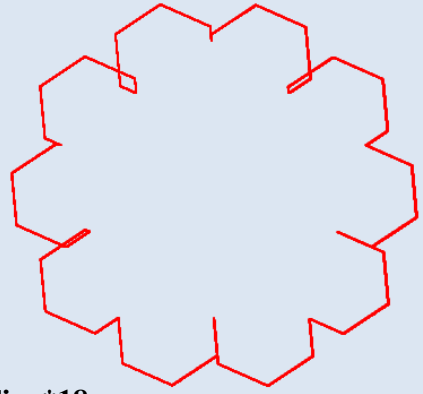


Fig. *17.



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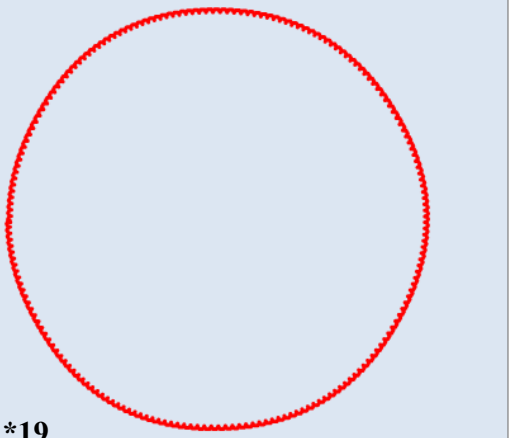


Fig. *19.

Fig. *20A.

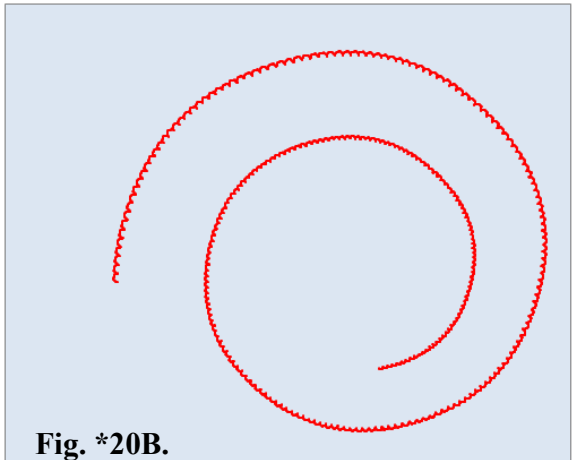


Fig. *20B.

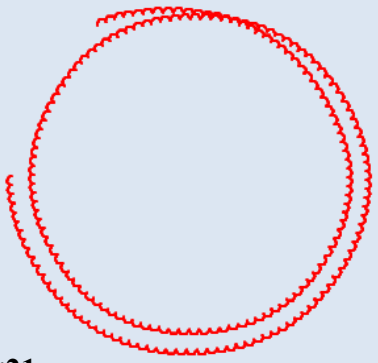
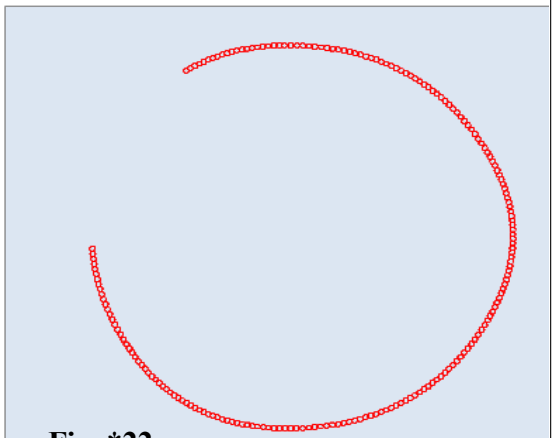


Fig.*21



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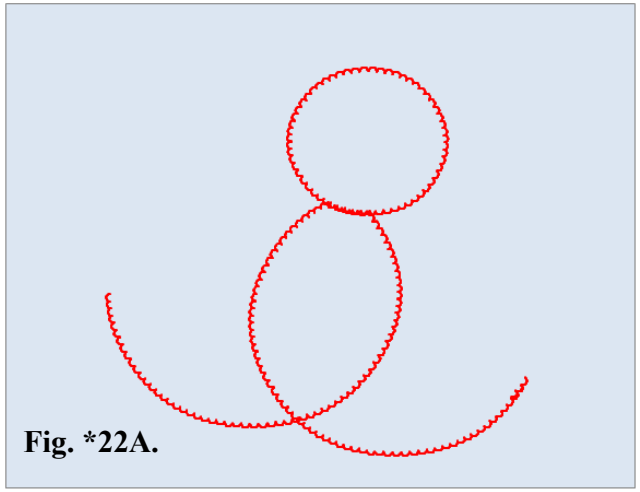

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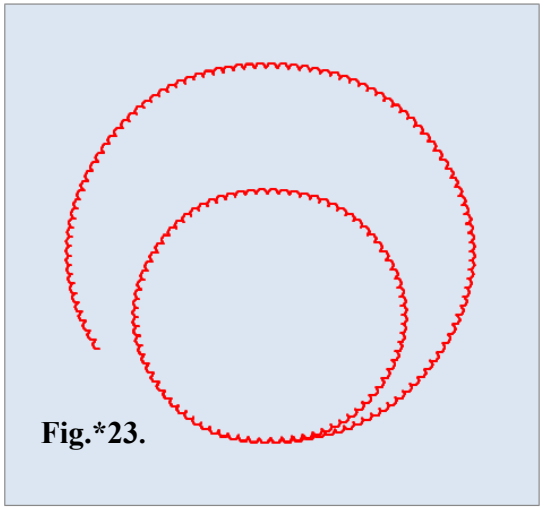

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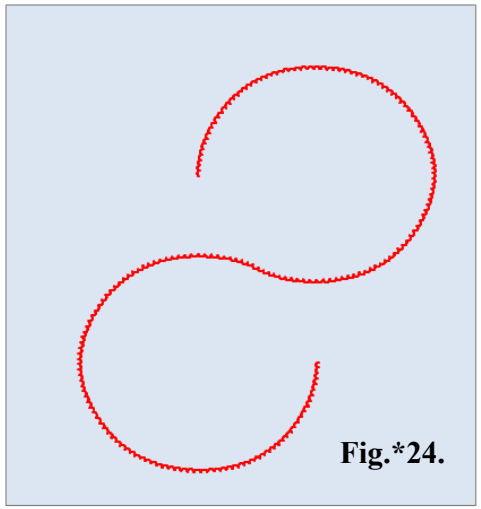


Fig.*24.

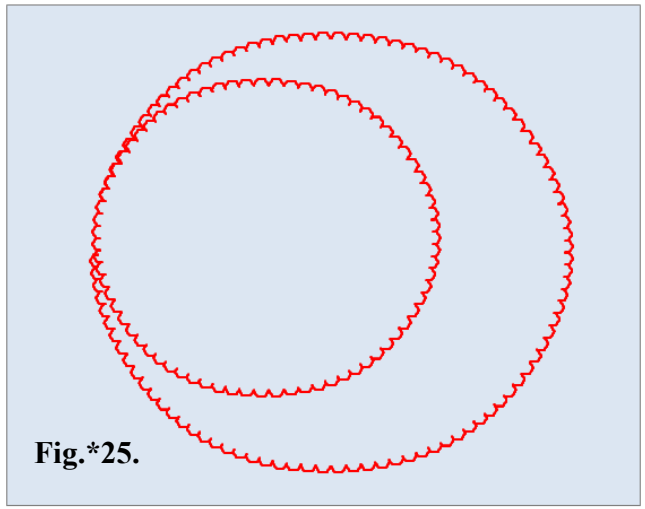


Fig.*25.

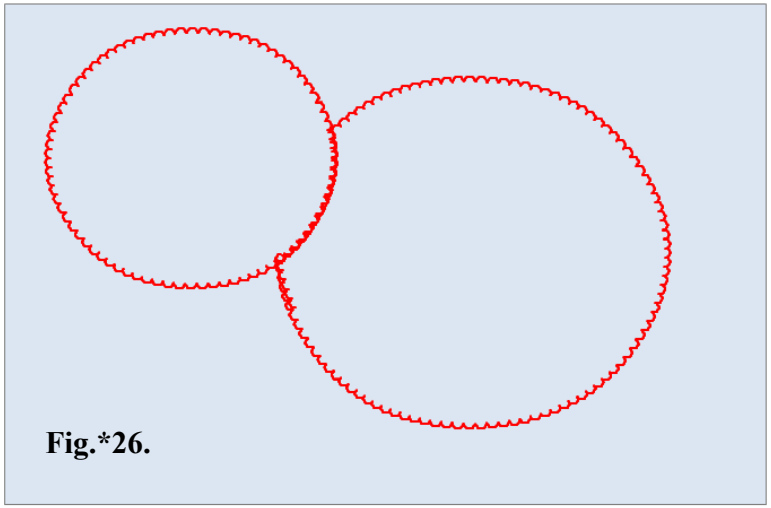


Fig.*26.

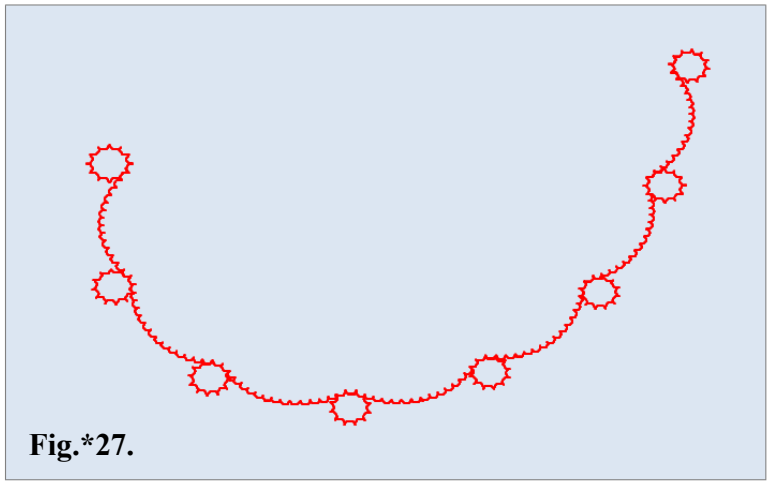
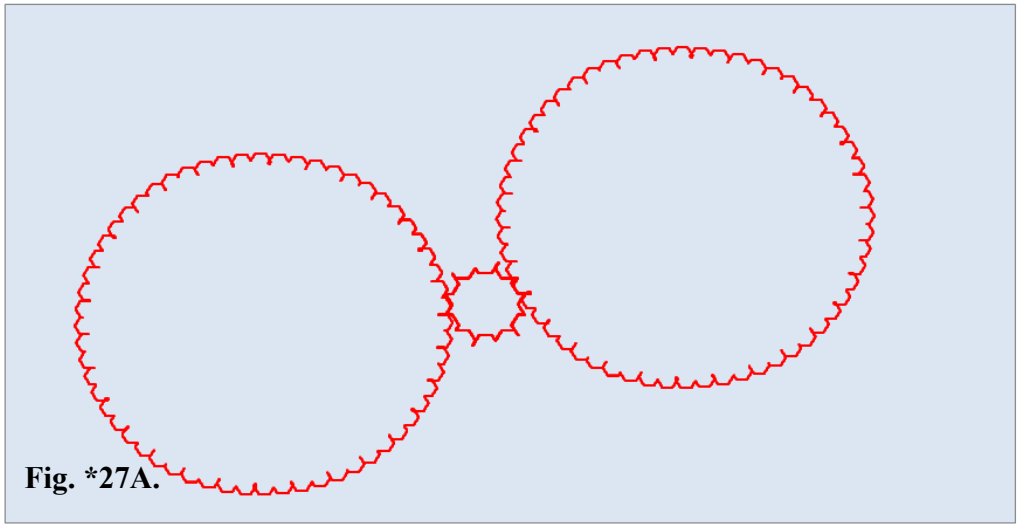


Fig.*27.



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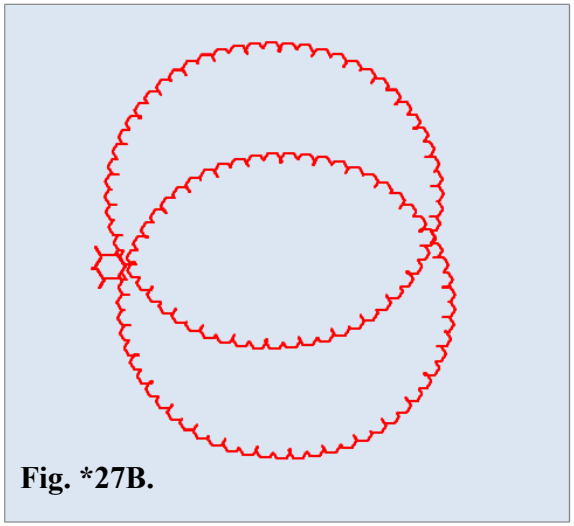


Fig. *27B.

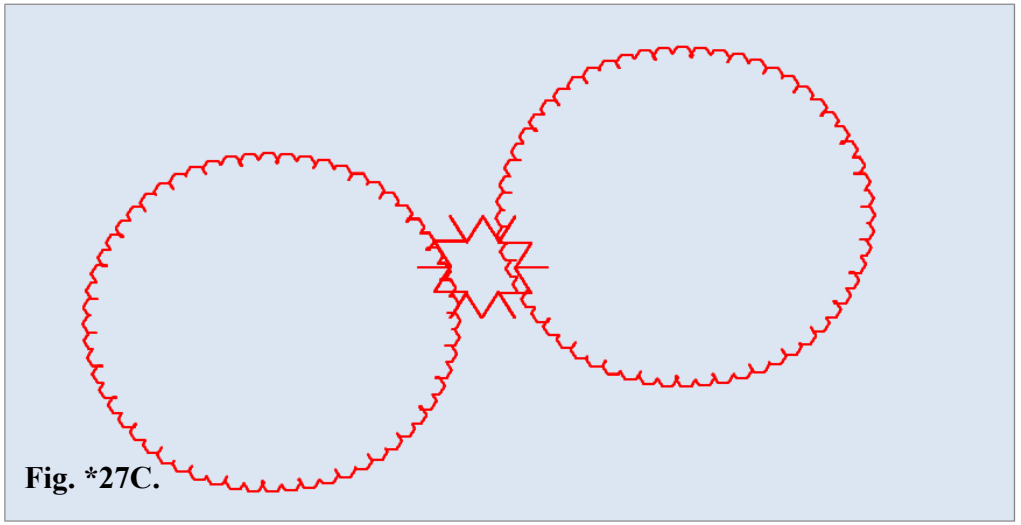


Fig. *27C.

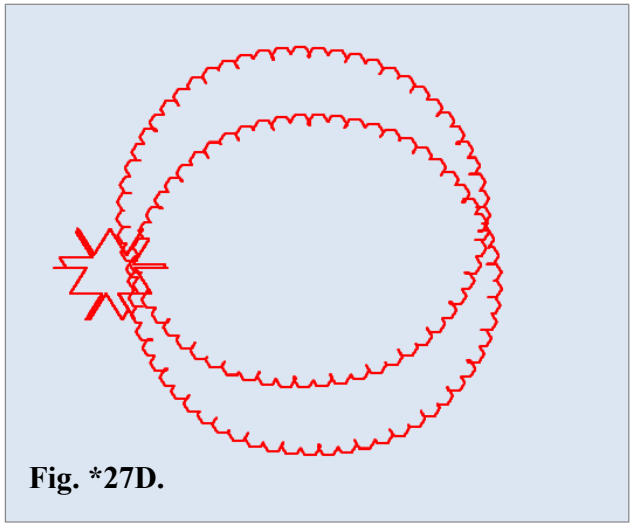


Fig. *27D.

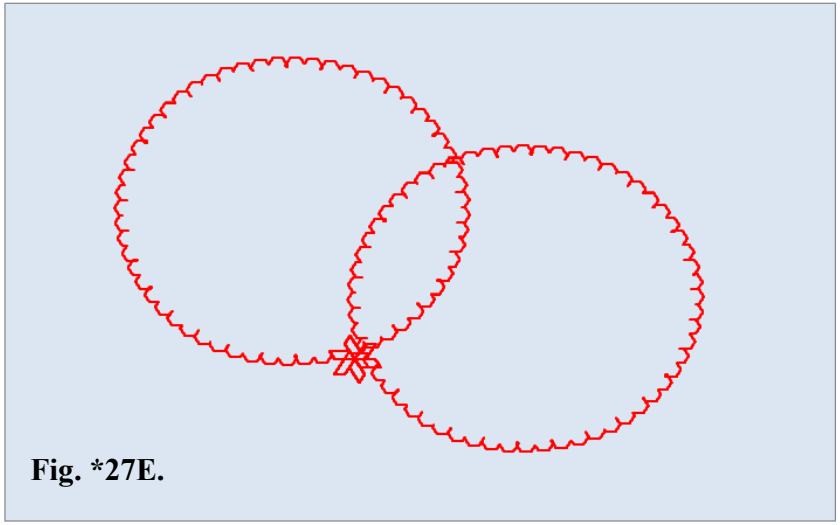


Fig. *27E.

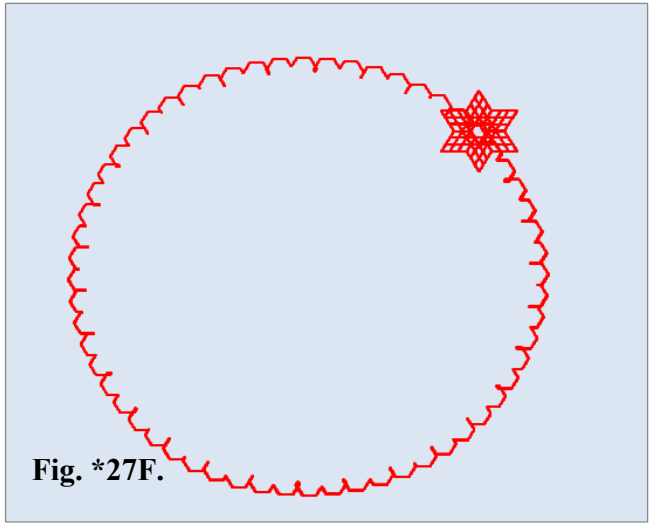


Fig. *27F.

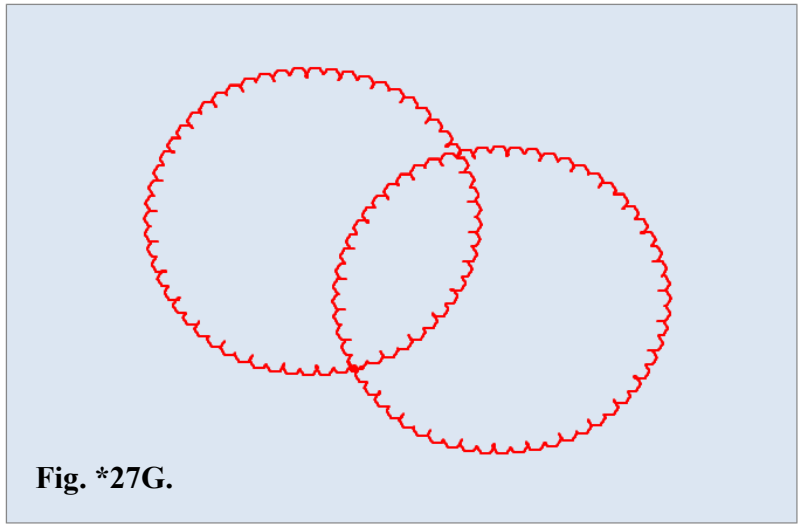


Fig. *27G.

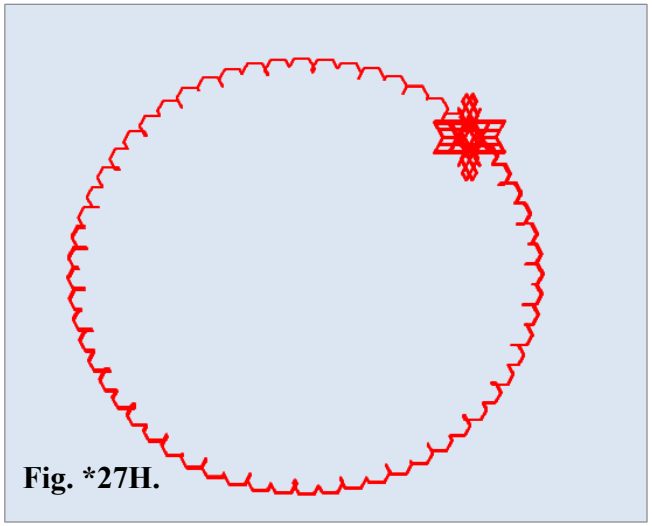


Fig. *27H.

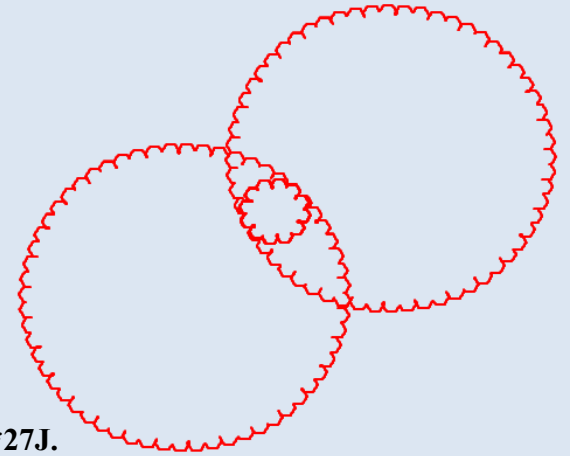


Fig. *27J.

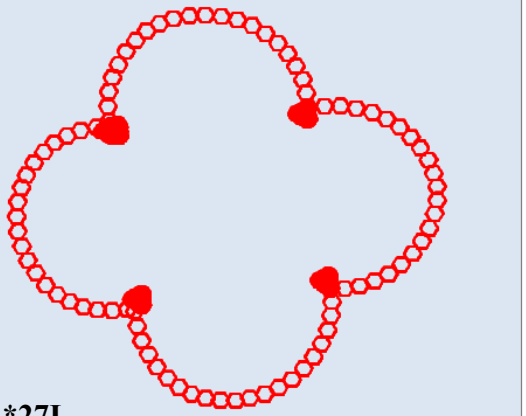


Fig. *27I.

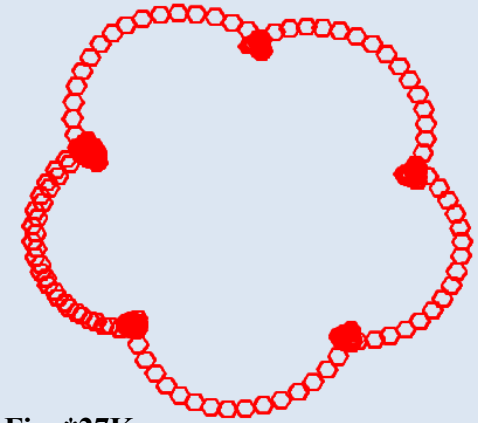


Fig. *27K.

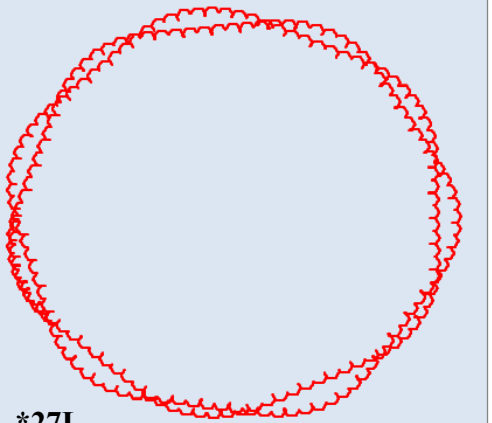


Fig. *27L.

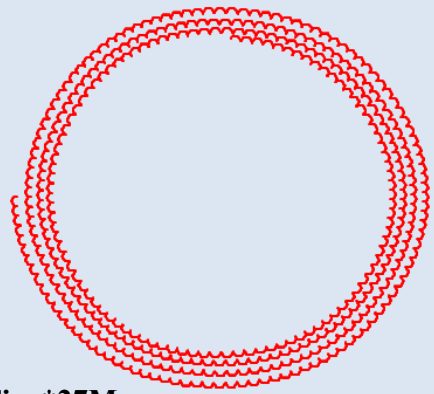


Fig. *27M.

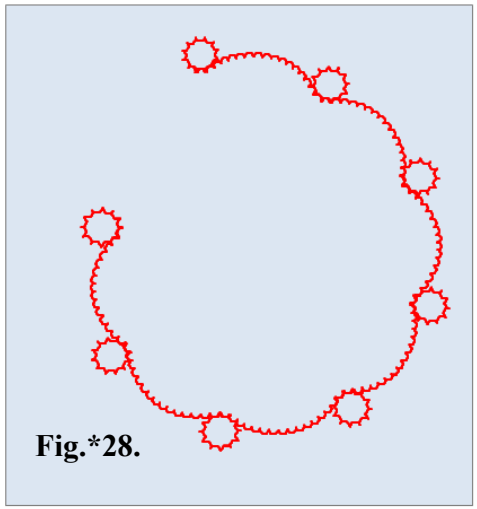


Fig.*28.

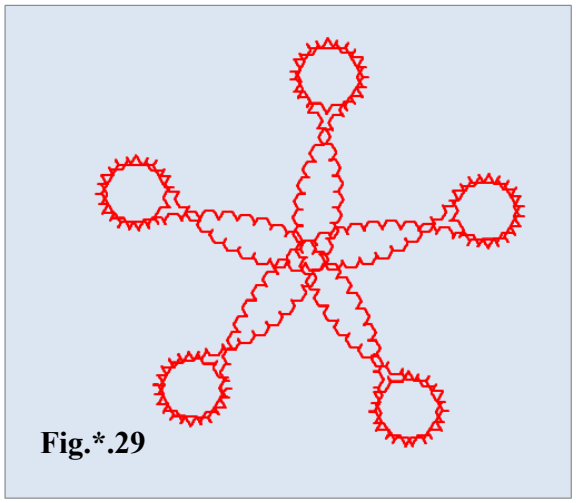


Fig.*.29

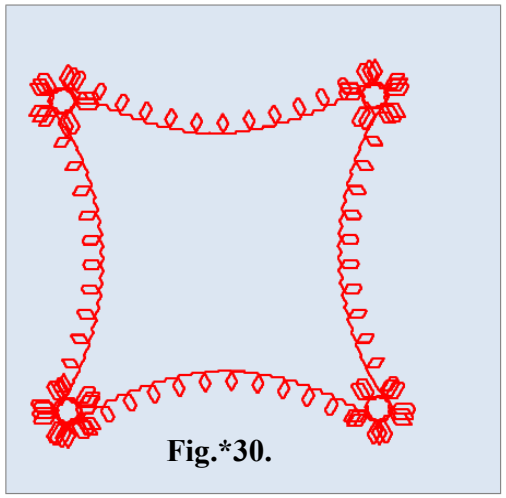


Fig.*30.

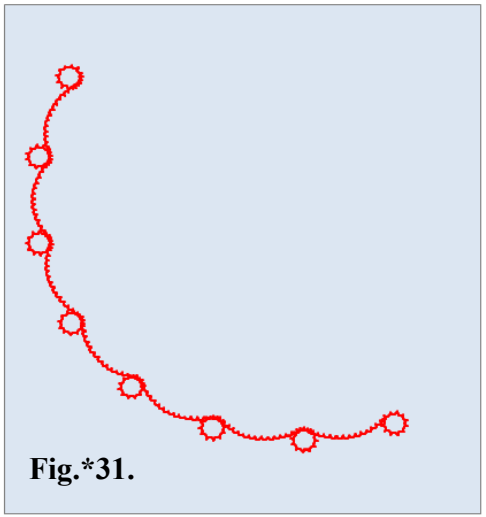


Fig.*31.

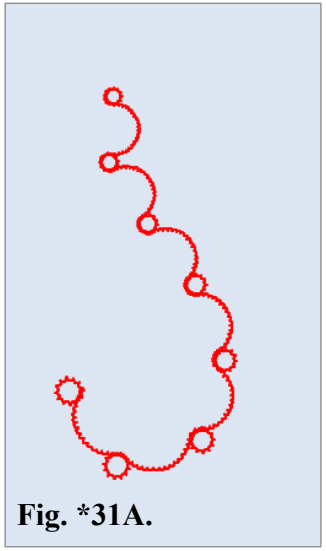
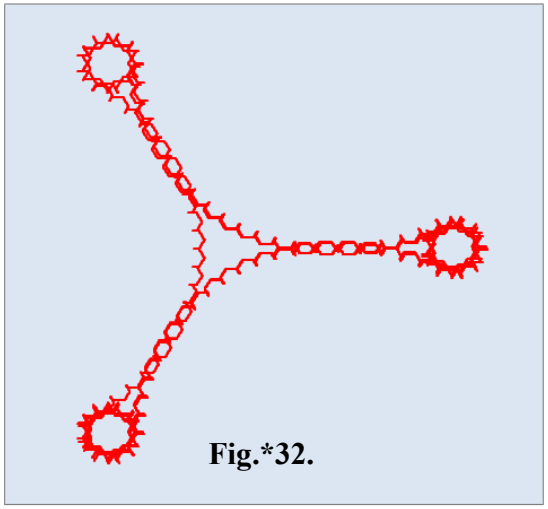


Fig. *31A.



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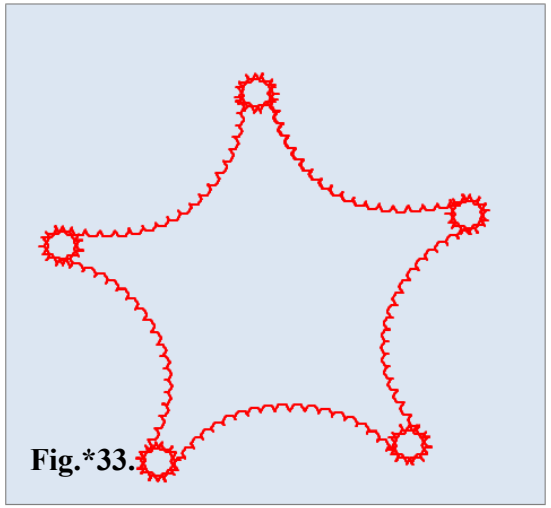


Fig.*33.

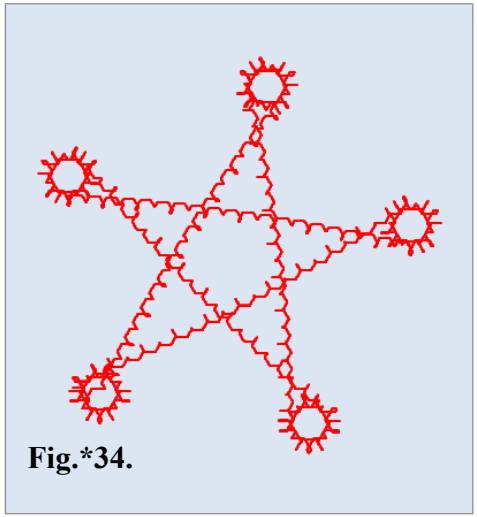
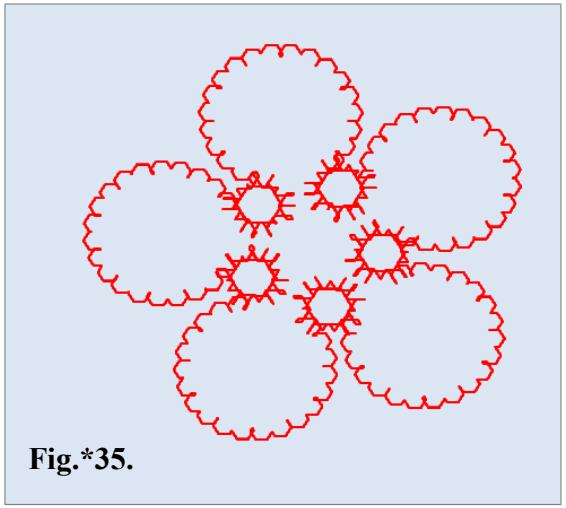


Fig.*34.



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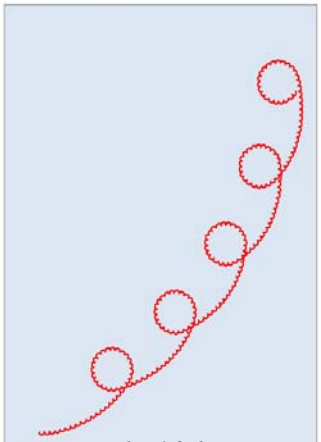


Fig.*36.

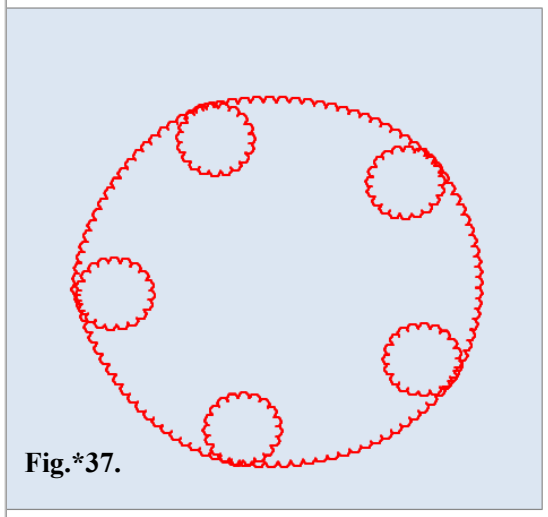


Fig.*37.

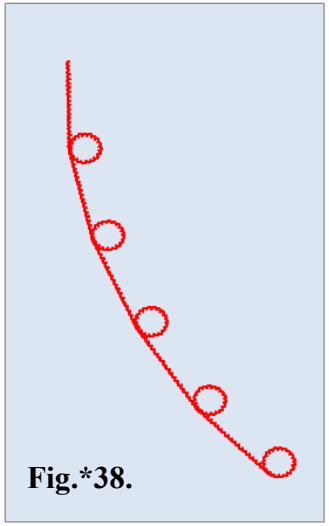
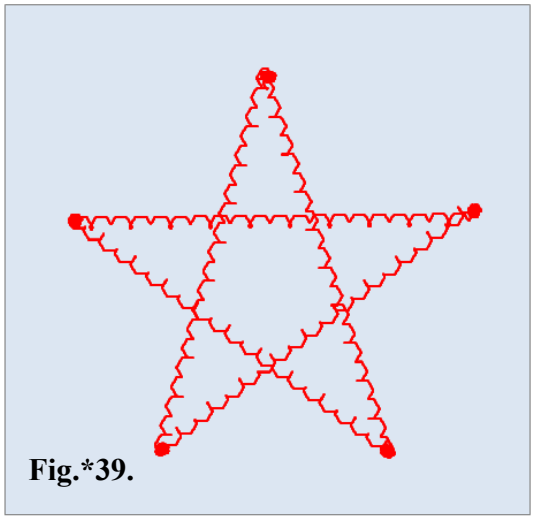


Fig.*38.



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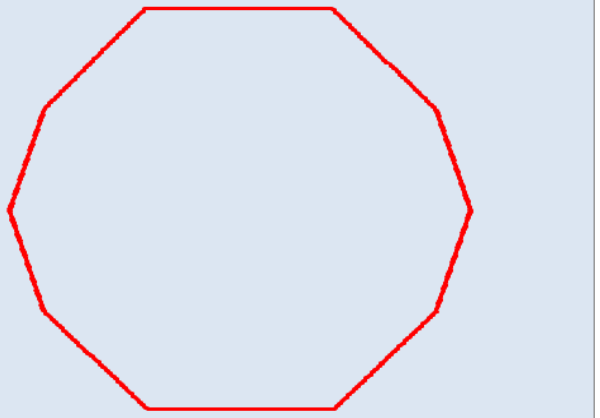

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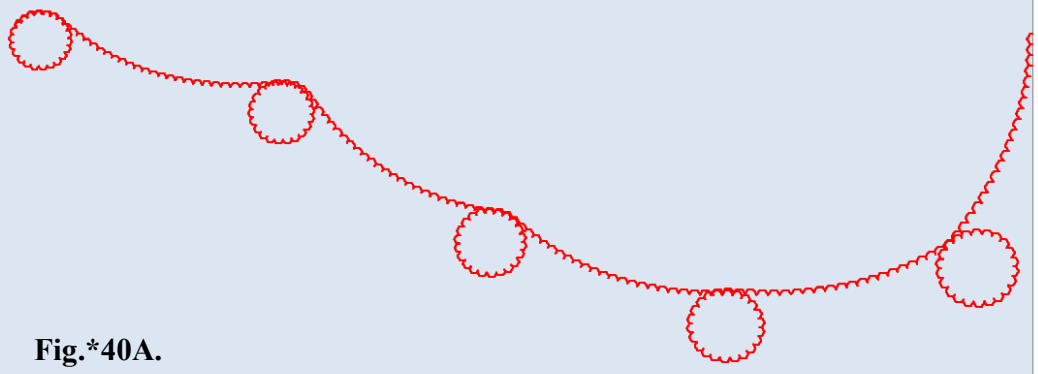
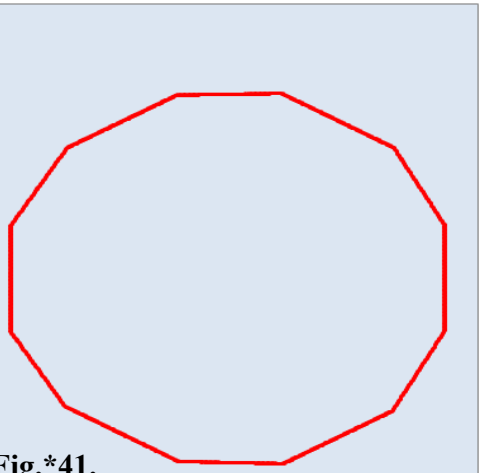


Fig.*40A.



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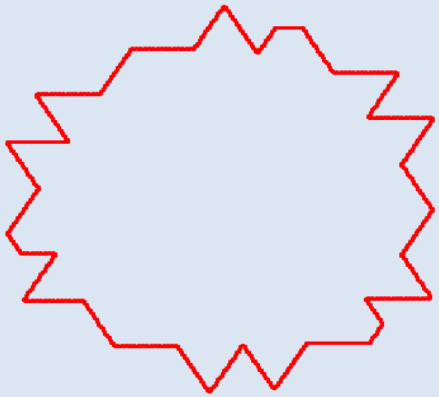

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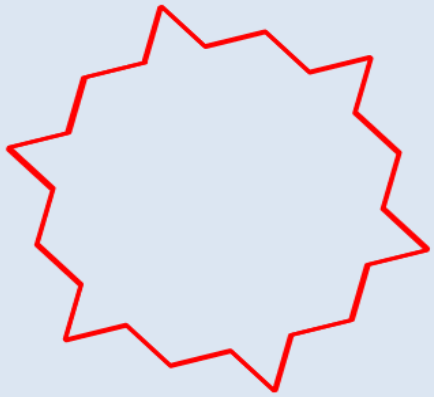

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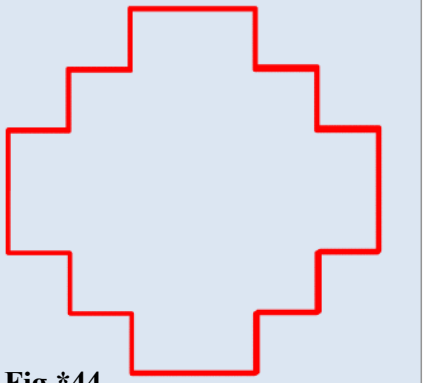


Fig.*44.

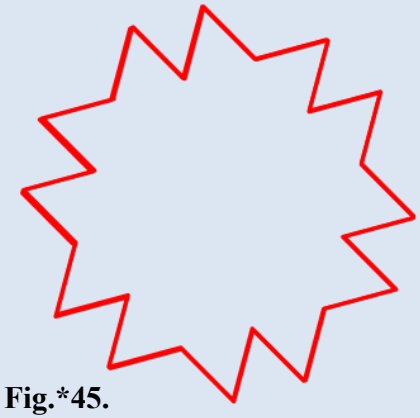


Fig.*45.

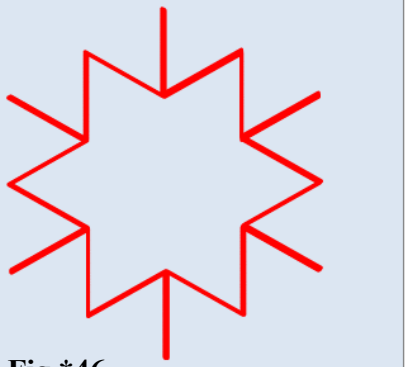


Fig.*46.

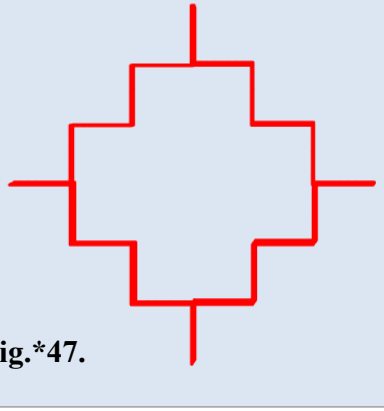


Fig.*47.

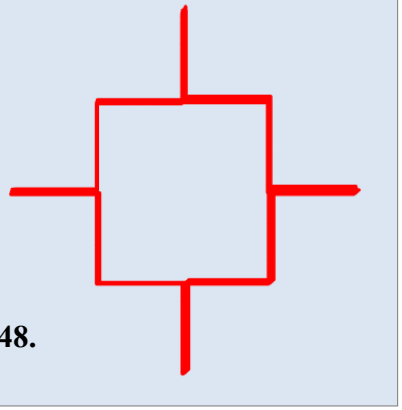


Fig.*48.

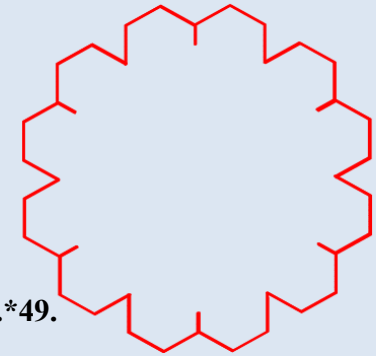


Fig.*49.

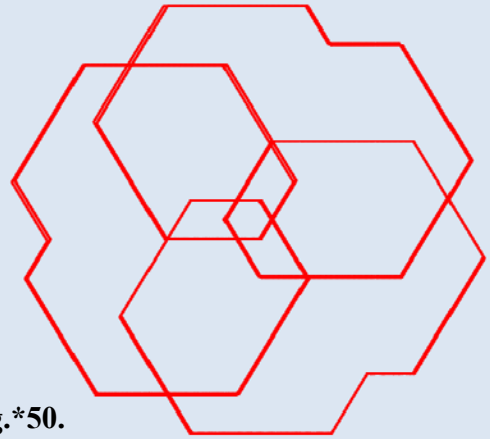


Fig.*50.

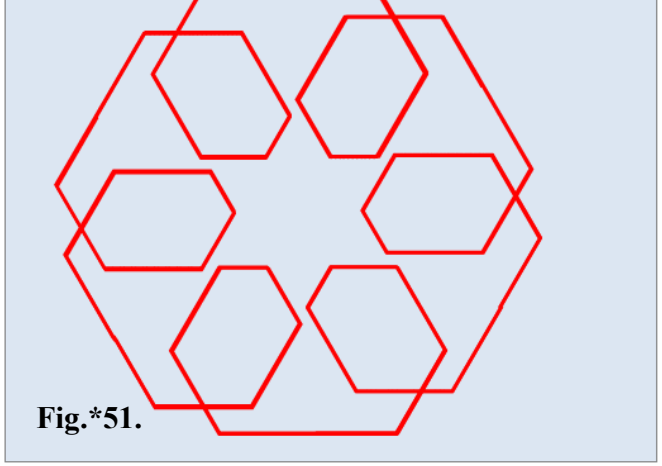


Fig.*51.

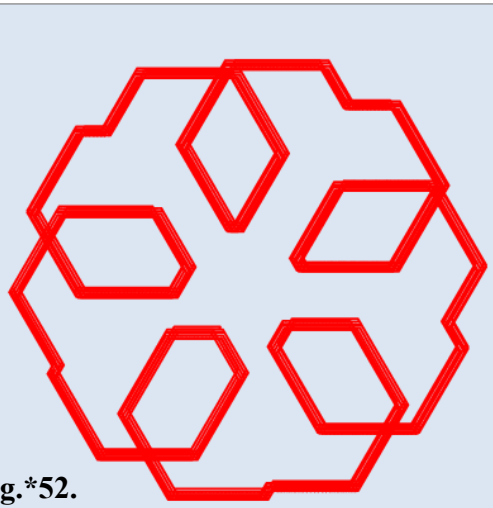


Fig.*52.

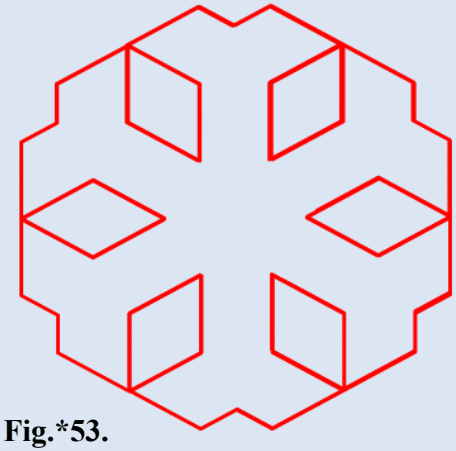


Fig.*53.

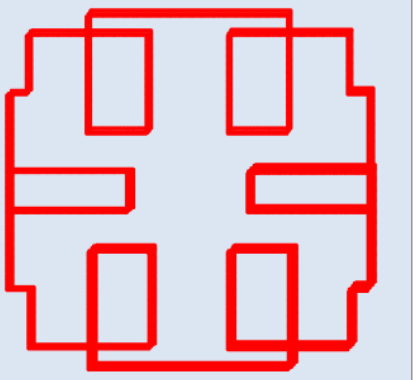


Fig.*54.

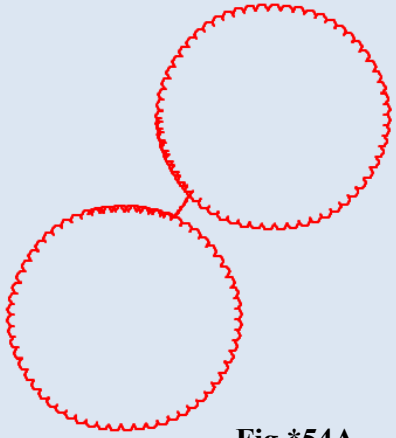


Fig.*54A.

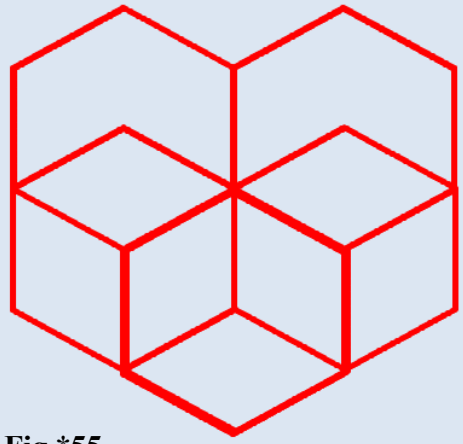


Fig.*55.

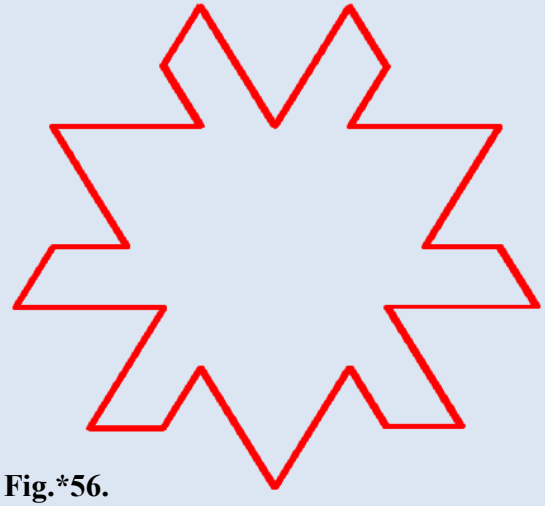


Fig.*56.

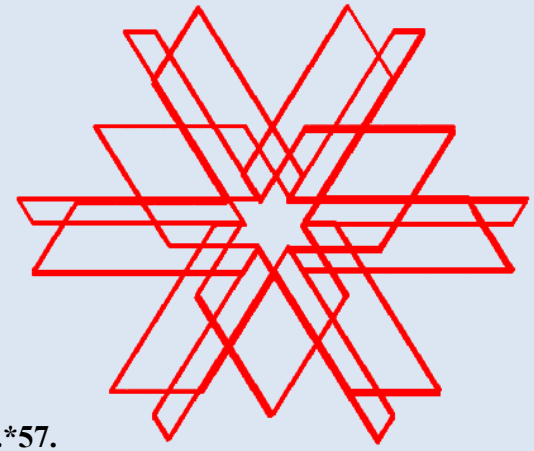


Fig.*57.

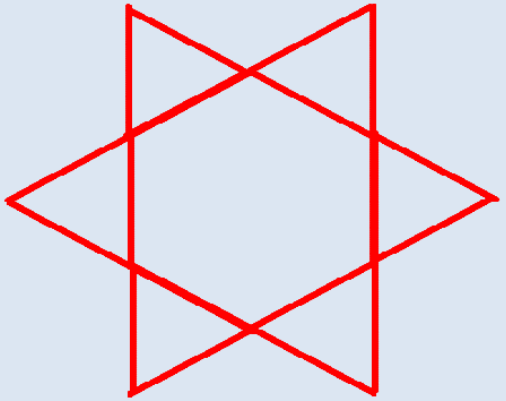


Fig.*58.

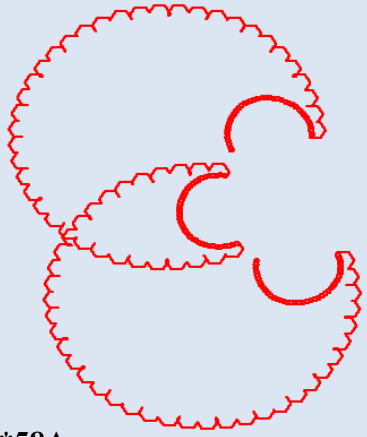


Fig.*58A.

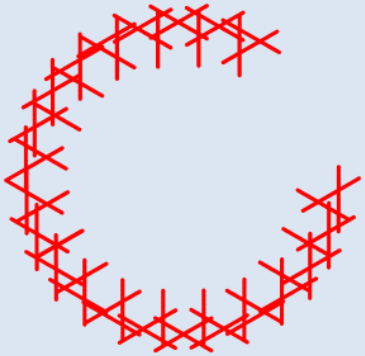


Fig.*59.

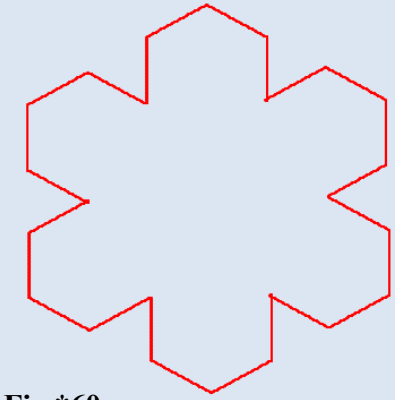


Fig.*60.

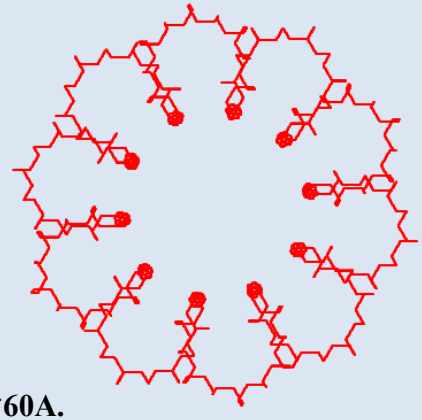


Fig.*60A.

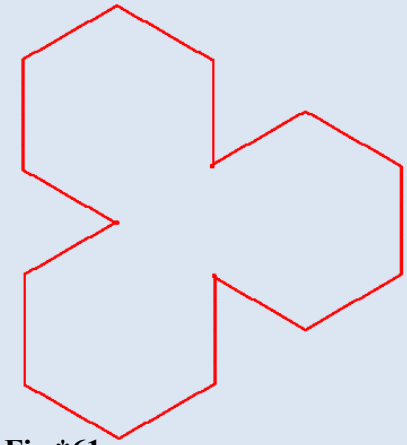


Fig.*61.

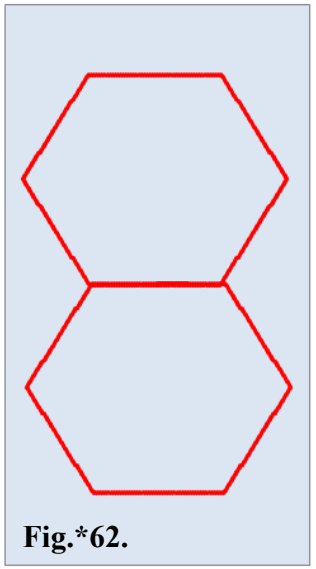


Fig.*62.

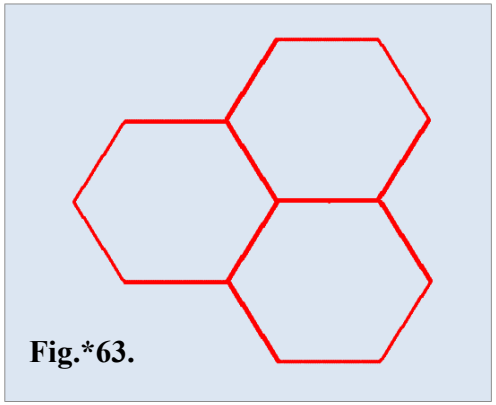


Fig.*63.

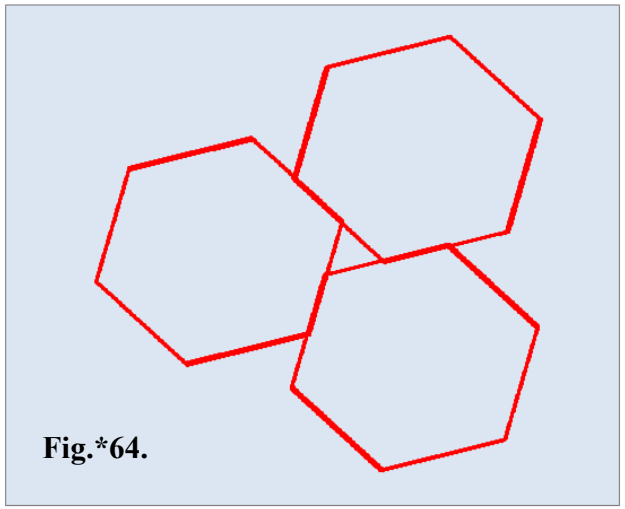


Fig.*64.

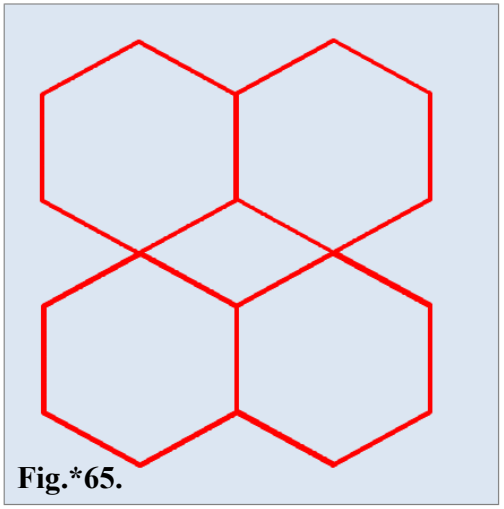


Fig.*65.

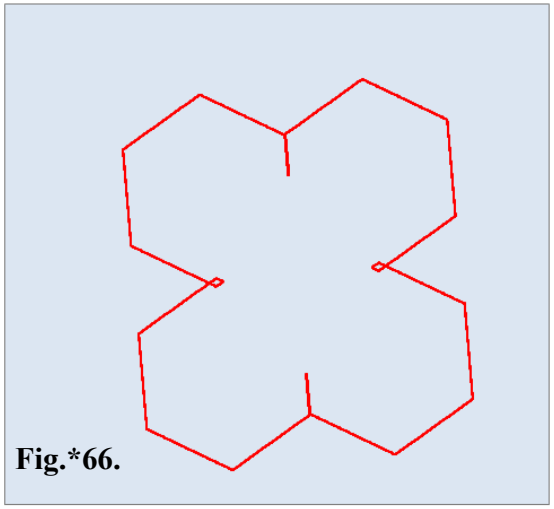


Fig.*66.

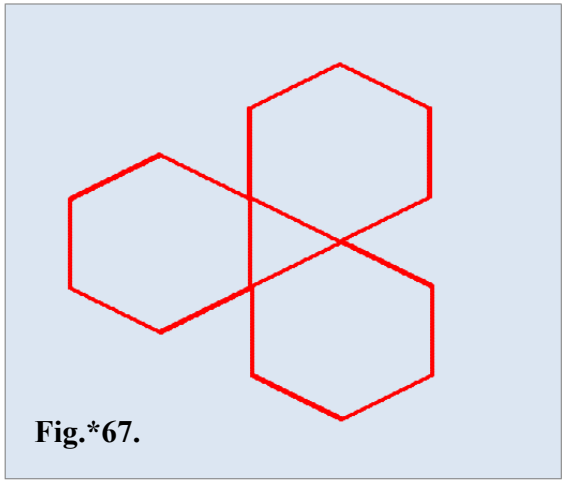


Fig.*67.

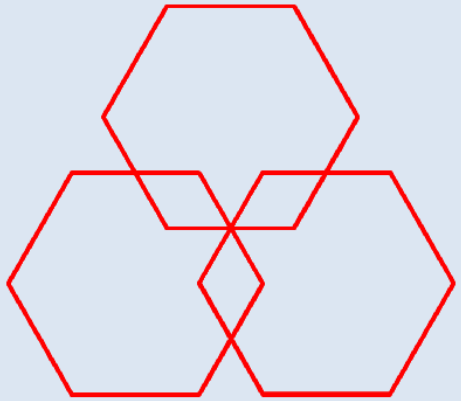


Fig.*68.

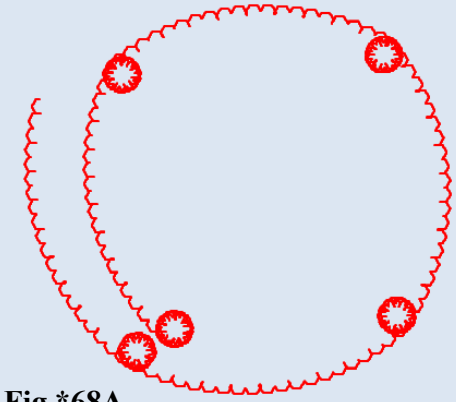


Fig.*68A.

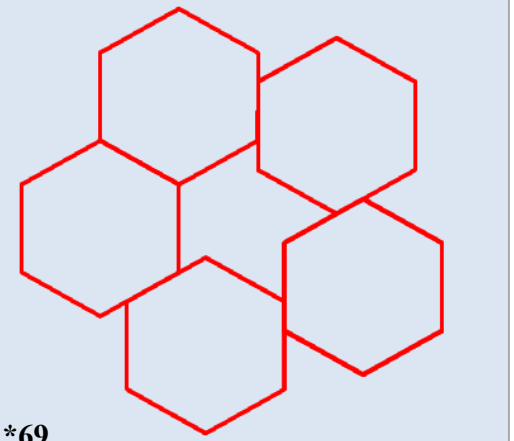


Fig.*69.

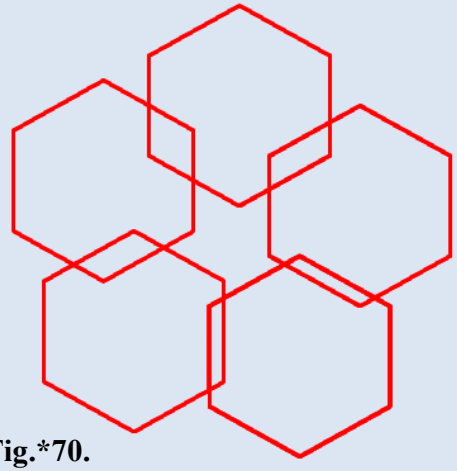


Fig.*70.

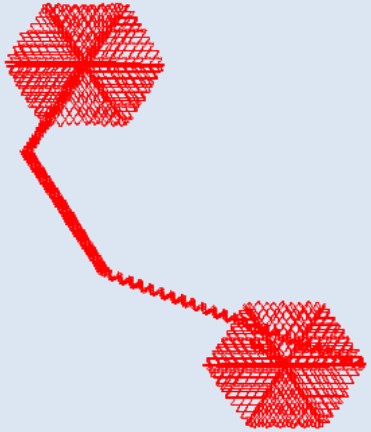


Fig.*70A.

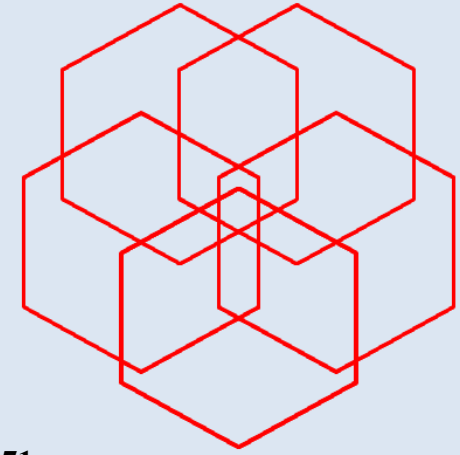


Fig.*71.

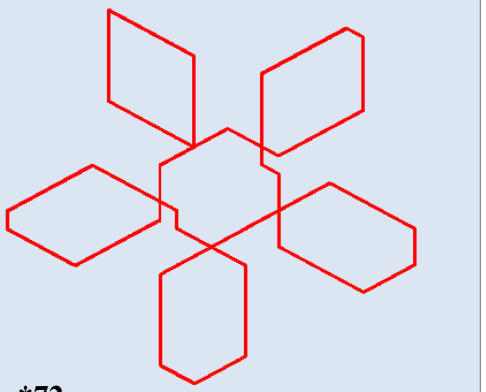


Fig.*72.

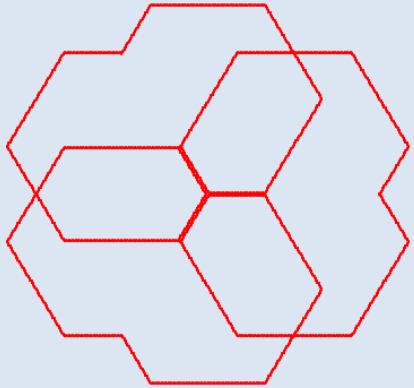


Fig.*73.

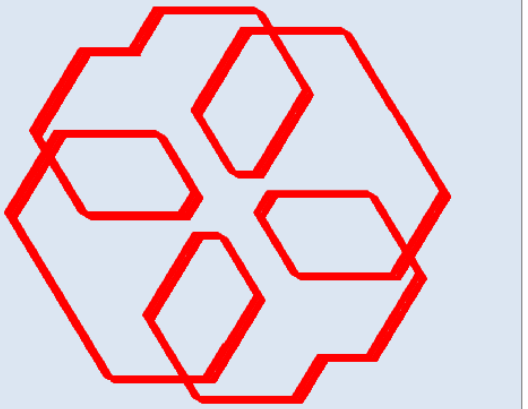


Fig.*74.

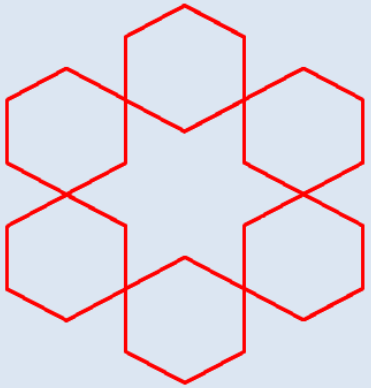


Fig.*75.

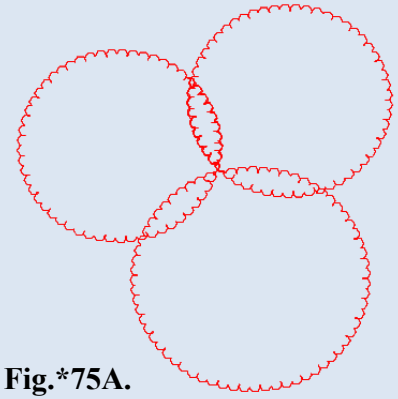


Fig.*75A.

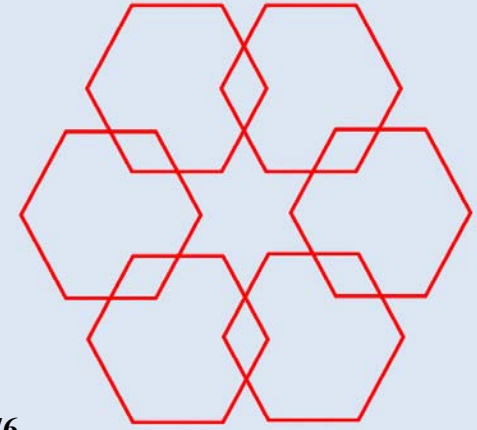


Fig.*76.

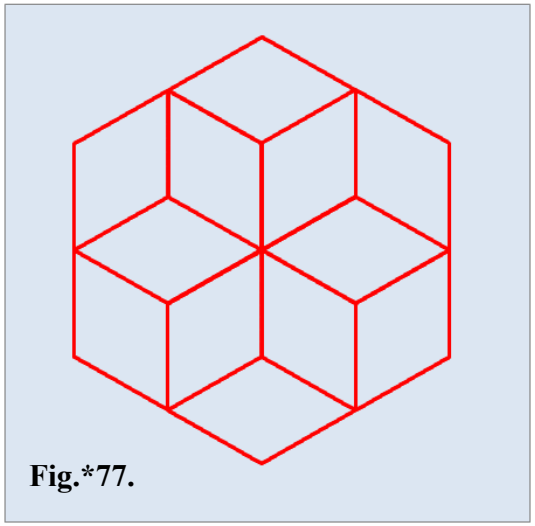


Fig.*77.

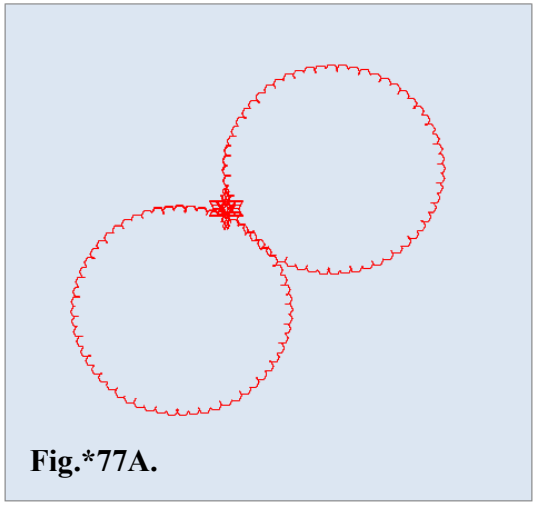


Fig.*77A.

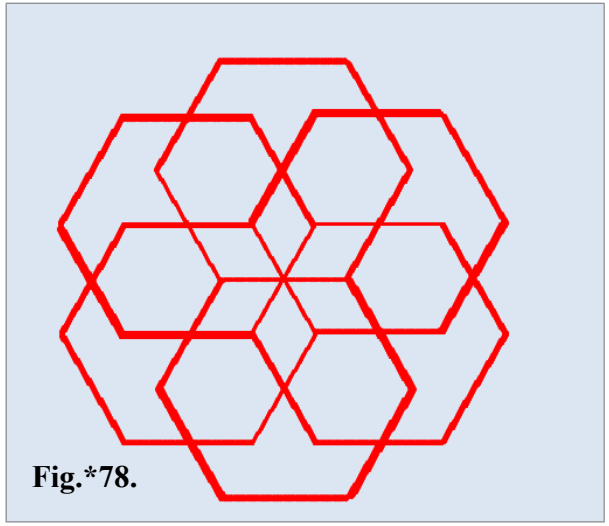


Fig.*78.

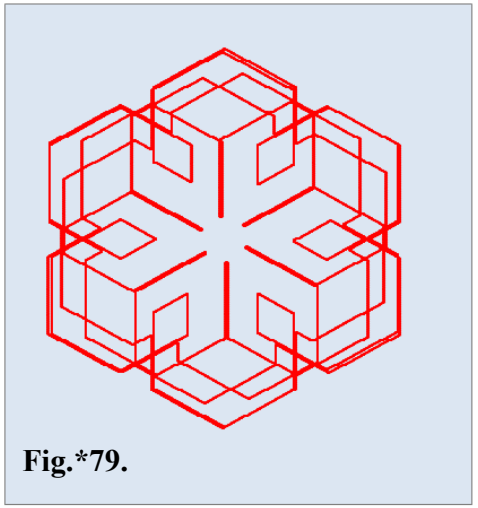


Fig.*79.

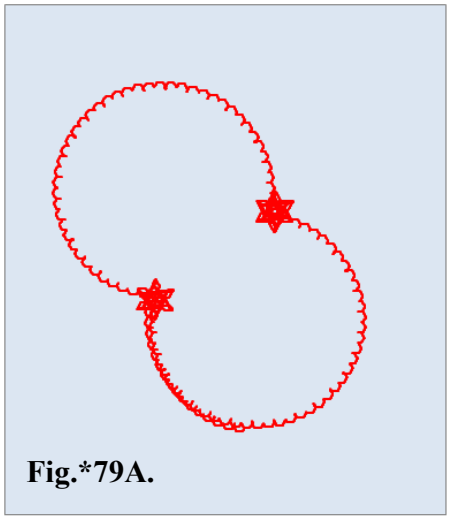


Fig.*79A.

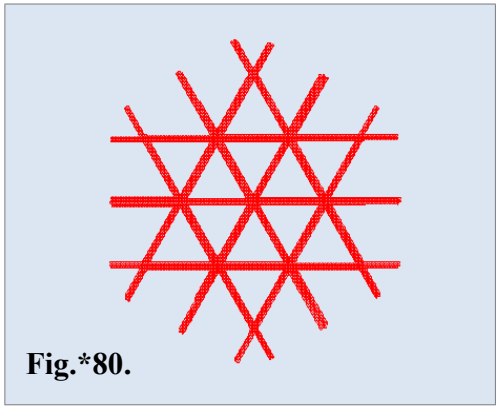


Fig.*80.

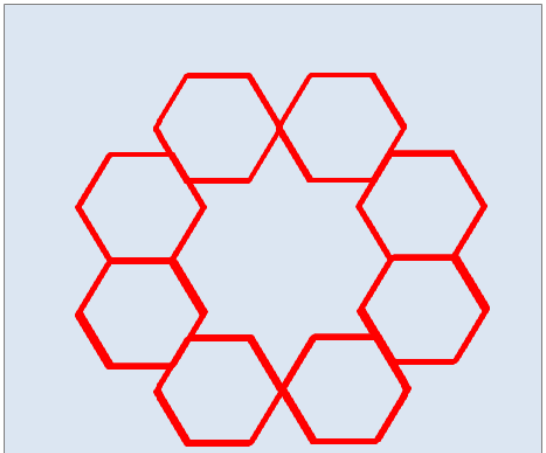


Fig.*81.

Fig.*82A.

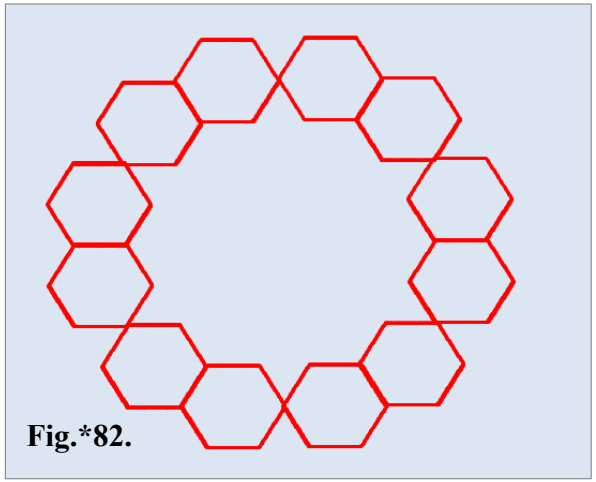


Fig.*82.

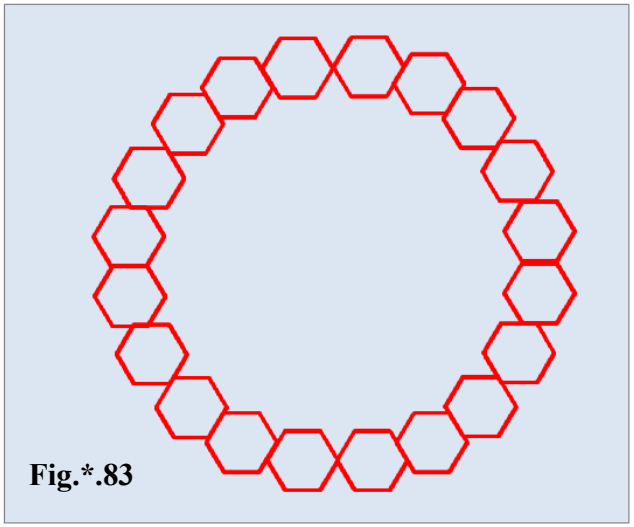


Fig.*.83

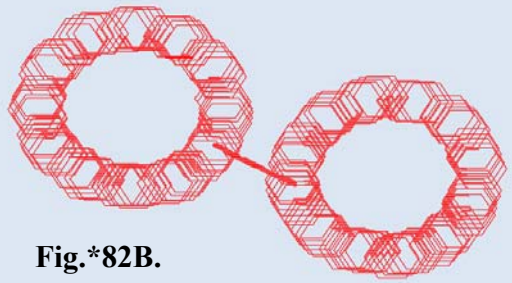


Fig.*82B.

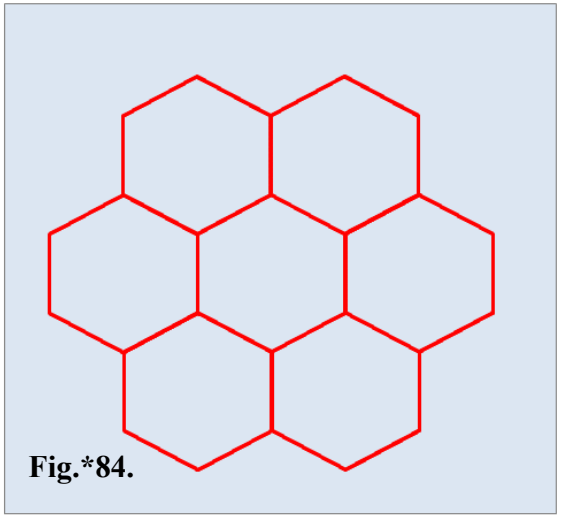


Fig.*84.

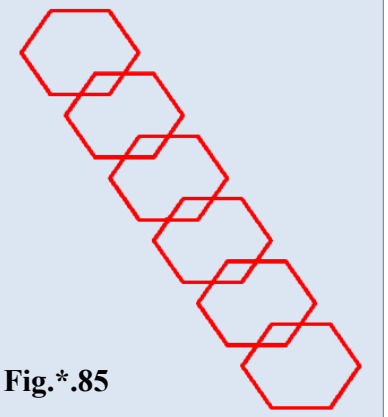


Fig.*.85

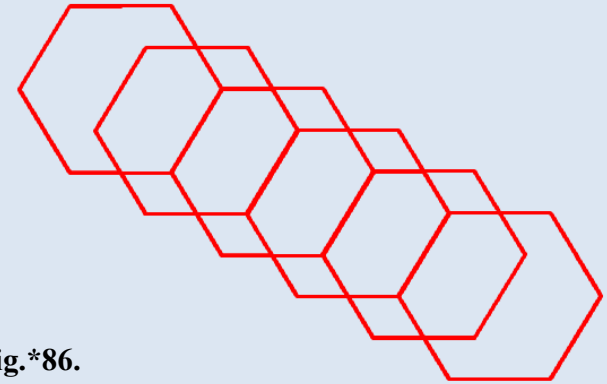


Fig.*86.

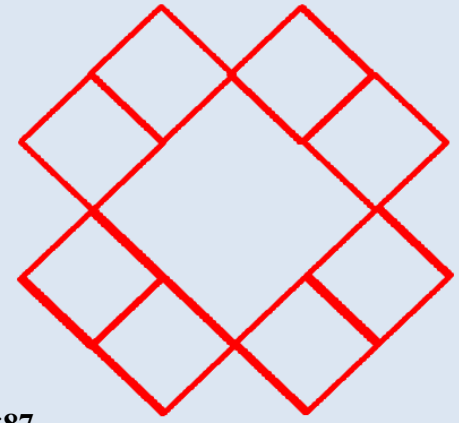


Fig.*87.

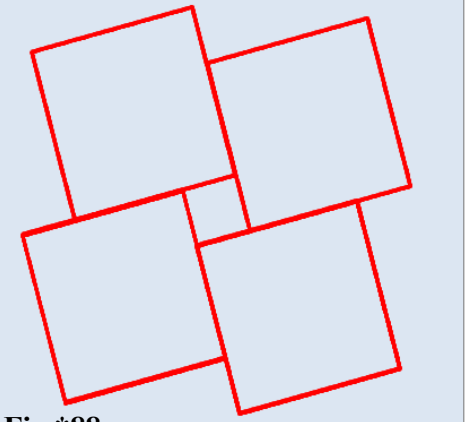


Fig.*88.

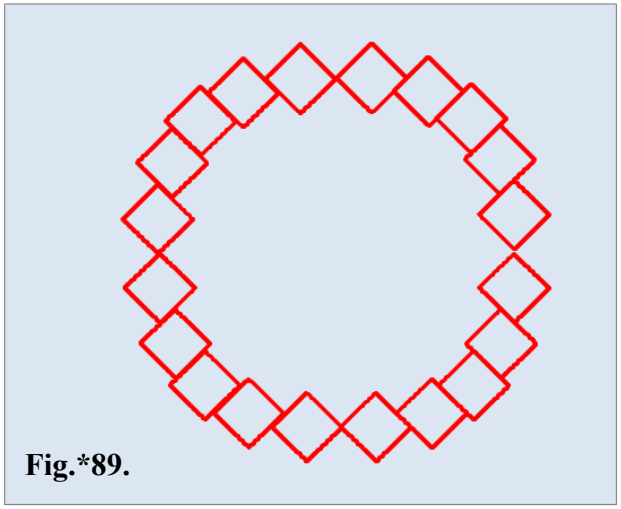


Fig.*89.

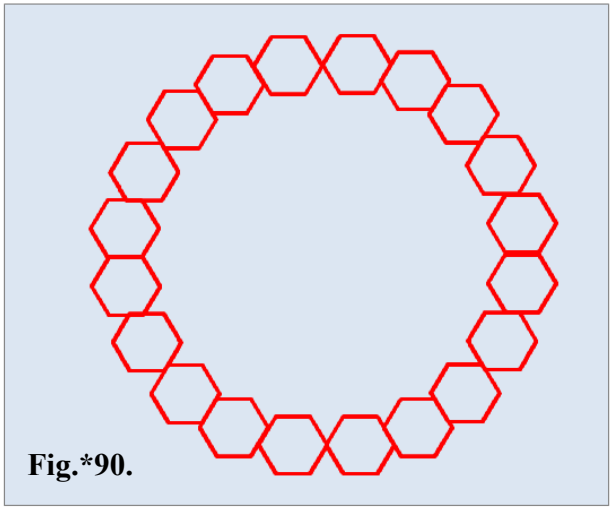


Fig.*90.

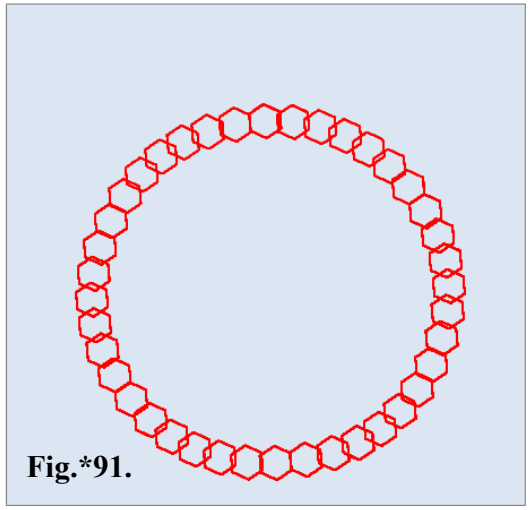


Fig.*91.

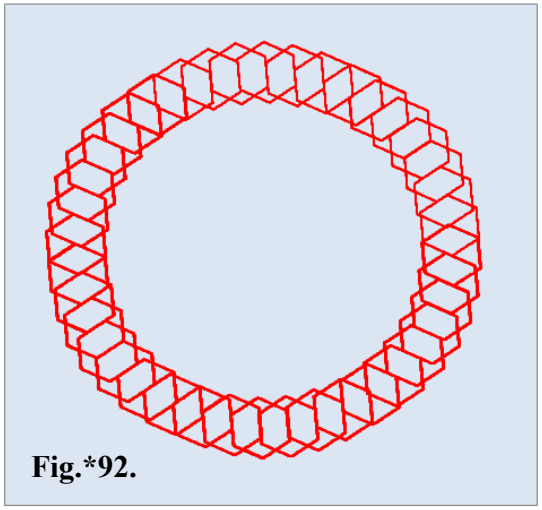


Fig.*92.

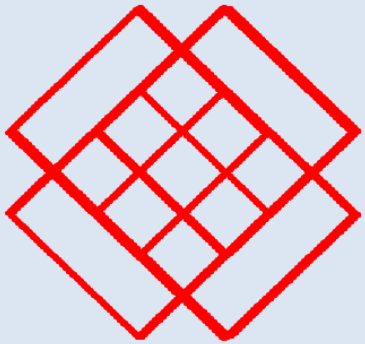


Fig.*93.

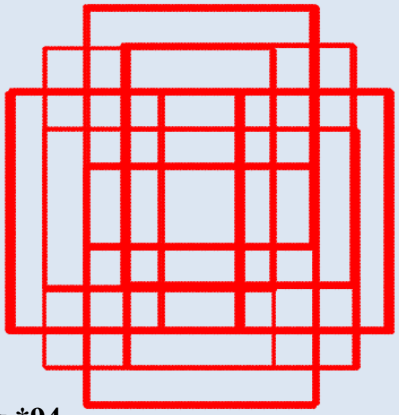


Fig.*94.

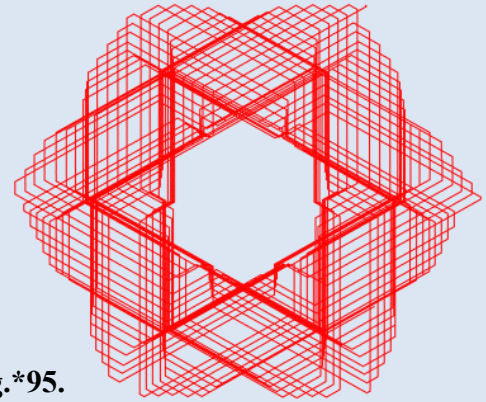


Fig.*95.

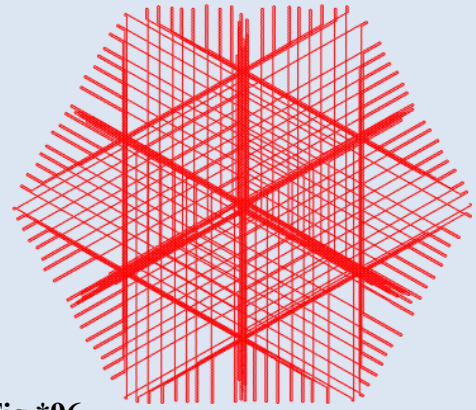


Fig.*96.

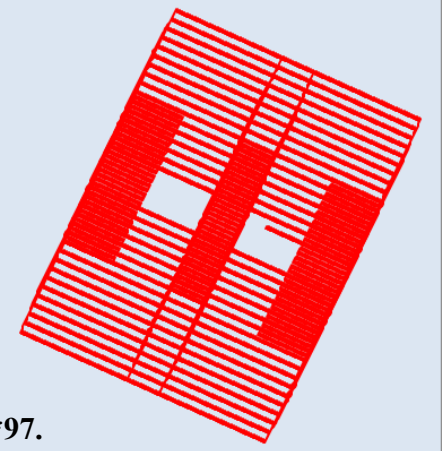


Fig.*97.

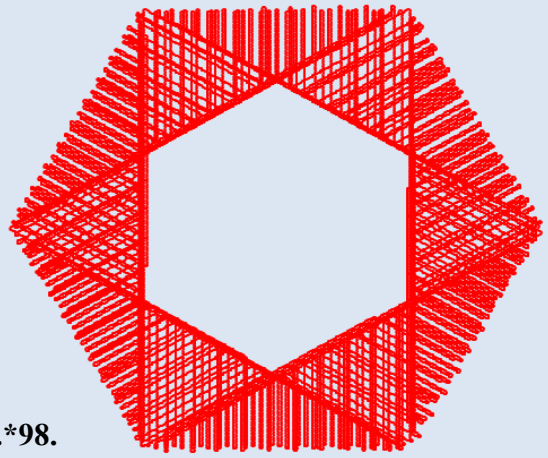


Fig.*98.

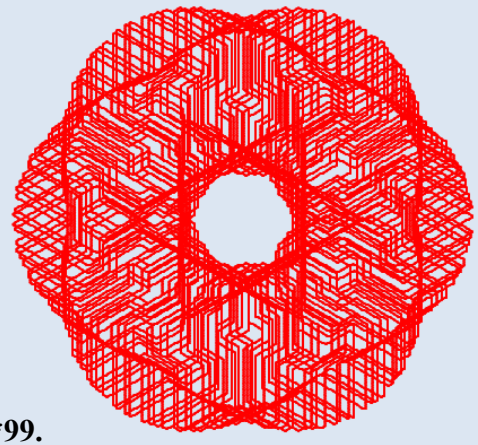


Fig.*99.

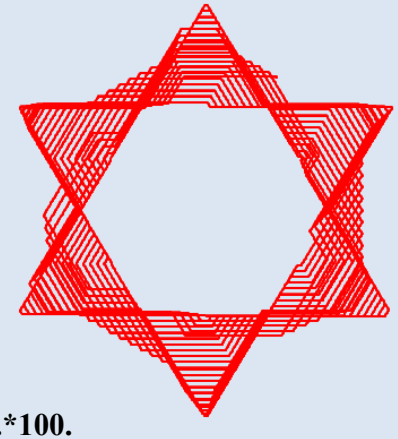


Fig.*100.

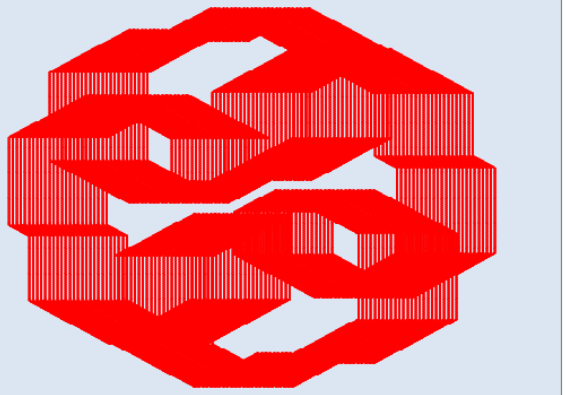


Fig.*101.

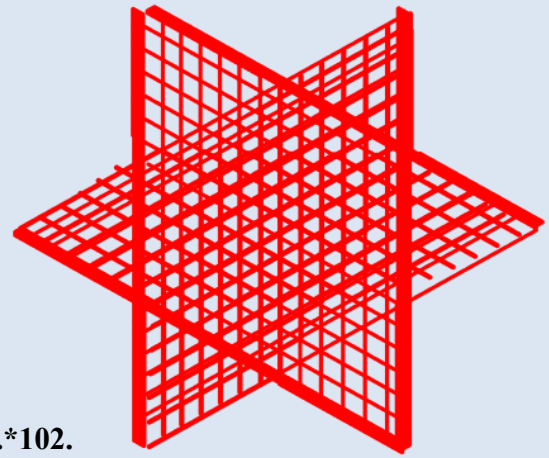


Fig.*102.

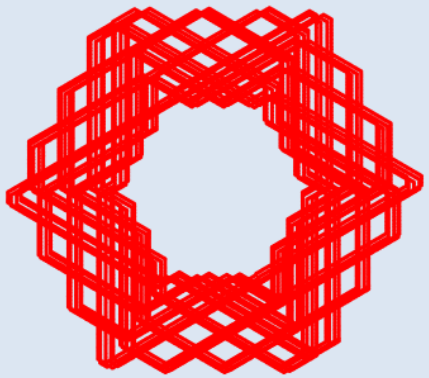


Fig.*103.

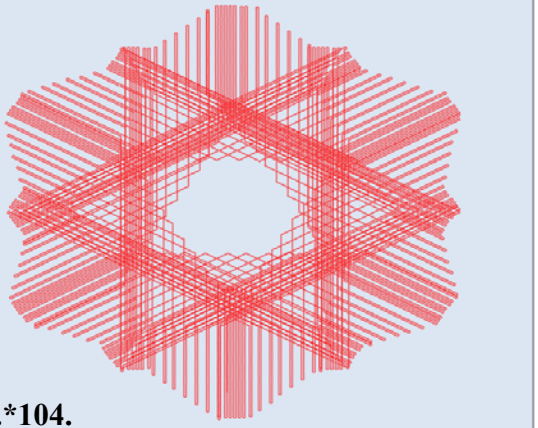


Fig.*104.

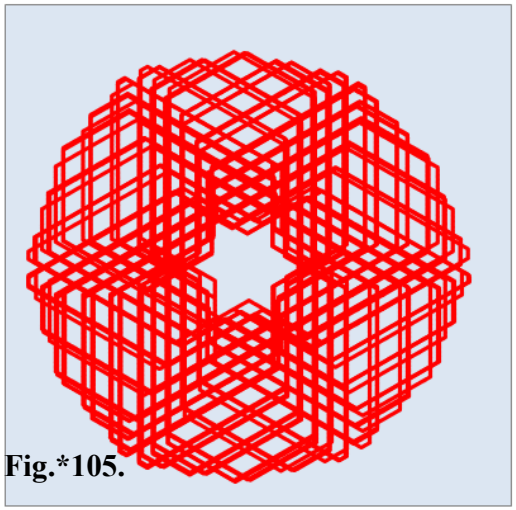


Fig.*105.

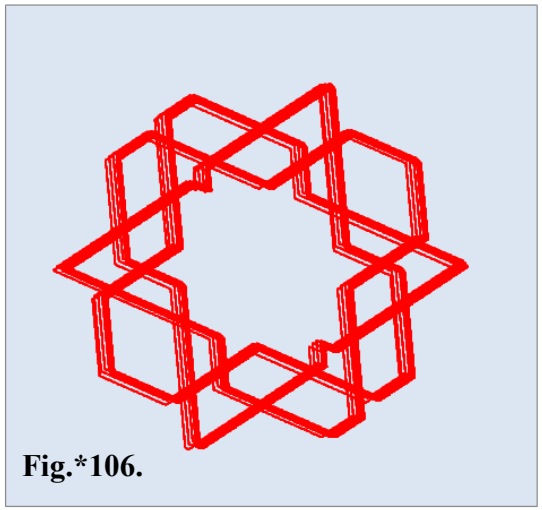


Fig.*106.

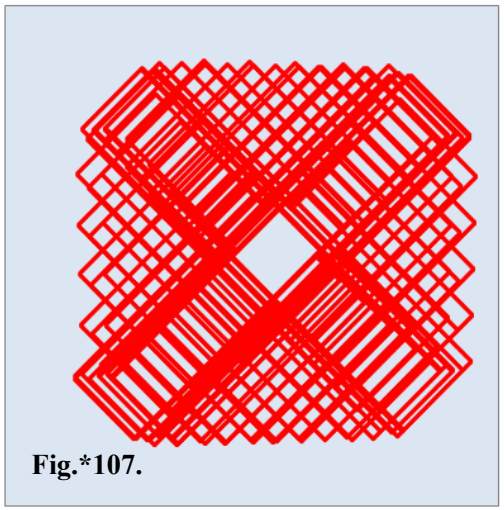


Fig.*107.

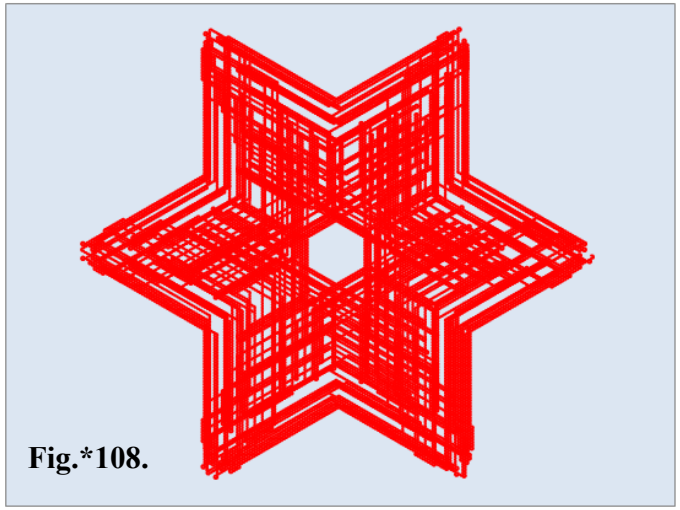


Fig.*108.

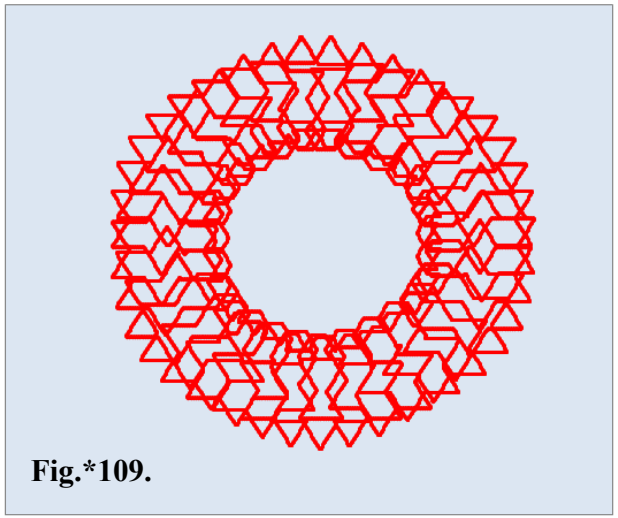


Fig.*109.

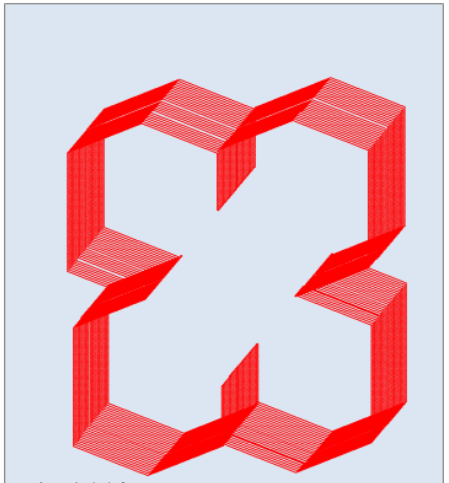


Fig.*110.

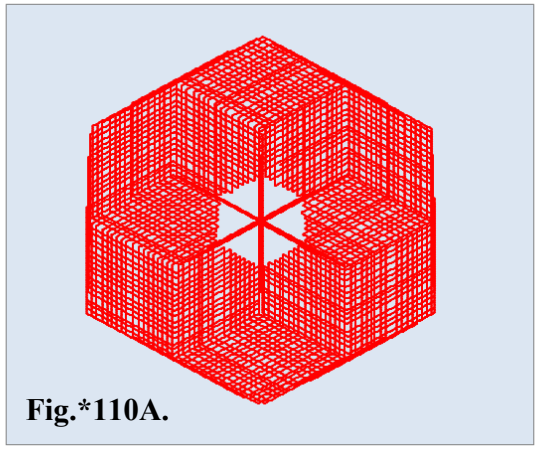


Fig.*110A.

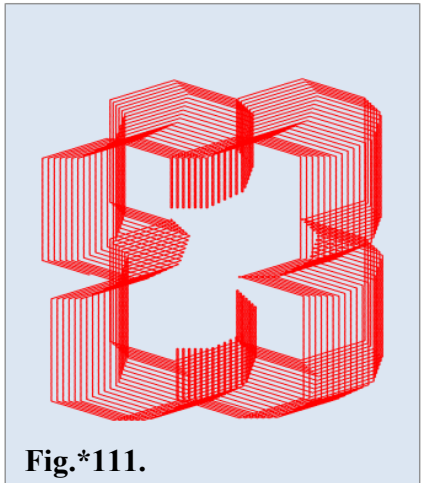


Fig.*111.

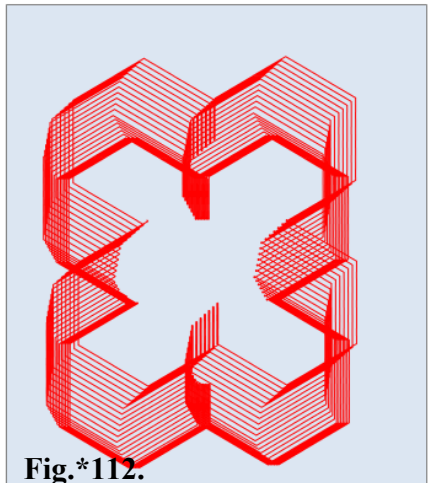


Fig.*112.

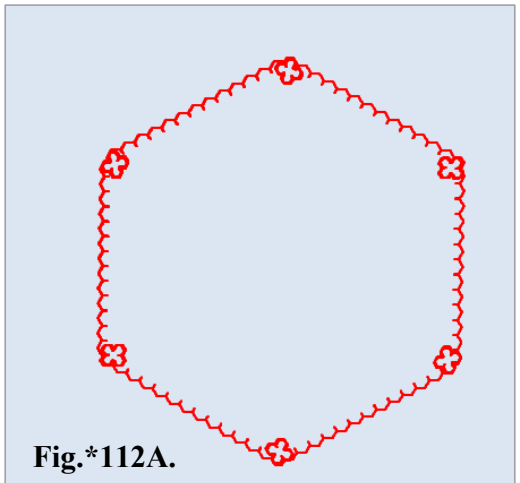


Fig.*112A.

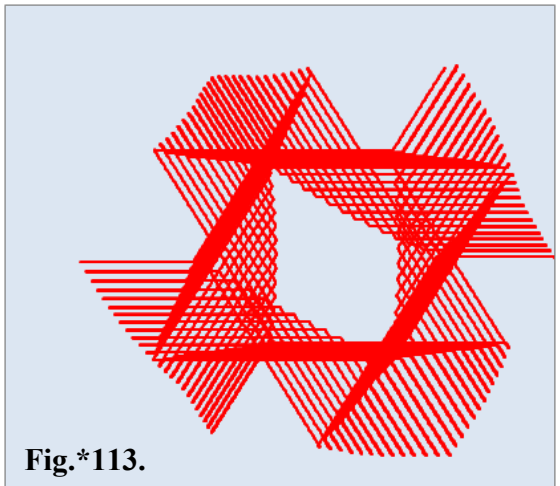


Fig.*113.

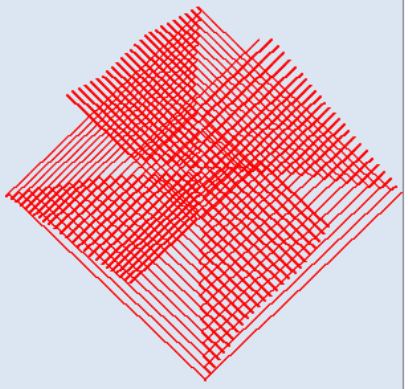


Fig.*114.

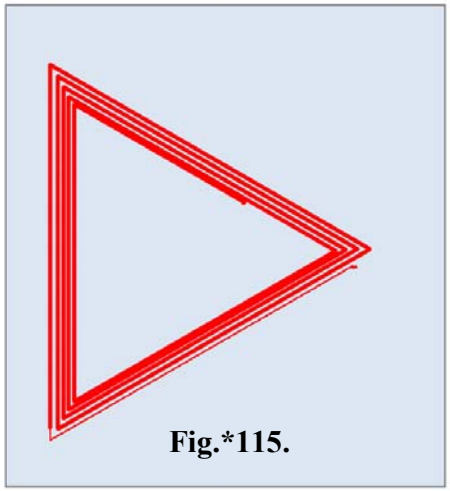


Fig.*115.

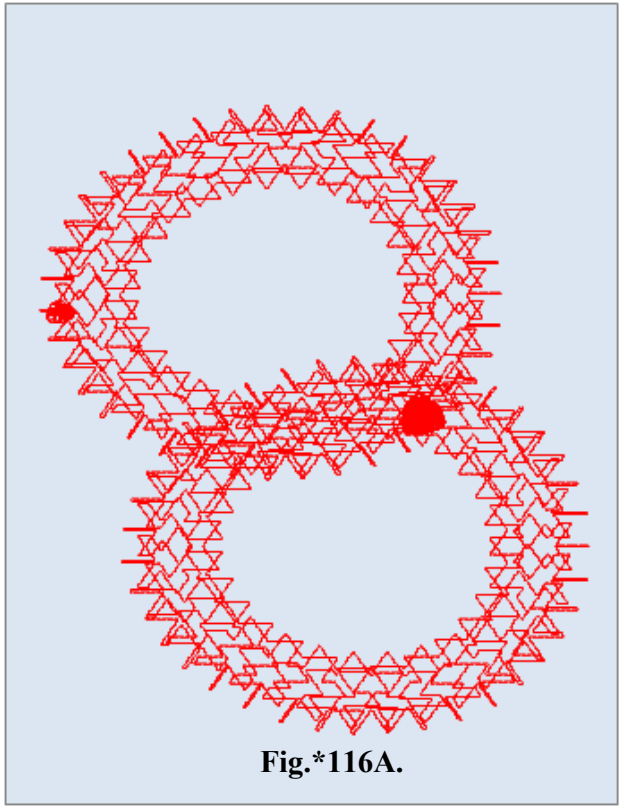


Fig.*116A.

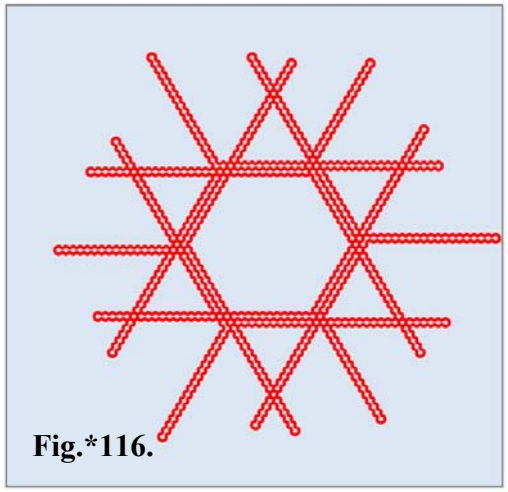


Fig.*116.

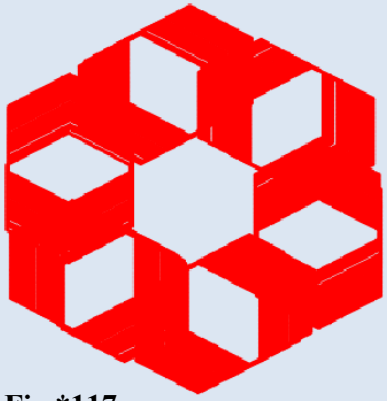


Fig.*117.

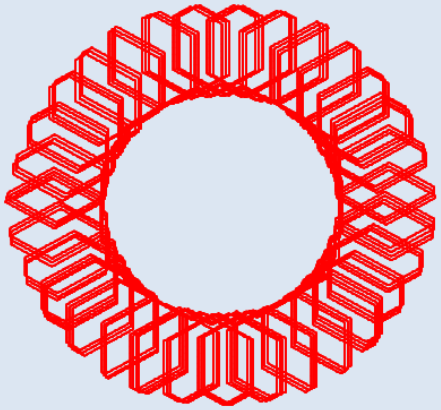


Fig.*118.

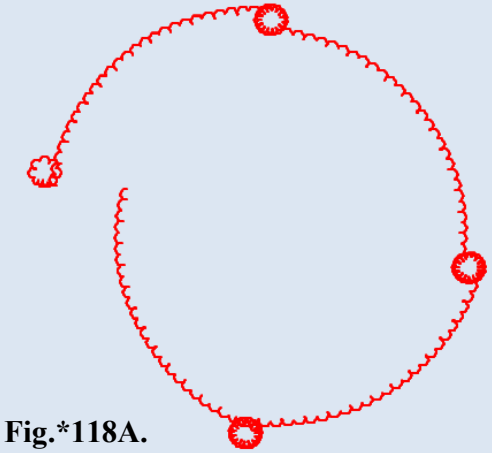


Fig.*118A.

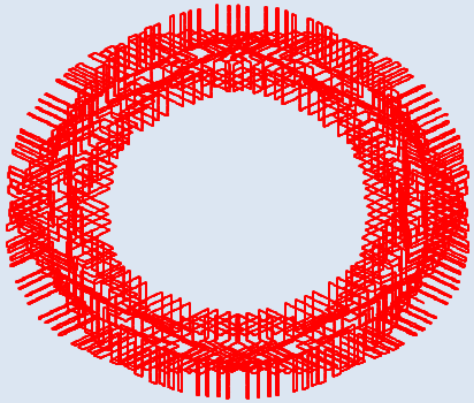


Fig.*119.

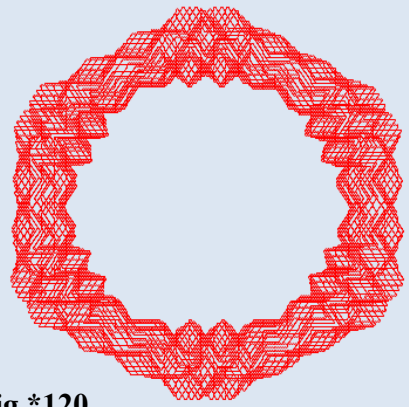


Fig.*120.

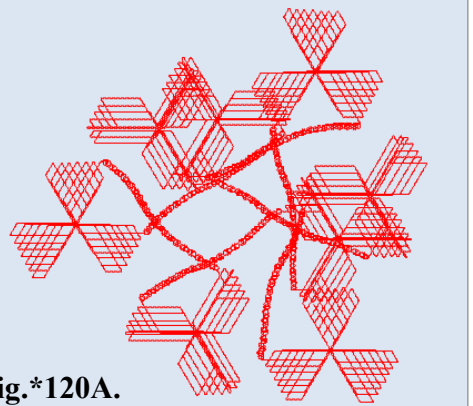


Fig.*120A.

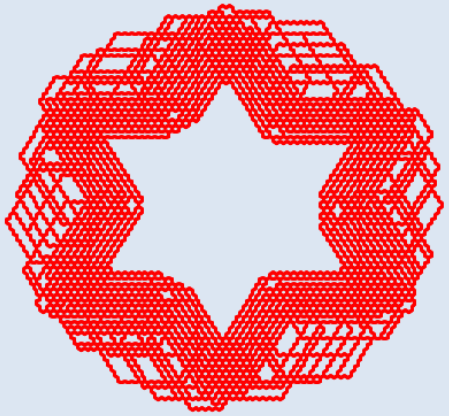


Fig.*121.

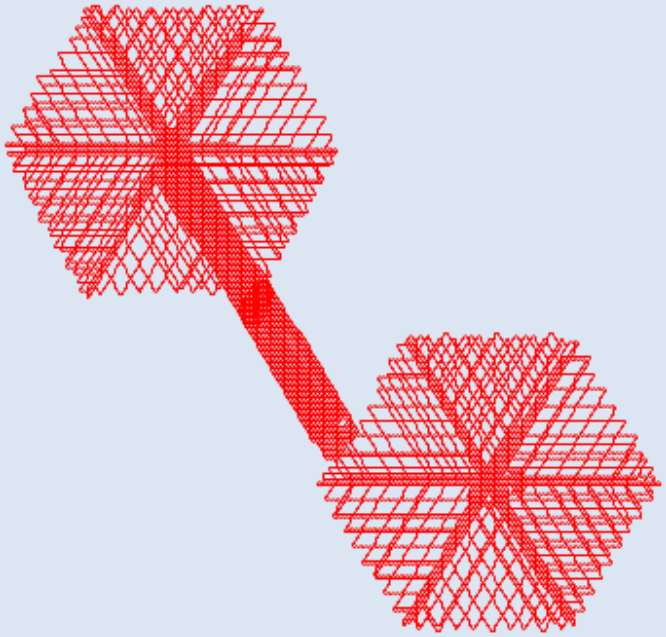


Fig.*121A.

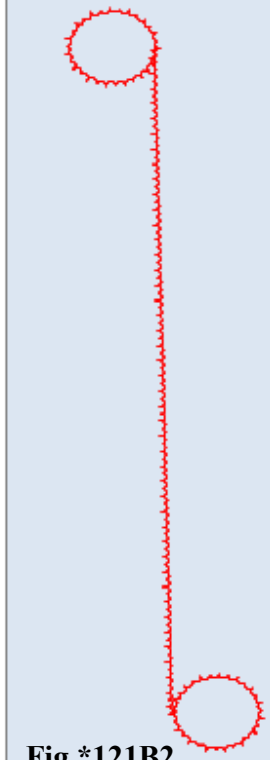


Fig.*121B2.

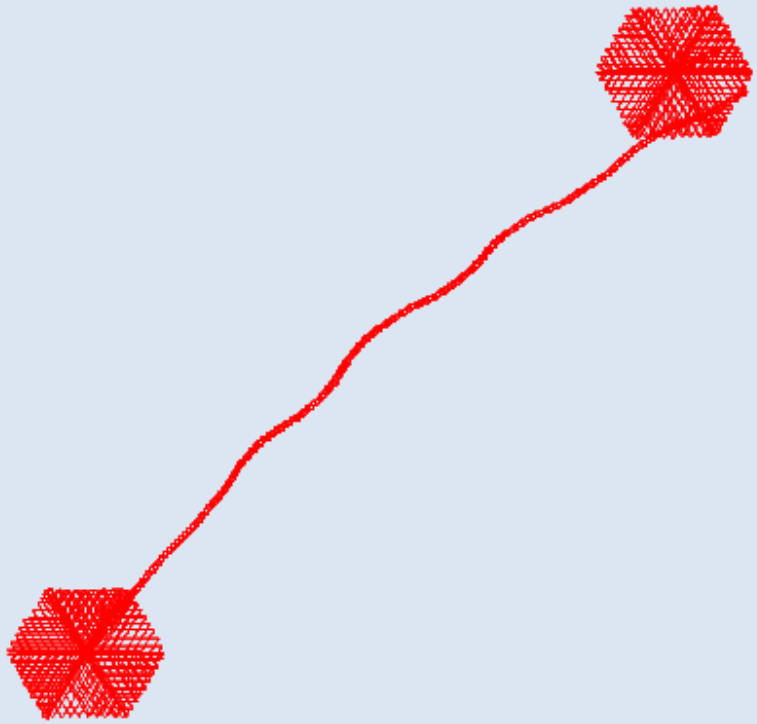


Fig.*121B.

Fig.*121B1.

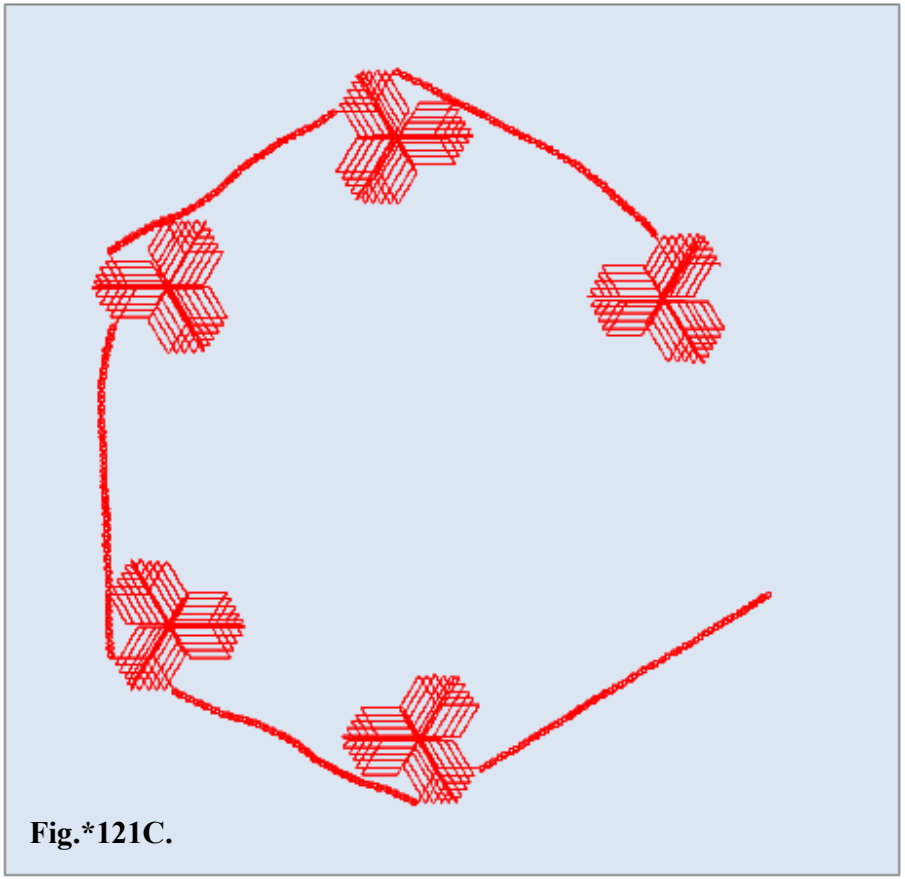


Fig.*121C.

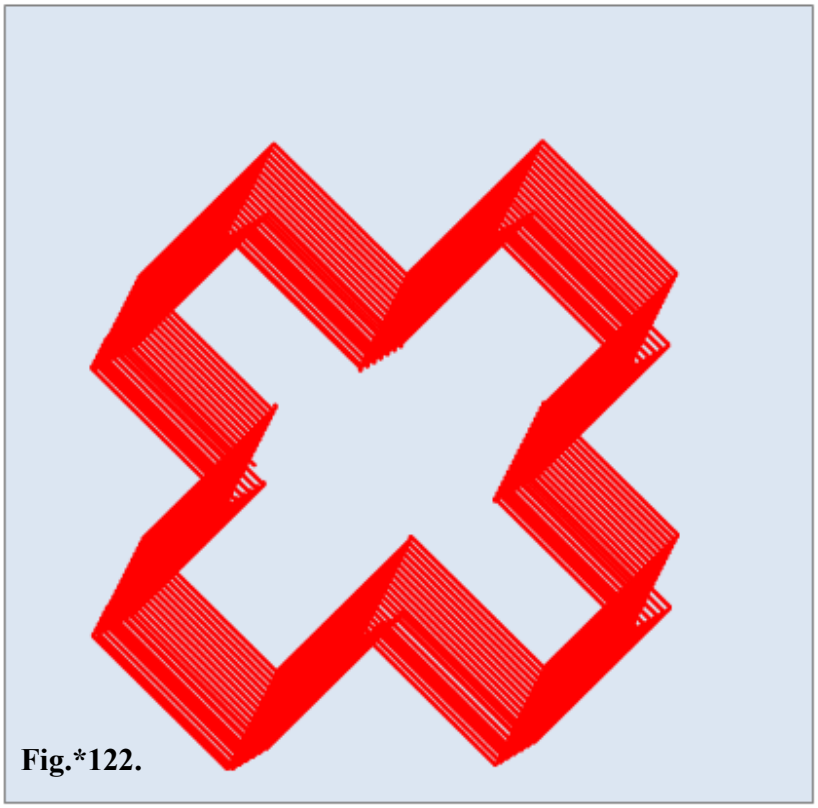


Fig.*122.

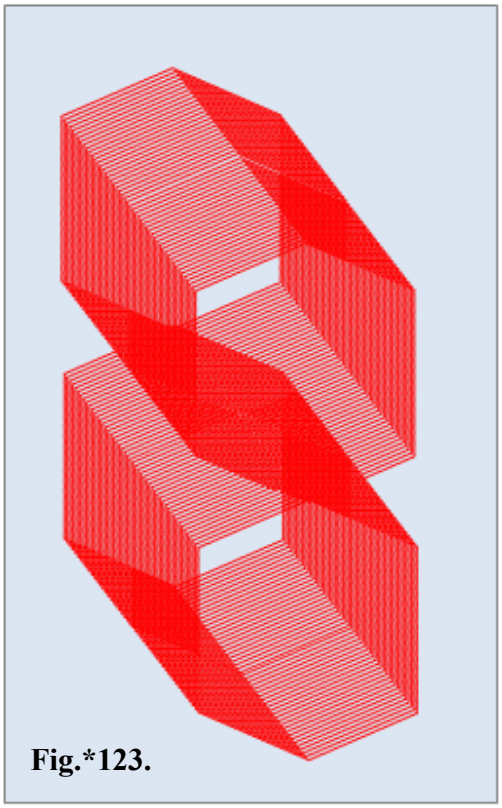


Fig.*123.

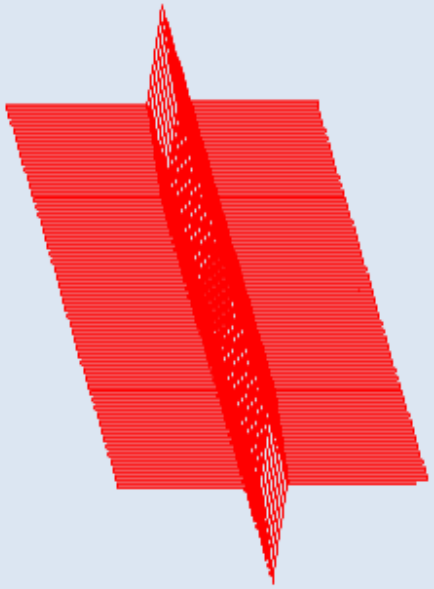


Fig.*124.

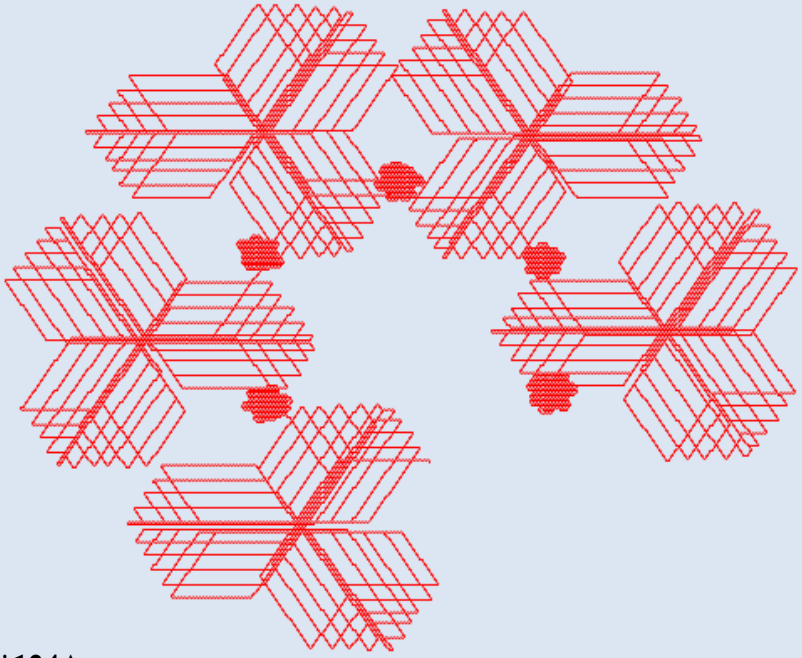


Fig.*124A.

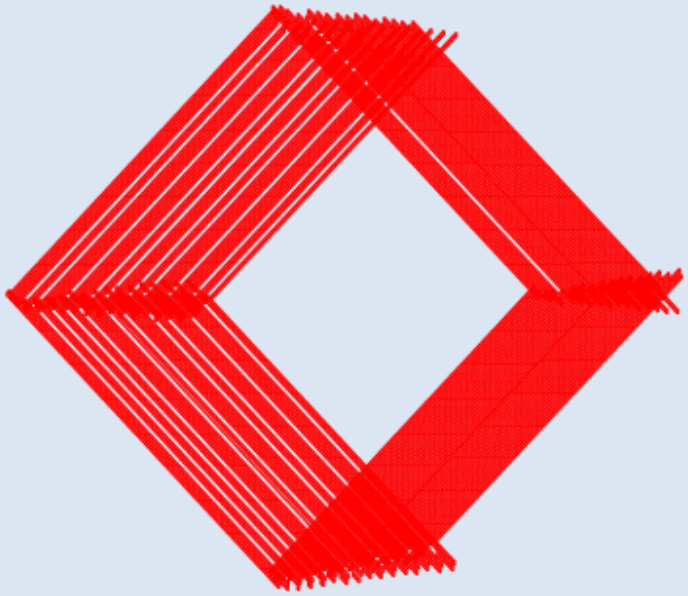


Fig.*125.

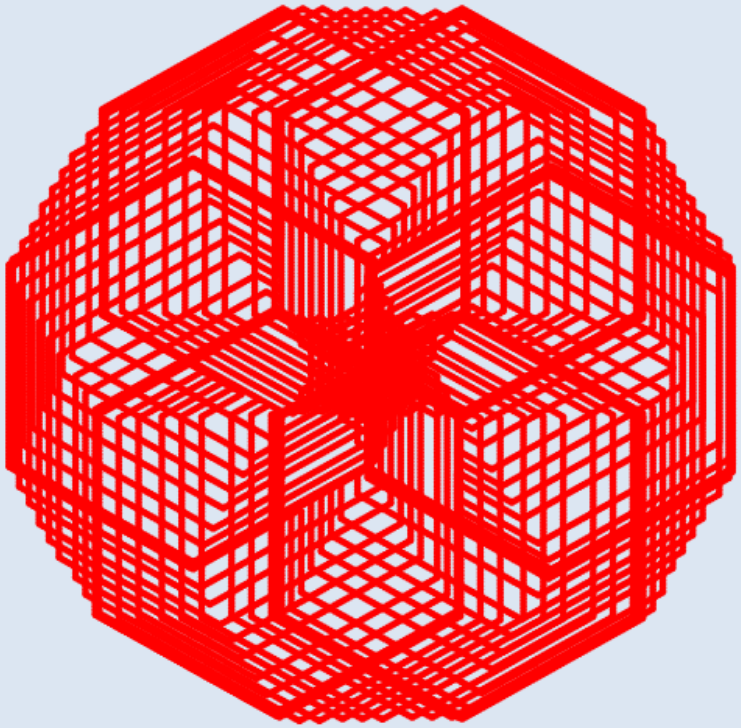


Fig.*126.

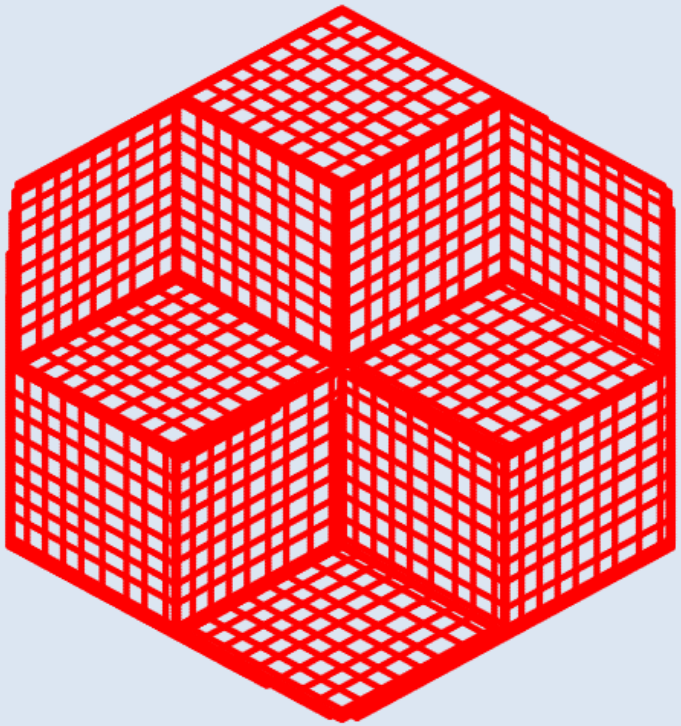


Fig.*127.

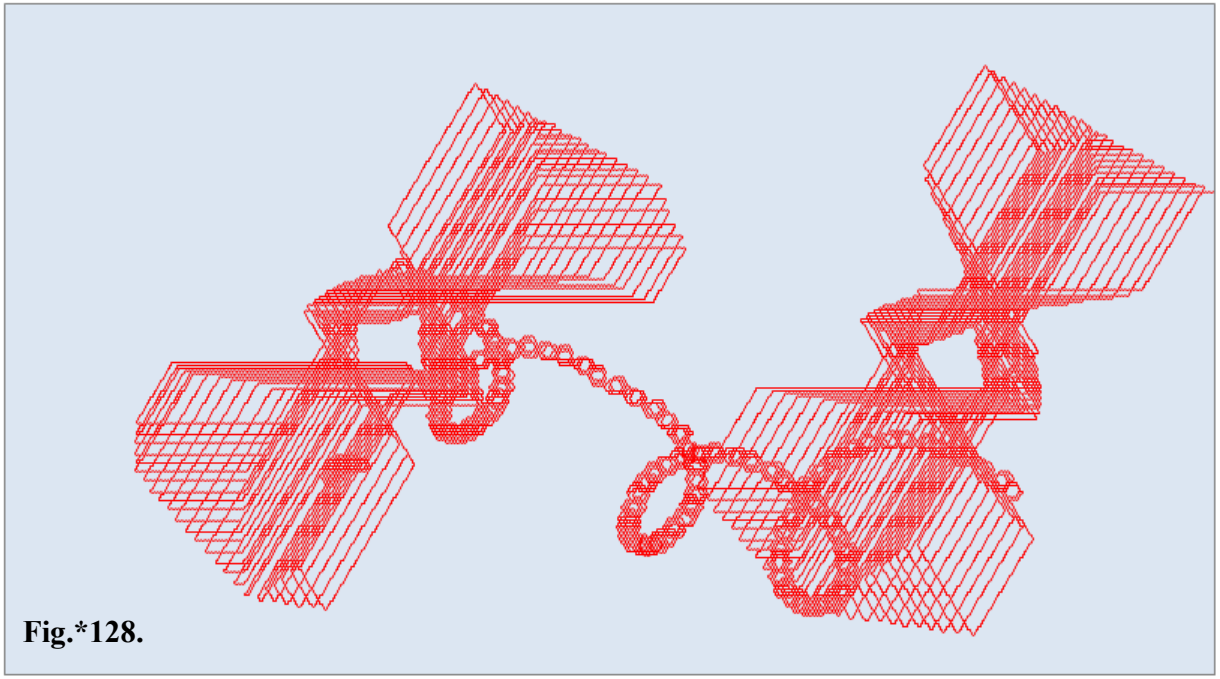


Fig.*128.

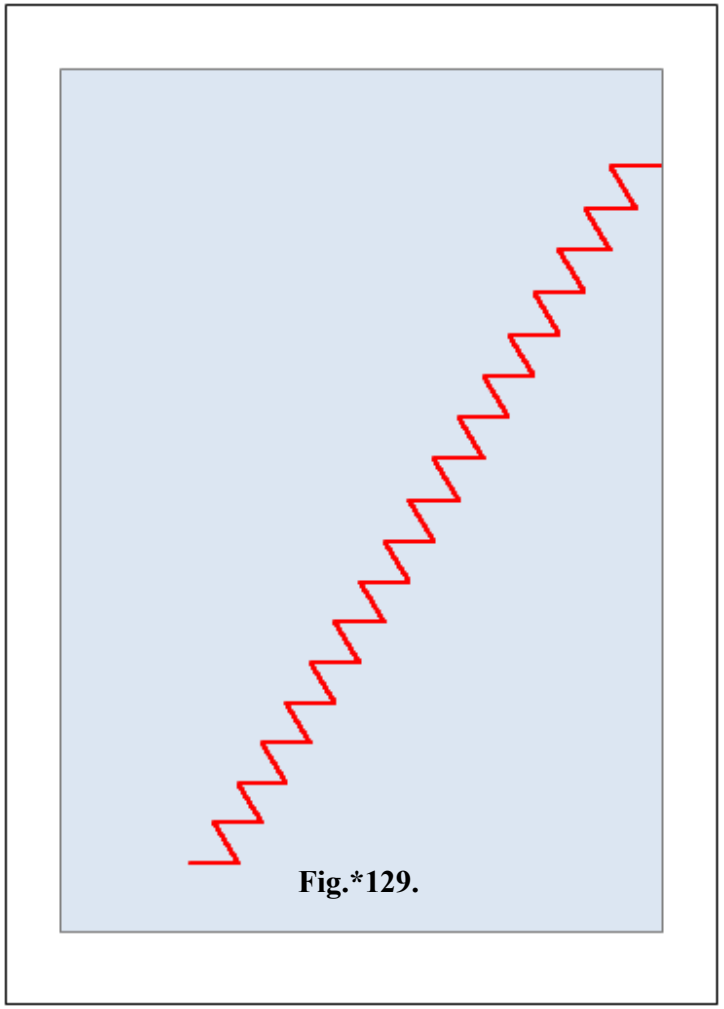
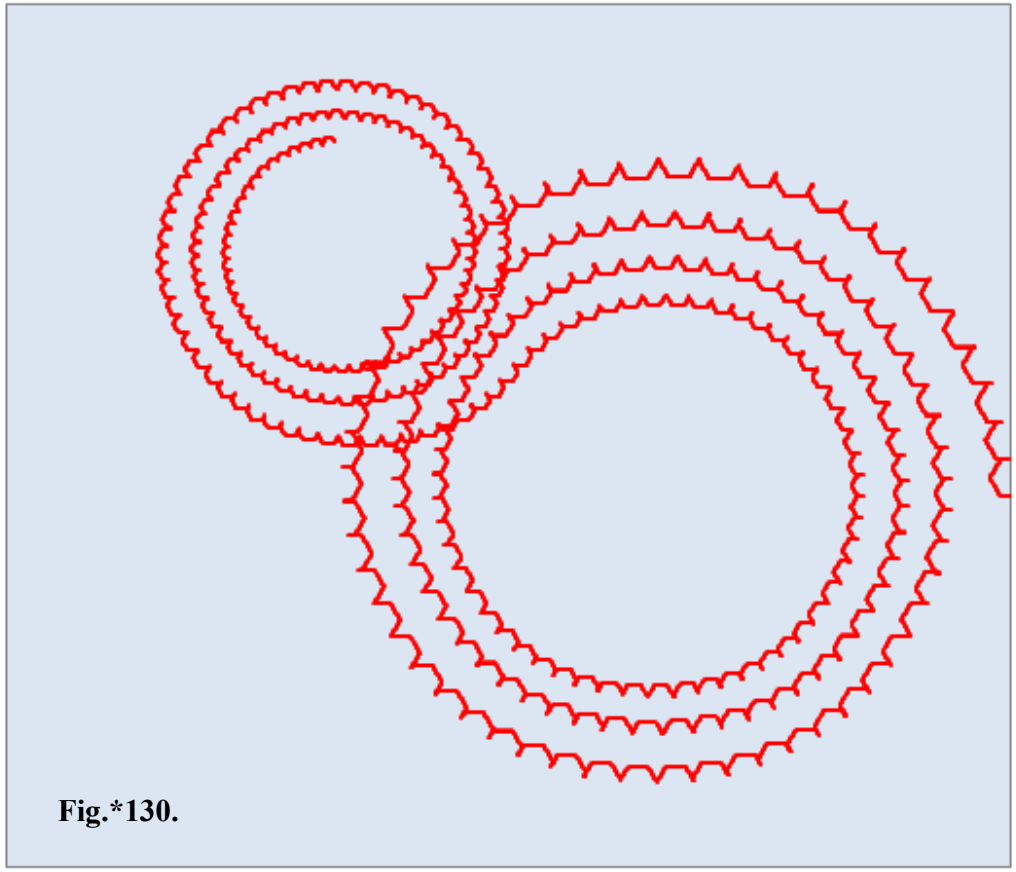


Fig.*129.



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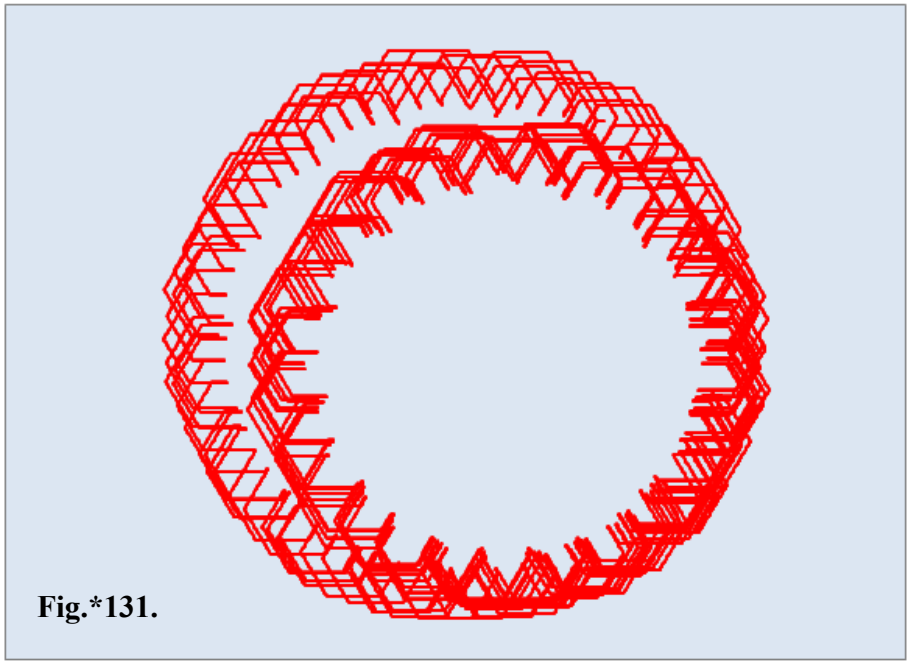

Fig.*131.

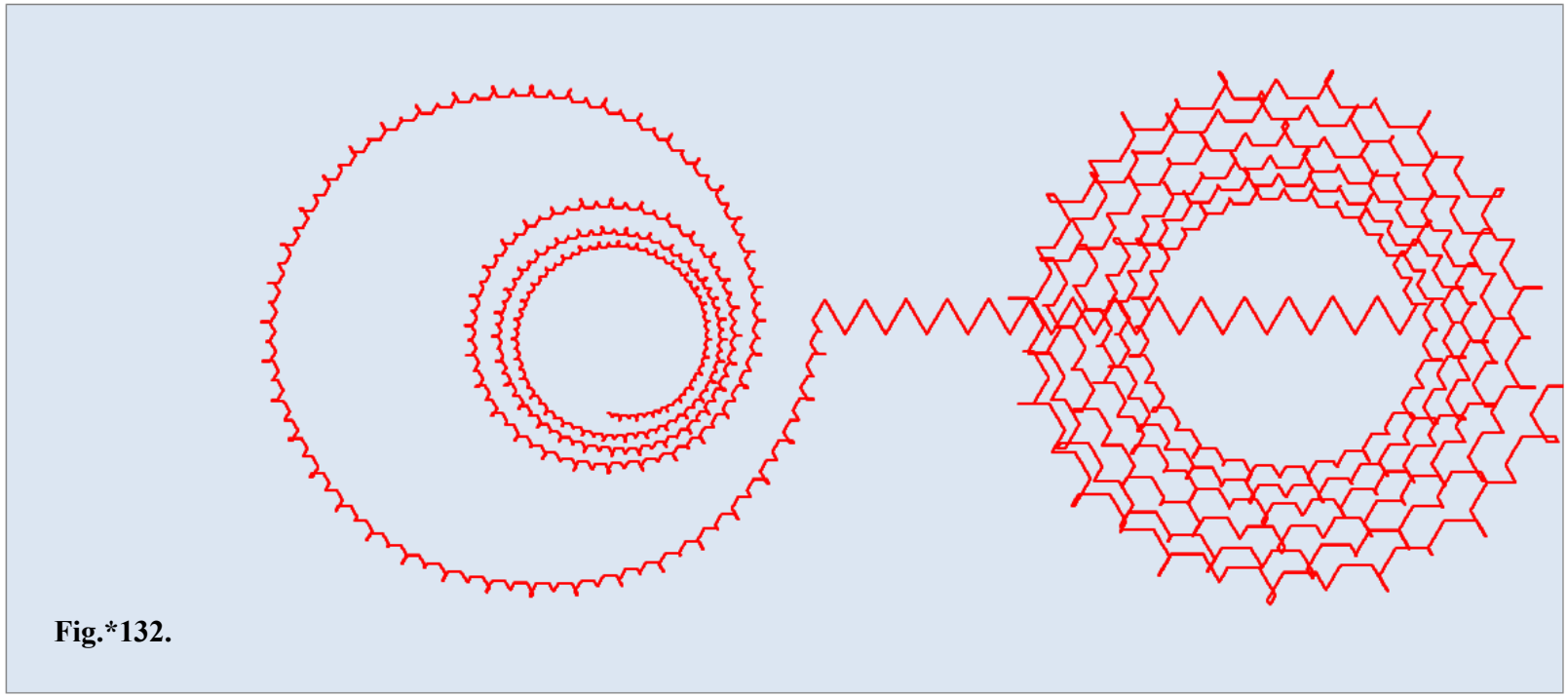

Fig.*132.

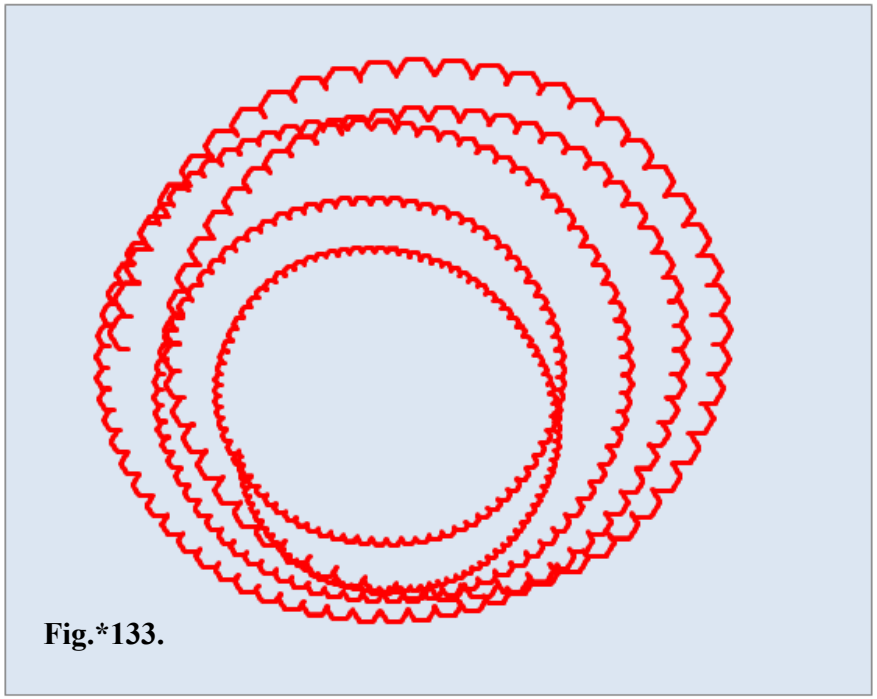

Fig.*133.

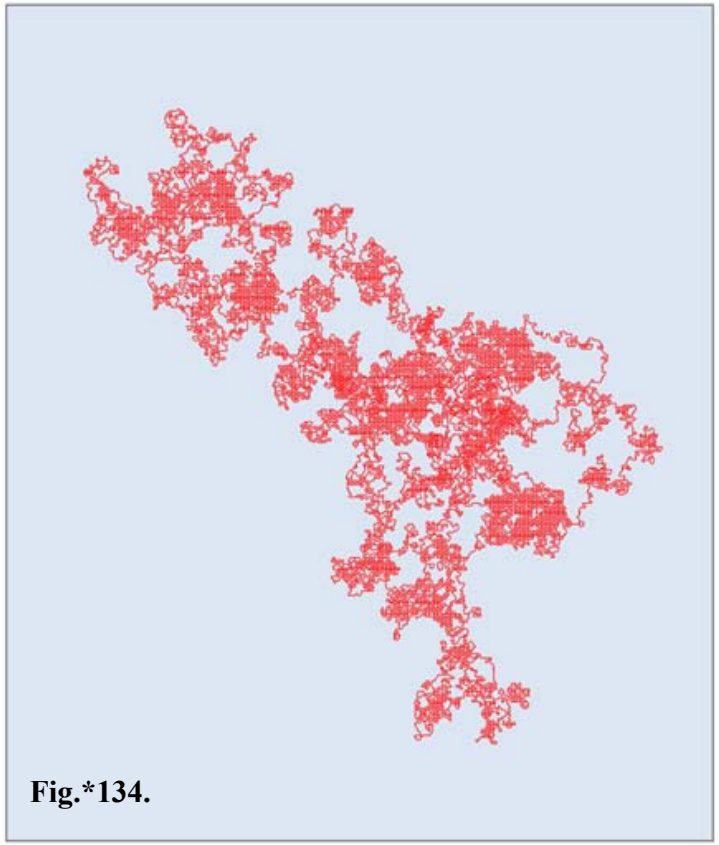

Fig.*134.

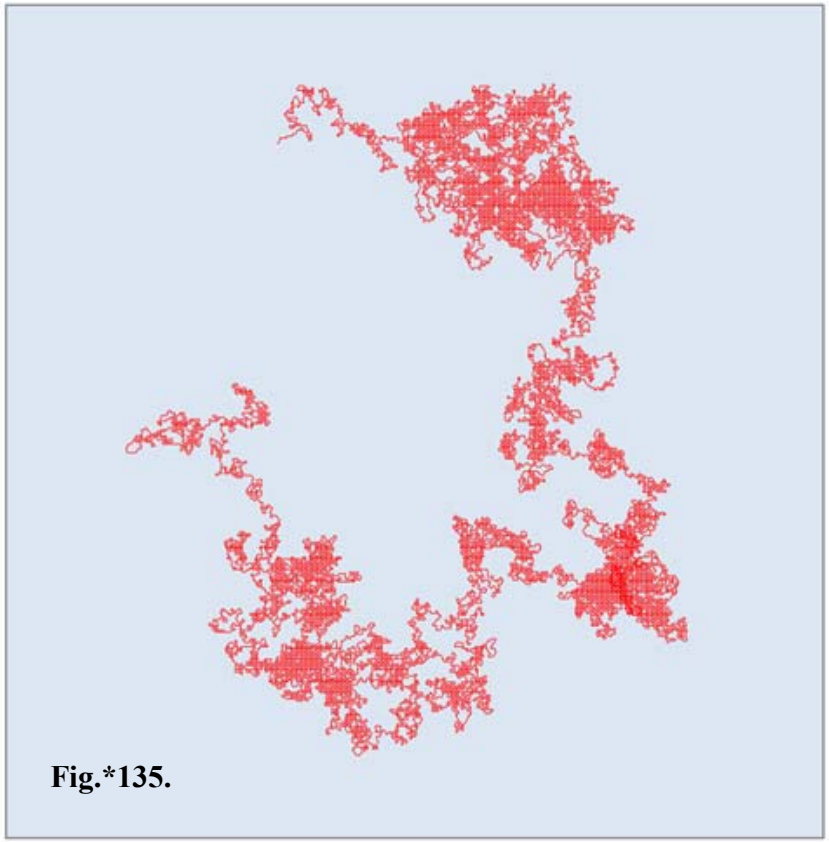

Fig.*135.

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APPENDIX.

Algorithm for calculating the geometrical figures, which shown on page 22, 76, is executed in accordance with the description of propagation micro-rarefaction (14.; 14.1.) in the model of the layer of porous rock.
The alphabetic characters of denotations of initial parameters in an algorithm coincide with such in the indicated description (14.; 14.1.).
Most of the images are obtained by calculating the spread of micro-rarefaction in undeformed model (Fig. XXI.) the network of micro-cells in model of the layer of porous rock.
In undeformed model (Fig. XXI.) the network of micro-cells, three, coming from a one (blue) point, segments of straight line divides a (perigon) full angle (with a top in the overall point) by three equal parts, for 120^0 each (14.; 14.1.).
The remaining images were obtained by calculating the spread of micro-rarefaction in a model of the deformed (Fig. XX.) by stretching along the vertical line of network of micro-cells or in a model of the deformed (Fig. XXII.) by streching along the horizontal line of network of micro-cells.
In the model of the deformed (Fig. XX.) by streching along the vertical line of network of micro-cells , three, coming from a one (blue) point, segments of straight line divides a (perigon) full angle (with a top in the overall point) by three angle, of which only two corners are equal among themselves.
Equal angles are symmetrical relatively of vertical line and each of them more than 120^0.
In the model of the deformed (Fig. XXII.) by streching along the horizontal line of network of micro-cells ,three, coming from a one (blue) point, segments of straight line divides a (perigon) full angle (with a top in the overall point) by three angle, of which only two corners are equal among themselves. Equal angles are symmetrical relatively the vertical line and each of them less than 120^0.

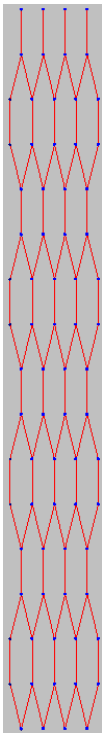

Fig.XX.
Model, deformed by stretching along the vertical line, of network of micro-cells in the model of the layer of porous rock.

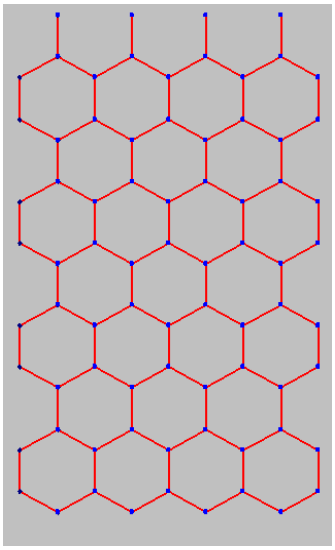

Fig.XXI .
Undeformed model of the network of micro-cells in the model of the layer of porous rock.

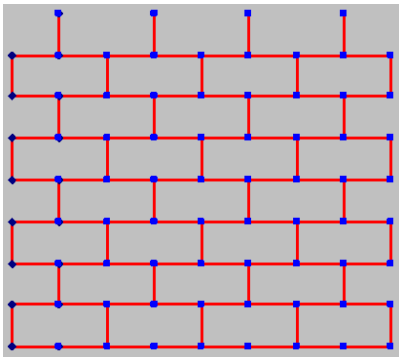

Fig.XXII .
Model, deformed by stretching along the horizontal line, of network of micro-cells in the model of the layer of porous rock.

Worksheet cell addresses and formulas in cells of Worksheet according to the system of Microsoft Excel .

Denotation of basic data: N_{zm}; ζ; N_h*; γ'^1_i; γ'^2_i; γ''_i; χ; A;D_f; B; k;$\forall$; Γ; ς.

Basic data in cells of Worksheet:

BC23=N_{zm}
BC24=ζ
BC20= N_h*
BD19= γ'^1_i
BD18= γ'^2_i
BC27= γ''_i
BC21=χ

BE21= 1
BE26= 1
BC26= A
M18= D_f
BE20= B

M20= k= 1 / 0

BD23=$\forall$ - parameter, which are characterizing the streching of micro-network along the vertical or horizontal lines.

AR21= ς= 1- if moving of solid micro-skeleton of layer of porous rock; / 0 - in the absence of movement of solid micro-skeleton of layer of porous rock.

B19 =2*π
K15=**$BC$26**
K17=**$BE$20**
D20=**$BD$22**

E18=**$BC$27**
K20=**$BD$18**
K21=**$BD$19**
M13=**$BC$24**
M12=**$BC$23**
M11=**$BC$20**
M16=0 (x_0= 0)
M17=0 (y_0= 0)
V20=1

AK21=$Q$20
AL21=$R$20
AM21=$S$20
AU20=$BE$26
O13=30*$BD$23+180+$BC$21
O14=90+$BC$21
O16=150+180+$BC$21+30*(1-$BD$23)
H14= COS(RADIANS($O$13))
H15= SIN(RADIANS($O$13))
H12 = IF(COS(RADIANS($O$14))<(0.0000000000000001);0;COS(RADIANS($O$14)))
H13 = SIN(RADIANS($O$14))
H16 = COS(RADIANS($O$16))
H17 = SIN(RADIANS($O$16))
L19 =$((3)^{1/2})/(2)$= SQRT(3)/(2)
Q20=2
R20=1
S20=3
V20 =1
W21 =2
X20=2
Z21 =1
AA20=1
AC21=3
AD20=3
AO21=$Q$20
AP21=$R$20
AQ21=$S$20
AF21=$Q$20
AG21=$R$20
AH21=$S$20
Q22=$O$13
R22=$O$14
S22=$O$16
M15=-60

Desired data:

T23 ; T24; T25;... T65536. (x – coordinates of common points through which spread micro-rarefaction)
U23 ; U24; U25;... U65536. (y– coordinates of common points through which spread micro-rarefaction)
(Diagram: =Sheet1!$T$23:$U$65536)

ALGORITHM.

A23=MOD(ABS($B23);$B$19)*SIGN($B23)
B23=(RADIANS(-$C23-$K$15*(1-(POWER(-1;$L23)))))
C23=$D23+E23
D23=-$E$18*(1-(POWER(-1;$L23+1)))
E23=($K$20*(1-$F23)/2+$K$21*(1+$F23)/2)/(POWER((1-1/$M$13);($L23*$BE$21)))
F23=POWER(-1;INT($J23/$BB$18))
G23=IF($M23>INT($M23);INT($M23)+1;INT($M23))
H23=POWER(-1;$I23)
I23=$J23+$M$20
J23=1
K23=IF($M$12-$J23-$M$11>0;1;0)
L23=0
M23=((POWER(1-1/$M$13;($L23*$BE$21)))*($M$12/$M$13))
N23=IF($G23>0;1;0)
O23=IF($G23-$N23<1;0;$G23-$N23)
P23=$K$17*(1-(POWER(-1;$AS23-1)))
Q23=IF(ABS(SIN(RADIANS(-$C23+$O$13-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23))))))<0.00000001;0;(SIN(RADIANS(-$C23+$O$13-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23)))))))
R23=IF(ABS(SIN(RADIANS(-$C23+$O$14-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23))))))<0.00000001;0;(SIN(RADIANS(-$C23+$O$14-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23)))))))
S23=IF(ABS(SIN(RADIANS(-$C23+$O$16-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23))))))<0.00000001;0;(SIN(RADIANS(-$C23+$O$16-$K$15*(1-(POWER(-1;$L23)))+$P23-90*(-1+(POWER(-1;$J23)))))))
T23=$M$16
U23=$M$17
V23=$V$20
W23=$T23+$H$14*$M$18*$H23
X23=$U23+$H$15*$M$18*$H23
Y23
Z23=$T23+($H$12)*$M$18*$H23
AA23=$U23+($H$13)*($M$18)*$H23
AB23
AC23=$T23+($H$16)*($M$18)*$H23
AD23=$U23+($H$17)*($M$18)*$H23
AE23
AF23=SIGN(($X23-$U23))
AG23=SIGN(($AA23-$U23))
AH23=SIGN(($AD23-$U23))
AI23=IF(($AK$21-$AK23)+($AL$21-$AL23)+($AM$21-$AM23)=1;3;IF(($AK$21-$AK23)+($AL$21-$AL23)+($AM$21-$AM23)=2;1;2))
AJ23=IF(($AK$21-$AK23)+($AL$21-$AL23)+($AM$21-$AM23)=1;2;IF(($AK$21-$AK23)+($AL$21-$AL23)+($AM$21-$AM23)=2;3;1))
AK23=IF($AK$21=$V23;0;$AK$21)
AL23=IF($AL$21=$V23;0;$AL$21)

AM23=IF($AM$21=$V23;0;$AM$21)
AN23
AO23=IF($AK23=$AK$21;0;(SIGN($Q23)))*(1-POWER((-1);$AR$21))/2
AP23=IF($AL23=$AL$21;0;(SIGN($R23)))*(1-POWER((-1);$AR$21))/2
AQ23=IF($AM23=$AM$21;0;(SIGN($S23)))*(1-POWER((-1);$AR$21))/2
AR23=IF(RAND()>0.5;1;0)
AS23=IF($AT22>0;$AS22;$AS22+1)
AT23=$AU$20-$AU23
AU23=IF($AT22=0;1;$AU22+1)
AV23=(1-SUM($AO23:$AQ23)*SUM($AO23:$AQ23))*(IF($AK$21=$V23;($AL23*$AR23-$AM23*(1-$AR23));($AK$21*$AR23+($AL23+$AM23)*(1-$AR23))))+SUM($AO23:$AQ23)*SUM($AO23:$AQ23)*(IF(SUM($AO23:$AQ23)<0;$AI23;$AJ23))

A24=MOD(ABS($B24);$B$19)*SIGN($B24)
B24=(RADIANS(-$C24-$K$15*(1-(POWER(-1;$L24)))))
C24=$D24+E24
D24=-$E$18*(1-(POWER(-1;$L24+1)))
E24=$E23+($K$20*(1-$F24)/2+$K$21*(1+$F24)/2)/(POWER((1-1/$M$13);($L24*$BE$21)))
F24=POWER(-1;INT($J24/$BB$18))
G24=IF($M24>INT($M24);INT($M24)+1;INT($M24))
H24=POWER(-1;$I24)
I24=$J24+$M$20
J24 =$J23+1
K24=IF($M$12-$J24-$M$11>0;1;0)
L24 =IF($O23=0;$L23+1;$L23)
M24=((POWER(1-1/$M$13;($L24*$BE$21)))*($M$12/$M$13))
N24 =IF($O23=0;1;$N23+1)
O24=IF($G24-$N24<1;0;$G24-$N24)
P24=$K$17*(1-(POWER(-1;$AS24-1)))
Q24=IF(ABS(SIN(RADIANS(-$C24+$O$13-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24))))))<0.00000001;0;(SIN(RADIANS(-$C24+$O$13-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24)))))))
R24=IF(ABS(SIN(RADIANS(-$C24+$O$14-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24))))))<0.00000001;0;(SIN(RADIANS(-$C24+$O$14-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24)))))))
S24=IF(ABS(SIN(RADIANS(-$C24+$O$16-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24))))))<0.00000001;0;(SIN(RADIANS(-$C24+$O$16-$K$15*(1-(POWER(-1;$L24)))+$P24-90*(-1+(POWER(-1;$J24)))))))
T24=IF(V23=3;$AC23;IF(V23=2;$W23;$Z23))*$K24+$T23*(1-$K24)
U24=IF(V23=3;$AD23;IF(V23=2;$X23;$AA23))*$K24+$U23*(1-$K24)
V24=$AV23
W24=$T24+$H$14*$M$18*$H24
X24=$U24+$H$15*$M$18*$H24
Y24
Z24=$T24+($H$12)*$M$18*$H24
AA24=$U24+($H$13)*($M$18)*$H24
AB24
AC24=$T24+($H$16)*($M$18)*$H24
AD24=$U24+($H$17)*($M$18)*$H24
AE24
AF24=SIGN(($X24-$U24))
AG24=SIGN(($AA24-$U24))
AH24=SIGN(($AD24-$U24))
AI24=IF(($AK$21-$AK24)+($AL$21-$AL24)+($AM$21-$AM24)=1;3;IF(($AK$21-$AK24)+($AL$21-$AL24)+($AM$21-$AM24)=2;1;2))
AJ24=IF(($AK$21-$AK24)+($AL$21-$AL24)+($AM$21-$AM24)=1;2;IF(($AK$21-$AK24)+($AL$21-$AL24)+($AM$21-$AM24)=2;3;1))
AK24=IF($AK$21=$V24;0;$AK$21)
AL24=IF($AL$21=$V24;0;$AL$21)
AM24=IF($AM$21=$V24;0;$AM$21)
AN24

AO24=IF($AK24=$AK$21;0;(SIGN($Q24)))*(1-POWER((-1);$AR$21))/2
AP24=IF($AL24=$AL$21;0;(SIGN($R24)))*(1-POWER((-1);$AR$21))/2
AQ24=IF($AM24=$AM$21;0;(SIGN($S24)))*(1-POWER((-1);$AR$21))/2
AR24=IF(RAND()>0.5;1;0)
AS24=IF($AT23>0;$AS23;$AS23+1)
AT24=$AU$20-$AU24
AU24=IF($AT23=0;1;$AU23+1)
AV24=(1-SUM($AO24:$AQ24)*SUM($AO24:$AQ24))*(IF($AK$21=$V24;($AL24*$AR24-$AM24*(1-$AR24));($AK$21*$AR24+($AL24+$AM24)*(1-$AR24))))+SUM($AO24:$AQ24)*SUM($AO24:$AQ24)*(IF(SUM($AO24:$AQ24)<0;$AI24;$AJ24))

A25=MOD(ABS($B25);$B$19)*SIGN($B25)
B25=(RADIANS(-$C25-$K$15*(1-(POWER(-1;$L25)))))
C25=$D25+E25
D25=-$E$18*(1-(POWER(-1;$L25+1)))
E25=$E24+($K$20*(1-$F25)/2+$K$21*(1+$F25)/2)/(POWER((1-1/$M$13);($L25*$BE$21)))
F25=POWER(-1;INT($J25/$BB$18))
G25=IF($M25>INT($M25);INT($M25)+1;INT($M25))
H25=POWER(-1;$I25)
I25=$J25+$M$20
J25 =$J24+1
K25=IF($M$12-$J25-$M$11>0;1;0)
L25=IF($O24=0;$L24+1;$L24)
M25=((POWER(1-1/$M$13;($L25*$BE$21)))*($M$12/$M$13))
N25 =IF($O24=0;1;$N24+1)
O25=IF($G25-$N25<1;0;$G25-$N25)
P25=$K$17*(1-(POWER(-1;$AS25-1)))
Q25=IF(ABS(SIN(RADIANS(-$C25+$O$13-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25))))))<0.00000001;0;(SIN(RADIANS(-$C25+$O$13-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25)))))))
R25=IF(ABS(SIN(RADIANS(-$C25+$O$14-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25))))))<0.00000001;0;(SIN(RADIANS(-$C25+$O$14-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25)))))))
S25=IF(ABS(SIN(RADIANS(-$C25+$O$16-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25))))))<0.00000001;0;(SIN(RADIANS(-$C25+$O$16-$K$15*(1-(POWER(-1;$L25)))+$P25-90*(-1+(POWER(-1;$J25)))))))
T25=IF(V24=3;$AC24;IF(V24=2;$W24;$Z24))*$K25+$T24*(1-$K25)
U25=IF(V24=3;$AD24;IF(V24=2;$X24;$AA24))*$K25+$U24*(1-$K25)
V25=$AV24
W25=$T25+$H$14*$M$18*$H25
X25=$U25+$H$15*$M$18*$H25
Y25
Z25=$T25+($H$12)*$M$18*$H25
AA25=$U25+($H$13)*($M$18)*$H25
AB25
AC25=$T25+($H$16)*($M$18)*$H25
AD25=$U25+($H$17)*($M$18)*$H25
AE25
AF25=SIGN(($X25-$U25))
AG25=SIGN(($AA25-$U25))
AH25=SIGN(($AD25-$U25))
AI25=IF(($AK$21-$AK25)+($AL$21-$AL25)+($AM$21-$AM25)=1;3;IF(($AK$21-$AK25)+($AL$21-$AL25)+($AM$21-$AM25)=2;1;2))
AJ25=IF(($AK$21-$AK25)+($AL$21-$AL25)+($AM$21-$AM25)=1;2;IF(($AK$21-$AK25)+($AL$21-$AL25)+($AM$21-$AM25)=2;3;1))
AK25=IF($AK$21=$V25;0;$AK$21)
AL25=IF($AL$21=$V25;0;$AL$21)
AM25=IF($AM$21=$V25;0;$AM$21)

AN25
AO25=IF($AK25=$AK$21;0;(SIGN($Q25)))*(1-POWER((-1);$AR$21))/2
AP25=IF($AL25=$AL$21;0;(SIGN($R25)))*(1-POWER((-1);$AR$21))/2
AQ25=IF($AM25=$AM$21;0;(SIGN($S25)))*(1-POWER((-1);$AR$21))/2
AR25=IF(RAND()>0.5;1;0)
AS25=IF($AT24>0;$AS24;$AS24+1)
AT25=$AU$20-$AU25
AU25=IF($AT24=0;1;$AU24+1)
AV25=(1-SUM($AO25:$AQ25)*SUM($AO25:$AQ25))*(IF($AK$21=$V25;($AL25*$AR25-$AM25*(1-$AR25));($AK$21*$AR25+($AL25+$AM25)*(1-$AR25))))+SUM($AO25:$AQ25)*SUM($AO25:$AQ25)*(IF(SUM($AO25:$AQ25)<0;$AI25;$AJ25))
……

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AV65636=(1-SUM($AO65636:$AQ65636)*SUM($AO65636:$AQ65636))*(IF($AK$21=$V65636;($AL65636*$AR65636-$AM65636*(1-$AR65636));($AK$21*$AR65636+($AL65636+$AM65636)*(1-$AR65636))))+SUM($AO65636:$AQ65636)*SUM($AO65636:$AQ65636)*(IF(SUM($AO65636:$AQ65636)<0;$AI65636;$AJ65636))

Table of basic data at the calculation of trajectories, represented on a pages 21-75.

(D_f = 0,0001 for all Fig. ; k = 1 for all Fig.); (ς = 0 for Fig. № *134; *135; ς = 1 for all other Fig.)

Fig. #	ƒ	γ'^1_i	γ'^2_i	N_h^*	σ	ϰ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***1**	65536	0.00025	0.00025	4.5E+10	1	0	0	9E+10	3.15E+9	1	135	1	0
***2**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	0	90	1	0
***2A**	6000	0.36488985	-50.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***3**	65536	0.00305	0.00305	2.1E+11	1	-35	0	4.2E+11	4.2E+8	0	450	1	0
***4**	65536	0.00305	0.00305	2.1E+11	1	0	0	4.2E+11	4.2E+8	1	450	1	0
***4A**	6000	1.6488985	-50.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***5**	65536	0.02001	0.02001	1.5E+12	1	0	0	3 E+12	5E+9	1	90	1	0
***6**	30000	0.5838	0.600001	9 E+10	1	0	0	1.8 E+11	6 E+8	1	75	1	0
***6A**	20000	0.62	0.600001	9 E+10	1	0	0	1.8 E+11	6 E+8	1	75	1	0
***6B**	12000	0.62	0.600001	9 E+10	1	0	0	1.8 E+11	6 E+8	1	75	1	0
***6C**	5978	0.62	0.600001	9 E+10	1	0	0	1.8 E+11	6 E+8	1	75	1	0
***6D**	3600	0.62501	0.60001	1.2E+11	1	0	0	2.4 E+11	6 E+8	1	75	1	0
***6E**	19600	0.6109	-0.6201	3 E+11	1	0	0	6 E+11	2 E+9	1	90	1	0
***6F**	15000	0.6100001	0.5900001	9 E+11	1	-45	0	1.8 E+12	6E+9	1	90	1	0
***6G**	6000	0.6200001	0.02500001	9 E+11	1	0	0	1.8 E+12	6E+9	1	30	1	0
***6H**	6000	0.6200001	0.0600001	6 E+11	1	0	0	1.2 E+12	2E+9	1	30	1	0
***6I**	6000	0.6200001	2E-6	9 E+11	1	0	0	1.8E+12	6E+9	1	30	1	0
***6J**	3000	0.610001	0.1500001	9 E+11	1	-45	0	1.8E+12	6E+9	1	120	1	0
***6K**	6000	0.66	0.581	6E+4	1	0	0	1.2E+5	4E+2	1	90	1	0
***6AA**	6751	0.63	0.610006	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***6AB**	12051	0.63	0.610006	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***6AC**	6000	0.525	-0.66	6E+10	1	0	0	1.2E+11	4E+8	1	90	1	0
***6AD**	12051	0.648	0.610006	9E+4	1	0	0	1.8E+5	6E+2	1	75	1	0
***6AE**	12051	0.648	0.600006	9E+4	1	0	0	1.8E+5	6E+2	1	75	1	0
***6AH**	12051	0.6308	0.590706	9E+4	1	0	0	1.8E+5	6E+2	1	75	1	0
***6AG**	12051	0.648	0.590006	9E+4	1	0	0	1.8E+5	6E+2	1	75	1	0
***6AF**	12051	0.6308	0.590006	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***6AJ**	12051	0.722	0.598006	9E+4	1	0	0	1.8E+5	6E+2	1	75	1	0
***6BC**	4500	0.6	0.7	6E+14	1	0	0	1.2E+15	4E+12	1	90	1	0
***7**	65536	0.00305	0.00305	3E+12	1	0	0	6E+12	6E+11	1	90	1	0
***8**	65536	0.05	0.05	1.5E+12	1	0	0	3 E+12	5E+9	1	120	1	0
***9**	65536	0.02	0.02	3E+12	1	0	0	6E+12	6E+10	0	0	1	0
***10**	65536	0.20201	0.20201	1.5E+12	1	0	0	3 E+12	5E+9	1	0	1	0
***11**	65536	0.05	0.05	3E+12	1	0	0	6E+12	5E+9	1	120	1	0
***12**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	0	15	1	0
***13**	65536	0.04	0.04	7.5E+7	1	-25	0	1.5E+8	5E+4	1	36	1	0
***14**	65536	0.08	0.08	7.5E+7	1	-25	0	1.5E+8	5E+4	1	36	1	0
***15**	65536	0.036	0.036	7.5E+9	1	-25	0	1.5E+10	5E+6	1	36	1	0
***16**	65536	0.108	0.108	7.5E+9	1	-25	0	1.5E+10	5E+6	1	72	1	0
***17**	65536	0.0504	0.0504	7.5E+9	1	-25	0	1.5E+10	3E+6	1	72	1	0
***18**	65536	0.1	0.1	1.08E+10	1	-25	0	2.16E+10	1E+7	1	72	1	0
***19**	65536	0.606005	0.606005	7.5E+11	1	0	0	1.5E+12	5E+9	1	90	1	0
***20A.**	65536	0.606	0.606	6E+4	1	-45	0	1.2E+5	4E+2	1	-90	1	0
***20B.**	65536	-0.606	-0.606	6E+4	1	-45	0	1.2E+5	4E+2	1	-90	1	0
***21**	65536	0.610001	0.610001	7.5E+6	1	0	0	1.5E+7	5E+4	1	90	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***22**	65536	3.0050001	3.0050001	7.5E+11	1	0	0	1.5E+12	5E+9	1	90	1	0
***22A.**	19700	0.6109	-0.6201	3E+11	1	0	0	6E+11	2E+9	1	90	1	0
***23**	30001	0.615	0.610006	3E+12	1	0	0	6E+12	2E+10	1	90	1	0
***24**	30001	0.59	0.610006	3E+12	1	0	0	6E+12	2E+10	1	90	1	0
***25**	30001	0.6115	0.616	3E+12	1	0	0	6E+12	2E+10	1	90	1	0
***26**	29300	0.610772	-0.61459	3E+11	1	0	0	6E+11	2E+9	1	90	1	0
***27**	4000	0.499	0.6201	3E+5	1	0	0	6E+5	2E+3	1	90	1	0
***27A.**	20000	0.62	0.500001	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***27B.**	20000	0.62	0.400001	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***27C.**	20000	0.62	0.050001	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***27D.**	20000	0.62	0.040001	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***27E.**	20000	0.62	0.100001	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***27F.**	30000	0.62001	0.1250001	1.2E+12	1	0	0	2.4E+12	8E+9	1	76	1	0
***27G.**	20000	0.62	3.70001	9E+11	1	0	0	1.8E+12	6E+9	1	75	1	0
***27H.**	30000	0.62001	0.1250001	1.2E+12	1	0	0	2.4E+12	8E+9	1.2	75	1	0
***27J.**	20000	0.62	0.70001	9E+11	1	0	0	1.8E+12	6E+9	1	75	1	0
***27I.**	6680	3.630001	3.03000501	9E+11	1	0	0	1.8E+12	6E+9	1	-75	1	0
***27K.**	5018	3.630001	3.03000501	9E+11	1	0	0	1.8E+12	6E+9	1	-75	1	0
***27L.**	2600	0.62501	0.60001	1.2E+12	1	0	0	2.4E+12	8E+9	1	75	1	0
***27M.**	65536	1.2200001	1.2200001	7.48E+6	1	0	0	1.496E+7	1E+5	1	90	1	0
***28**	5000	0.498	0.6231	4.5E+5	1	0	0	9E+5	3E+3	1	90	1	0
***29**	6000	0.496	0.6201	4.5E+15	1	0	0	9E+15	3E+13	1	90	1	0
***30**	7100	0.4759	0.61	4.5E+20	1	0	0	9E+20	3E+18	1	36	1	0
***31**	4050	0.496	0.6201	4.5E+15	1	0	0	9E+15	3E+13	1	90	1	0
***31A**	4050	0.496	0.6201	7.6005E+4	1	0	0	1.5201E+5	5E+2	1	90	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***32**	6000	0.43985	0.6201	7.5E+14	1	0	0	1.5E+15	5E+12	1	90	1	0
***33**	5652	0.43985	0.6201	7.5E+14	1	0	0	1.5E+15	5E+12	1	90	1	0
***34**	5929	0.43985	0.60201	4.5E+15	1	0	0	9E+15	3E+13	1	72	1	0
***35**	5990	0.43985	0.65201	4.5E+16	1	0	0	9E+16	3E+14	1	72	1	0
***36**	5990	0.610006	0.65201	4.5E+6	1	0	0	9E+6	3E+4	1	90	1	0
***37**	5990	0.610006	0.662	4.5E+11	1	0	0	9E+11	3E+9	1	90	1	0
***38**	5990	0.600006	0.662	4.5E+11	1	0	0	9E+11	3E+9	1	90	1	0
***39**	5977	0.600001	3.2138	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***40**	65536	0.006	0.006	1.05E+14	1	0	0	2.1E+14	2.8E+12	1.971	142	1	0
***40A**	5990	0.600006	0.662	1.05E+5	1	0	0	2.1E+5	7.09E+2	1	90	1	0
***41**	65536	0.006	0.006	4.2E+11	1	-30	0	8.4E+11	3.15E+10	0.99	130	1	0
***42**	65536	0.4	0.4	4.7E+10	1	0	0	9.4E+10	3.15E+9	1	135	1	0
***43**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	1	30	1	0
***44**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	0	30	1	0
***45**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	1	45	1	0
***46**	65536	0.02501	0.02501	1.5E+12	1	-90	0	3 E+12	5E+9	1	120	1	0
***47**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	0	120	1	0
***48**	65536	0.02501	0.02501	1.5E+12	1	-45	0	3 E+12	5E+9	0	60	1	0
***49**	65536	0.35001	0.35001	1.5E+12	1	-90	0	3 E+12	5E+9	1	90	1	0
***50**	65536	0.40001	0.40001	1.5E+12	1	-60	0	3 E+12	5E+9	1	155	1	0
***51**	65536	0.35001	0.35001	1.5E+12	1	-60	0	3 E+12	5E+9	1	155	1	0
***52**	65536	0.36001	0.36001	1.5E+12	1	-60	0	3 E+12	5E+9	1	150	1	0
***53**	65536	0.35001	0.35001	1.5E+12	1	-90	0	3 E+12	5E+9	1	150	1	0
***54A**	20001	0.6201	-16.201	9E+10	1	0	0	1.8E+11	6E+8	1	90	1	0
***54**	65536	0.35001	0.35001	1.5E+12	1	-45	0	3 E+12	5E+9	0	150	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***55**	65536	0.2550001	0.2550001	2 E+12	1	-30	0	4 E+12	4E+8	1	90	1	0
***56**	65536	0.05	0.05	2.5E+14	1	0	0	5 E+14	1.25E+12	1	120	1	0
***57**	65536	0.13150001	0.13150001	1.825E+13	1	-60	0	3.65E+13	1 E+11	1	120	1	0
***58**	65536	0.10000005	0.10000005	1.2E+12	1	-30	0	2.4E+12	1 E+10	1	90	1	0
***58A**	12001	3.018005	-0.62501	1.2E+11	1	0	0	2.4E+11	8E+8	1	75	1	0
***59**	65536	0.06101	0.06101	1.5E+12	1	-90	0	3 E+12	5E+9	1	90	1	0
***60**	65536	0.80000005	0.80000005	1.5E+12	1	-30	0	3 E+12	1 E+10	1	90	1	0
***60A**	3000	3.208005	0.50001	1.2E+11	1	0	0	2.4E+11	8E+8	1	75	1	0
***61**	65536	0.6000005	0.6000005	1.5E+9	1	-30	0	3 E+9	6E+6	1	90	1	0
***62**	65536	0.6000001	0.6000001	6E+12	1	0	0	1.2E+13	4E+8	1	90	1	0
***63**	65536	0.5550001	0.5550001	8 E+11	1	0	0	1.6E+12	4E+8	1	90	1	0
***64**	65536	0.5550001	0.5550001	8 E+11	1	-45	0	1.6E+12	4E+8	1	90	1	0
***65**	65536	0.1530001	0.1530001	2 E+12	1	-30	0	4 E+12	4E+8	1	90	1	0
***66**	65536	0.30000005	0.30000005	4.5E+12	1	-25	0	9E+12	1E+10	1	95	1	0
***67**	65536	0.5550001	0.5550001	8E+11	1	-90	0	1.6E+12	4E+8	1	90	1	0
***68**	65536	0.1500001	0.1500001	2E+12	1	0	0	4E+12	4E+8	1	120	1	0
***68A**	6000	0.6105	0.78001	1.2E+6	1	0	0	2.4E+6	8E+3	1	75	1	0
***69**	65536	0.0830001	0.0830001	2E+12	1	-30	0	4E+12	4E+8	1	90	1	0
***70**	65536	0.0830001	0.0830001	2E+12	1	-30	0	4E+12	4E+8	1	60	1	0
***70A**	19700	0.6109	-6201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***71**	65536	0.0830001	0.0830001	2E+12	1	-30	0	4E+12	4E+8	1	30	1	0
***72**	65536	0.0830001	0.0830001	3.47E+12	1	-30	0	6.94E+12	4E+9	1	30	1	0
***73**	65536	0.800000001	0.800000001	1.5E+12	1	0	0	3E+12	1E+10	1	30	1	0
***74**	65536	0.25000005	0.25000005	4.5E+12	1	-25	0	9E+12	1E+10	1	30	1	0
***75**	65536	0.0840001	0.0840001	2E+12	1	-30	0	4E+12	4E+8	1	90	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***75A**	20001	0.621	-0.6179	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***76**	65536	0.8	0.8	3E+12	1	0	0	6E+12	5E+9	1	120	1	0
***77**	65536	0.0840001	0.0840001	2E+12	1	-30	0	4E+12	4E+8	1	150	1	0
***77A**	20000	0.62001	0.1250001	1.2E+12	1	0	0	2.4E+12	8E+9	1.2	75	1	0
***78**	65536	0.61000001	0.61000001	6E+11	1	0	0	1.2E+12	4E+8	1	120	1	0
***79**	65536	0.85000005	0.85000005	1.5E+12	1	-30	0	3E+12	1E+10	1	120	1	0
***79A**	13843	0.62001	0.1250001	1.2E+12	1	0	0	2.4E+12	8E+9	1	76	1	0
***80**	65536	0.700001	0.700001	7.5E+11	1	0	0	1.5E+12	5E+9	1	90	1	0
***81**	65536	0.55500001	0.55500001	6E+11	1	0	0	1.2E+12	4E+8	1	90	1	0
***82**	65536	0.65000001	0.65000001	6E+11	1	0	0	1.2E+12	4E+8	1	90	1	0
***82A**	20001	1.701	-31.201	9E+10	1	0	0	1.8E+11	6E+8	1	90	1	0
***82B**	20001	1.701	-31.201	9E+10	1	0	0	1.8E+11	6E+8	1	75	1	0
***83**	65536	0.65400001	0.65400001	6E+11	1	0	0	1.2E+12	4E+8	1	90	1	0
***84**	65536	0.0840001	0.0840001	2E+12	1	-30	0	4E+12	4E+8	1	120	1	0
***85**	65536	0.0900001	0.0900001	2E+12	1	0	0	4E+12	4E+8	1	120	1	0
***86**	65536	0.0900001	0.0900001	2E+12	1	0	0	4E+12	4E+8	1	150	1	0
***87**	65536	0.55500001	0.55500001	6E+11	1	0	0	1.2E+12	4E+8	0	90	1	0
***88**	65536	0.1530001	0.1530001	2E+12	1	-30	0	4E+12	4E+8	0	90	1	0
***89**	65536	0.65400001	0.65400001	6E+11	1	0	0	1.2E+12	4E+8	0	90	1	0
***90**	65536	-0.65400001	-0.65400001	6E+11	1	0	0	1.2E+12	4E+8	1	90	1	0
***91**	65536	0.61000005	0.61000005	4.5E+12	1	-25	0	9E+12	1E+10	1	60	1	0
***92**	65536	0.61000005	0.61000005	4.5E+12	1	-25	0	9E+12	1E+10	1	30	1	0
***93**	65536	0.6100001	0.6100001	6E+11	1	0	0	1.2E+12	4E+8	0	150	1	0
***94**	65536	0.6100001	0.6100001	6E+11	1	-45	0	1.2E+12	4E+8	0	150	1	0
***95**	65536	0.25043506	0.25043506	7.5E+11	1	-90	0	1.5E+12	5E+9	1	150	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***96**	65536	0.25043506	0.25043506	7.5E+11	1	-90	0	1.5E+12	5E+9	1	90	1	0
***97**	65536	0.30000005	0.30000005	4.5E+12	1	-25	0	9E+12	1E+10	2.8	65	1	0
***98**	65536	0.6050001	0.6050001	2E+12	1	-30	0	4E+12	2E+10	1	90	1	0
***99**	65536	0.6050001	0.6050001	3E+12	1	-30	0	6E+12	1E+11	1	150	1	0
***100**	65536	0.16050001	0.16050001	1.25E+13	1	-60	0	2.5E+13	1E+11	1	150	1	0
***101**	65536	0.75000005	0.75000005	1.5E+12	1	-30	0	3E+12	1E+10	1	150	1	0
***102**	65536	0.0745055	0.0745055	1.5E+12	1	-90	0	3 E+12	5E+9	1	90	1	0
***103**	65536	0.210005	0.210005	7.5E+11	1	-90	0	1.5E+12	5E+9	1	30	1	0
***104**	65536	0.28043506	0.28043506	7.5E+11	1	-90	0	1.5E+12	5E+9	1	90	1	0
***105**	65536	0.310005	0.310005	7.5E+11	1	-90	0	1.5E+12	5E+9	1	30	1	0
***106**	65536	0.18	0.18	7.5E+8	1	-25	0	1.5E+9	5E+6	1	36	1	0
***107**	65536	0.310005	0.310005	7.5E+11	1	-90	0	1.5E+12	5E+9	0	30	1	0
***108**	65536	0.60043506	0.60043506	4.575E+11	1	-90	0	9.15E+11	5E+9	1	90	1	0
***109**	65536	0.8	0.8	5E+10	1	0	0	1E+11	3.15E+9	1	135	1	0
***110**	65536	0.45001	0.45001	1.5E+12	1	-90	0	3E+12	5E+9	1.5	90	1	0
***111**	65536	0.45001	0.45001	1.5E+12	1	-90	0	3E+12	5E+9	1.7	90	1	0
***112**	65536	0.45001	0.45001	1.5E+12	1	-90	0	3E+12	5E+9	1	90	1	0
***112A**	3800	-0.6	-0.9	6E+11	1	0	0	1.2E+12	4E+9	1	90	1	0
***113**	65536	0.1510001	0.1510001	1.5E+12	1	0	0	3E+12	5E+9	1	90	1	0
***114**	65536	0.1510001	0.1510001	1.5E+12	1	0	0	3E+12	5E+9	0	90	1	0
***115**	65536	0.0205	0.0205	6.4E+4	1	0	0	1.28E+5	2.58E+4	1	90	1	0
***116**	65536	0.8	0.8	3E+12	1	0	0	6E+12	6E+10	1	90	1	0
***116A**	19700	0.8	-11.64201	3E+11	1	0	0	6E+11	1.89E+10	1	120	1	0
***117**	65536	0.80045055	0.80045055	1.5E+12	1	-90	0	3 E+12	5E+9	1	90	1	0
***118**	65536	0.54200005	0.54200005	1.5E+12	1	-30	0	3E+12	1E+10	1	150	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ƛ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***118A**	8200	0.6105	-0.760001	1.2E+11	1	0	0	2.4E+11	8E+8	1	75	1	0
***119**	65536	0.6050001	0.6050001	3E+12	1	-30	0	6E+12	1E+11	1	120	1	0
***120**	65536	0.25	0.25	4.5E+10	1	0	0	9E+10	3.15E+9	1	135	1	0
***120A**	4000	0.6109	-16.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***121**	65536	0.85	0.85	5E+10	1	0	0	1E+11	3.15E+9	1	135	1	0
***121A**	19700	0.6109	-7.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***121B**	19700	0.6109	-16.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***121C**	6000	0.6109	-16.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***121B1**	19700	0.3021	-16.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***121B2**	21240	0.7	-0.75	6E+12	1	0	0	1.2E+13	5E+10	1	75	1	0
***122**	65536	0.45001	0.45001	1.5E+12	1	-90	0	3E+12	5E+9	0	90	1	0
***123**	65536	0.60001	0.60001	1.5E+12	1	-90	0	3E+12	5E+9	1.4	90	1	0
***124**	65536	0.3	0.3	2.1E+11	1	0	0	4.2E+11	1.4E+9	2.4667	90	1	0
***124A**	6000	0.6109	-21.201	3E+11	1	0	0	6E+11	6E+9	1	120	1	0
***125**	65536	0.10003506	0.10003506	7.5E+11	1	-90	0	1.5E+12	5E+9	0.001	90	1	0
***126**	65536	0.5505	0.5505	1.5E+12	1	-30	0	3E+12	5E+9	1	120	1	0
***127**	65536	0.5505	0.5505	1.5E+12	1	-30	0	3E+12	5E+9	1	90	1	0
***128**	19700	0.453	-11.64201	6E+10	1	0	0	1.2E+11	6E+8	1	120	1	0
***129**	30000 (только ячейки с 23 по 10000. Остальные отключить)	- (1E-5)	- (1E-5)	6500	1	0	0	1.4E+5	475	1	-105	1	0
***130**	41000	-0.59	-0.632	1500	1	0	0	88000	300	1	-90	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ϰ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
***131**	35000	-0.695	-0.675	1500	1	0	0	600000	2000	1	90	1	0
***132**	γ'^1_i=0.6125 для ячеек с 23 по 36601; γ'^2_i= - (1E-7) для ячеек с 36602 по 40113; γ'^3_i= (0.636) для ячеек с 40114 по 48253; γ'^4_i= (0.628) для ячеек с 48254 по 65536.			1500	1	0	0	70000	255	1	-105	1	0
***133**	γ'^1_i= - 0.63 для ячеек с 23 по 10023; γ'^2_i= - 0.6285 для ячеек с 10024 по 20023; γ'^3_i= - 0.6235 для ячеек с 20024 по 30023;			1500	1	0	0	72000	243	1	90	1	0

Fig. #	ſ	γ'^1_i	γ'^2_i	N_h^*	σ	ϰ	B	N_{zm}	ζ	∀	A	Ə	γ''_i
	γ'^4_i= -0.6214 для ячеек с 30024 по 40023; γ'^5_i= -0.6205 для ячеек с 40024 по 50023; γ'^6_i= -0.6153 для ячеек с 50024 по 56000.												
***134**	**65536**	0.61	0.61	330	1	0	0	66000	220	1	-90	1	0
***135**	**65536**	0.61	0.61	330	1	0	0	66000	220	1	-90	1	0