



ISTVÁN G. KOCSIS  
NIKOLA TESLA'S  
LIFE AND WORK

## Nikola Tesla's Life And Work

This brief, systematic summary, designed as a map, will familiarize the reader through quotations with one of the greatest minds of our history; Nikola Tesla's life and work.

Like the cognition of every human life, Tesla's also starts with the cognition of his parents, since one's genetic endowments are a key determinant of one's future life and opportunities. Beyond the genetic determination we can also get to know his unique, mechanical world view that was created by the extraordinary upbringing of his and the potential of his outstanding talents, whose correctness are entirely confirmed by the results of today's neuroscience, human perception and examination of mental functions. However mention will be made of his life's events that belong clearly to a more advanced, universal consciousness, that is evidence of the interventions of the Creator.

The genetic capabilities, the constant development of exceptional abilities, widespread literacy, technical studies, as well as logical thinking and common sense and due to the unquenchable desire to truly understand Nature, Nikola Tesla became a researcher, who always verified through experiments the findings that lay beneath his theories, thus making him a true naturalist, a cultivator of positive science.

As a result of this, figuratively speaking he soon found the thread of knowledge, and furling it up systematically he became an outstanding figure and a founder of fields such as the AC power supply, electric lighting, high-voltage high-frequency technology, resonant power conversion, single wire or "wireless" power and information transmission, remote control and robotics, particle physics, electro therapy, harnessing renewable energy sources, radio-astronomy, tele-geodynamics, fluid mechanics, interstellar transmission of information and energy, transmutation of elements and the creation of the unified theory of natural forces.

The map below shows the most significant stages of Nikola Tesla's life and work and those connections that led to a more and more diverse knowledge, discoveries and inventions. Beyond the aforementioned genetic endowments, acquired knowledge and enhanced capabilities, Nikola Tesla's work is particularly defined by the discovery and wide spread applications of the rotating magnetic field and the high-voltage high-frequency currents, and within that the emphasized importance of single wire or "wireless" transmission of information and electrical energy. The steps of the expansion of his knowledge can clearly be seen in his career and makes the proper function and real purpose of his often misunderstood and misinterpreted inventions understandable.

The map is designed chronologically but it needs to be noted that Nikola Tesla was working for months, years or even decades on an idea, invention or discovery. It is worth noticing that some of these are based on childhood experiences or on previous works of his, as he has also mentioned in his writings, therefore the development of these can be followed from the early beginnings until the point where they came true.

His work is divided into two parts for the sake of clarity; the achievements of his inventive and scientific knowledge, of course in reality they happened simultaneously, in parallel with each other, this is why they are also marked with light blue on the illustration. Temporal differences between events are shown with slight rightward and downward positioning. One of the most important direction in Nikola Tesla's oeuvre is harnessing the energies of Natur, this is why this activity is marked with \*. Although some references consist of parts of lectures, articles and autobiographical works, one shall read all of his patent's descriptions to know the full oeuvre of his. This can be a great help especially for those who are interested in science, fg. university students, engineers and researchers. I personally highly recommend it to those who have interest in any field of technic or science.

In order to facilitate the navigation, the elements of the map and the numerically corresponding citations, as well as they references are mutually connected to each other. Clicking on the map will open the citations, the number of citation will open his reference and vice versa, whereas clicking on the ↑ will navigate to the map.

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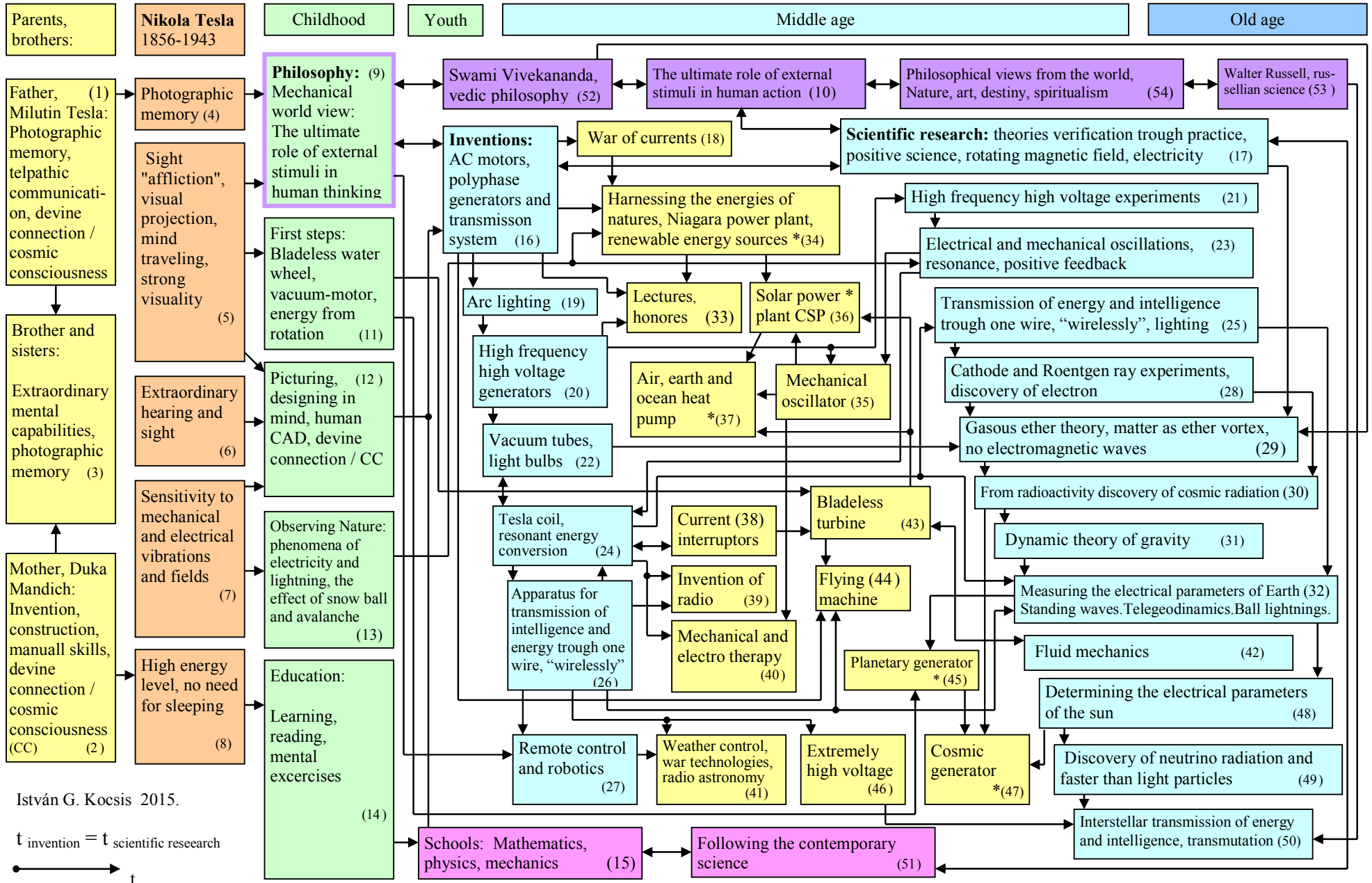
For more actual information please visite Nikola Tesla's facebook page:

<https://www.facebook.com/pages/Nikola-Tesla/112596765455228?ref=hl>

Special thanks to Mr. György Kocsis Jr. for the english version of this preface.



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István G. Kocsis 2015.

$t_{invention} = t_{scientific\ research}$

→ t

**(1) Parents, his father, Milutin Tesla:**

a) "(My father) was the son of an officer who served in the army of the Great Napoleon and in common with his brother, professor of mathematics in a prominent institution, had received a military education; but, singularly enough, later embraced the clergy in which vocation he achieved eminence. He was a very erudite man, a veritable natural philosopher, poet and writer and his sermons were said to be as eloquent as those of Abraham a-Sancta-Clara. He had a prodigious memory and frequently recited at length from works in several languages. He often remarked playfully that if some of the classics were lost he could restore them. His style of writing was much admired. He penned sentences short and terse and full of wit and satire. The humorous remarks he made were always peculiar and characteristic." ↑

b) "He had the odd habit of talking to himself and would often carry on an animated conversation and indulge in heated argument, changing the tone of his voice. A casual listener might have sworn that several people were in the room." ↑



Milka



Angelina



Marica



Father, Milutin Tesla, his sisters and Nikola Tesla in the age of 23

From Nikola Tesla's mother and brother there wasn't made any photograph in they life

**(2) Parents, his mother, Duka Mandich:**

a) "My mother descended from one of the oldest families in the country and a line of inventors. Both her father and grandfather originated numerous implements for household, agricultural and other uses. She was a truly great woman, of rare skill, courage and fortitude, who had braved the storms of life and passed through many a trying experience." ↑

b) "My mother was an inventor of the first order and would, I believe, have achieved great things had she not been so remote from modern life and its multifold opportunities. She invented and constructed all kinds of tools and devices and wove the finest designs from thread which was spun by her. She even planted the seeds, raised the plants and separated the fibers herself. She worked indefatigably, from break of day till late at night, and most of the wearing apparel and furnishings of the home were the product of her hands. When she was past sixty, her fingers were still nimble enough to tie three knots in an eyelash." ↑

c) "At this time, as at many other times in the past, my thoughts turned towards my Mother's teaching. The gift of mental power comes from God, Divine Being, and if we concentrate our minds on that truth, we become in tune with this great power." ↑

**(3) Brother:**

"I had a brother who was gifted to an extraordinary degree; one of those rare phenomena of mentality which biological investigation has failed to explain. His premature death left my earth parents disconsolate. (I will explain my remark about my "earth parents" later.)" ↑

**(4) Photographic memory:**

"It was nothing for me to read from memory the contents of an entire book, with every word between the covers, from the first to the last. My sister and brother, however, could do much better than myself. I would like to know whether any of you has that kind of memory. It is curious, entirely visual and retroactive. To be explicit - when I made my exams, I had always to read the books three or four days if not a week before, because in that time I could reconstruct the images and visualize them; but if I had an examination the next day after reading, images were not clear and the remembrance was not quite complete." ↑

**(5) Sight "affliction", visual projection, mind traveling, strong visuality:**

a) "In my boyhood I suffered from a peculiar affliction due to the appearance of images, often accompanied by strong flashes of light, which marred the sight of real objects and interfered with my thoughts and action. They were pictures of things and scenes which I had really seen, never of those imagined. When a word was spoken to me the image of the object it designated would present itself vividly to my vision and sometimes I was quite unable to distinguish whether what I saw was tangible or not." ↑

b) "As I performed these mental operations for the second or third time, in order to chase the appearances from my vision, the remedy gradually lost all its force. Then I instinctively commenced to make excursions beyond the limits of the small world of which I had knowledge, and I saw new scenes. These were at first very blurred and indistinct, and would flit away when I tried to concentrate my attention upon them. They gained in strength and distinctness and finally assumed the concreteness of real things. I soon discovered that my best comfort was attained if I simply went on in my vision further and further, getting new impressions all the time, and so I began to travel; of course, in my mind." ↑

c) "When I close my eyes I invariably observe first, a background of very dark and uniform blue, not unlike the sky on a clear but starless night. In a few seconds this field becomes animated with innumerable scintillating flakes of green, arranged in several layers and advancing towards me. Then there appears, to the right, a beautiful pattern of two systems of parallel and closely spaced lines, at right angles to one another, in all sorts of colors with yellow, green, and gold predominating. Immediately thereafter, the lines grow brighter and the whole is thickly sprinkled with dots of twinkling light. This picture moves slowly across the field of vision and in about ten seconds vanishes on the left, leaving behind a ground of rather unpleasant and inert gray until the second phase is reached. Every time, before falling asleep, images of persons or objects flit before my view. When I see them I know I am about to lose consciousness. If they are absent and refuse to come, it means a sleepless night." ↑

**(6) Extraordinary sight and hearing:**

a) "My sight and hearing were always extraordinary. I could clearly discern objects in the distance when others saw no trace of them. Several times in my boyhood I saved the houses of our neighbors from fire by hearing the faint crackling sounds which did not disturb their sleep, and calling for help. In 1899, when I was past forty and carrying on my experiments in Colorado, I could hear very distinctly thunderclaps at a distance of 550 miles. My ear was thus over thirteen times more sensitive, yet at that time I was, so to speak, stone deaf in comparison with the acuteness of my hearing while under the nervous strain.

In Budapest I could hear the ticking of a watch with three rooms between me and the time-piece. A fly alighting on a table in the room would cause a dull thud in my ear." ↑

b) "But we are all meat machines and it happens that I am a much more sensitive machine than other people and I receive impressions to which they are inert, and I can both understand and interpret these impressions. I am simply a finer automaton than others." ↑

**(7) Sensitivity to mechanical oscillations and electrical fields:**

"A carriage passing at a distance of a few miles fairly shook my whole body. The whistle of a locomotive twenty or thirty miles away made the bench or chair on which I sat, vibrate so strongly that the pain was unbearable. The ground under my feet trembled continuously. I had to support my bed on rubber cushions to get any rest at all. The roaring noises from near and far often produced the effect of spoken words which would have frightened me had I not been able to resolve them into their accumulated components. The sun rays, when periodically intercepted, would cause blows of such force on my brain that they would stun me. I had to summon all my will power to pass under a bridge or other structure, as I experienced the crushing pressure on the skull. In the dark I had the sense of a bat, and could detect the presence of an object at a distance of twelve feet by a peculiar creepy sensation on the forehead."

"When I drop little squares of paper in a dish filled with liquid, I always sense a peculiar and awful taste in my mouth." ↑



Sitting before his high frequency coil Nikola Tesla reading Roger Boscovich's book, *Theoria Philosophiae Naturalis*, in his laboratory on East Houston Street, in New York ↑

**(8) High energy level, sleeplessness:**

a) "Of all things I liked books best. My father had a large library and whenever I could manage I tried to satisfy my passion for reading. He did not permit it and would fly in a rage when he caught me in the act. He hid the candles when he found that I was reading in secret. He did not want me to spoil my eyes. But I obtained tallow, made the wicking and cast the sticks into tin forms, and every night I would bush the keyhole and the cracks and read, often till dawn, when all others slept and my mother started on her arduous daily task." ↑

b) "Sometimes I doze for an hour or so," he said, "and once in a long time – perhaps once in a year – I have a long sleep of five, six or seven hours. When I awake from that I am so full of energy that I have to work it off."

c) "Sleep? I scarcely ever sleep. I come of a long-lived family, but it is noted for its poor sleepers. I expect to match the records of my ancestors and live to be at least 100." ↑

"My sleeplessness does not worry me. Sometimes I doze for an hour or so. Occasionally, however, once in a few months, I may sleep for four or five hours. Then I awaken virtually charged with energy, like a battery. Nothing can stop me after such a night. I feel great strength then. There is no doubt about it but that sleep is a restorer, a vitalizer, that it increases energy. But on the other hand, I do not think it is essential to one's well being, particularly if one is habitually a poor sleeper." ↑

"Today, at 77, as a result of a well regulated life, sleeplessness notwithstanding, I have an excellent certificate of health. I never felt better in my life. I am energetic, strong, in full possession of all my mental facilities. In my prime I did not possess the energy I have today. And what is more, in solving my problems I use but a small part of the energy I possess, for I have learned how to conserve it. Because of my experience and knowledge gained through the years, my tasks are much lighter. Contrary to general belief, work comes easier for older people if they are in good health, because they have learned through years of practice how to arrive at a given place by the shortest path." ↑

**(9) Philosophy, mechanical world view, the ultimate role of external stimuli in human thinking:**

a) "A long time ago, when I was a boy, I was afflicted with a singular trouble, which seems to have been due to an extraordinary excitability of the retina. It was the appearance of images which, by their persistence, marred the vision of real objects and interfered with thought. When a word was said to me, the image of the object which it designated would appear vividly before my eyes, and many times it was impossible for me to tell whether the object I saw was real or not. This caused me great discomfort and anxiety, and I tried hard to free myself of the spell." ↑

b) "The incessant mental exertion developed my powers of observation and enabled me to discover a truth of great importance. I had noted that the appearance of images was always preceded by actual vision of scenes under peculiar and generally very exceptional conditions, and I was impelled on each occasion to locate the original impulse. After a while this effort grew to be almost automatic and I gained great facility in connecting cause and effect." ↑

c) "I noted, namely, that whenever the image of an object appeared before my eyes I had seen something which reminded me of it. In the first instances I thought this to be purely accidental, but soon I convinced myself that it was not so. A visual impression, consciously or unconsciously received, invariably preceded the appearance of the image. Gradually the desire arose in me to find out, every time, what caused the images to appear, and the satisfaction of this desire soon became a necessity. The next observation I made was that, just as these images followed as a result of something I had seen, so also the thoughts which I conceived were suggested in like manner. Again, I experienced the same desire to locate the image which caused the thought, and this search for the original visual impression soon grew to be a second nature. My mind became automatic, as it were, and in the course of years of continued, almost unconscious performance, I acquired the ability of locating every time and, as a rule, instantly the visual impression which started the thought." ↑

**(10) The ultimate role of external stimuli in human thinking and action:**

a) "Nor is this all. It was not long before I was aware that also all my movements were prompted in the same way, and so, searching, observing, and verifying continuously, year after year, I have, by every thought and every act of mine, demonstrated, and do so daily, to my absolute satisfaction, that I am an automaton endowed with power of movement, which merely responds to external stimuli beating upon my sense organs, and thinks and acts and moves accordingly. I remember only one or two cases in all my life in which I was unable to locate the first impression which prompted a movement or a thought, or even a dream." ↑

b) "1. The human being is a self-propelled automaton entirely under the control of external influences. Willful and predetermined though they appear, his actions are governed not from within, but from without. He is like a float tossed about by the waves of a turbulent sea.

2: There is no memory or retentive faculty based on lasting impression. What we designate as memory is but increased responsiveness to repeated stimuli.

3. It is not true, as Descartes taught, that the brain is an accumulator. There is no permanent record in the brain, there is no stored knowledge. Knowledge is something akin to an echo that needs a disturbance to be called into being." ↑

**(11) First steps of invention, bladeless water wheel, vacuum-motor, energy from rotational bodies:**

a) "In my next attempt, I seem to have acted under the first instinctive impulse which later dominated me - to harness the energies of nature to the service of man. I did this through the medium of May bugs, or June bugs as they are called in America, which were a veritable pest in that country and sometimes broke the branches of trees by the sheer weight of their bodies. The bushes were black with them. I would attach as many as four of them to a cross-piece, rotably arranged on a thin spindle, and transmit the motion of the same to a large disc and so derive considerable "power." These creatures were remarkably efficient, for once they were started, they had no sense to stop and continued whirling for hours and hours and the hotter it was, the harder they worked."

b) "Shortly thereafter, I went into the manufacture of a kind of pop-gun which comprised a hollow tube, a piston, and two plugs of hemp." ↑

c) "If I remember rightly, I then took to carving swords from pieces of furniture which I could conveniently obtain." ↑

d) "The pump incident, of which I have been told, had set afire my youthful imagination and impressed me with the boundless possibilities of a vacuum. I grew frantic in my desire to harness this inexhaustible energy but for a long time I was groping in the dark. Finally, however, my endeavors crystallized in an invention which was to enable me to achieve what no other mortal ever attempted. Imagine a cylinder freely rotatable on two bearings and partly surrounded by a rectangular trough which fits it perfectly. The open side of the trough is enclosed by a partition so that the cylindrical segment within the enclosure divides the latter into two compartments entirely separated from each other by air-tight sliding joints. One of these compartments being sealed and once for all exhausted, the other remaining open, a perpetual rotation of the cylinder would result. At least, so I thought." ↑

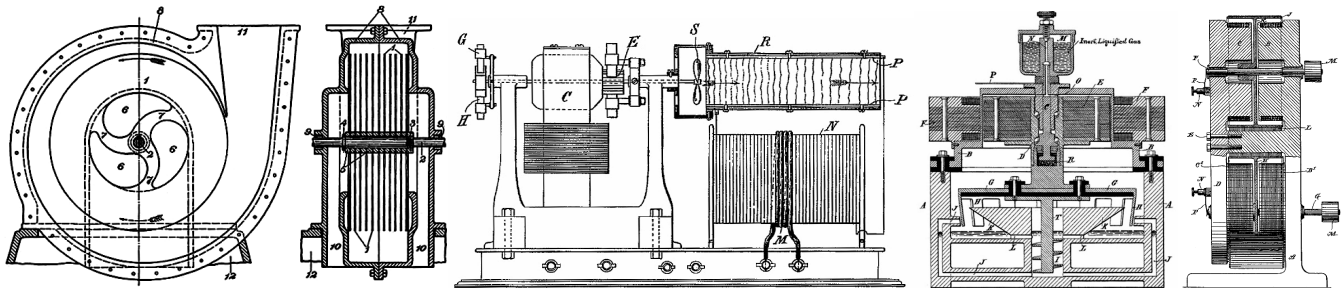
e) "Still another scheme, far more important and attractive, was to derive power from the rotational energy of terrestrial bodies." ↑



**(12) Picturing, designing in mind, human CAD, devine connection / cosmic consciousness (CC):**

a) "Then I observed to my delight that I could visualize with the greatest facility. I needed no models, drawings or experiments. I could picture them all as real in my mind. Thus I have been led unconsciously to evolve what I consider a new method of materializing inventive concepts and ideas, which is radially opposite to the purely experimental and is in my opinion ever so much more expeditious and efficient." ↑

b) "When I get an idea, I start at once building it up in my imagination. I change the construction, make improvements and operate the device in my mind. It is absolutely immaterial to me whether I run my turbine in thought or test it in my shop. I even note if it is out of balance. There is no difference whatever; the results are the same. In this way I am able to rapidly develop and perfect a conception without touching anything. When I have gone so far as to embody in the invention every possible improvement I can think of and see no fault anywhere, I put into concrete form this final product of my brain. Invariably my device works as I conceived that it should, and the experiment comes out exactly as I planned it." ↑



Drawings from Nikola Tesla's patents no. US1,061,142; US568,177; US611,719; US406,968

c) "But instinct is something which transcends knowledge. We have, undoubtedly, certain finer fibers that enable us to perceive truths when logical deduction, or any other willful effort of the brain, is futile." ↑

d) "At that moment, when my situation seemed absolutely hopeless, I experienced one of those flashes of light and the structure above me appeared before my vision." ↑

e) "I passed through dreadful diseases and met with all kinds of odd mishaps and that I am whole and hearty today seems like a miracle. But as I recall these incidents to my mind I feel convinced that my preservation was not altogether accidental, but was indeed the work of divine power." ↑

**(13) Observing Nature, phenomena of electricity and lightning, the effect of snow ball and avalanche:**

a) "I was fascinated by a description of Niagara Falls I had perused, and pictured in my imagination a big wheel run by the falls. I told my uncle that I would go to America and carry out this scheme. Thirty years later I was able to see my ideas carried out at Niagara and marveled at the unfathomable mystery of the mind." ↑

b) "As I review the events of my past life I realize how subtle are the influences that shape our destinies. An incident of my youth may serve to illustrate. One winter's day I managed to climb a steep mountain, in company with other boys. The snow was quite deep and a warm southerly wind made it just suitable for our purpose. We amused ourselves by throwing balls which would roll down a certain distance, gathering more or less snow, and we tried to out-do one another in this sport. Suddenly a ball was seen to go beyond the limit, swelling to enormous proportions until it became as big as a house and plunged thundering into the valley below with a force that made the ground tremble. I looked on spellbound incapable of understanding what had happened. For weeks afterward the picture of the avalanche was before my eyes and I wondered how anything so small could grow to such an immense size.

Ever since that time the magnification of feeble actions fascinated me, and when, years later, I took up the experimental study of mechanical and electrical resonance, I was keenly interested from the very start. Possibly, had it not been for that early powerful impression I might not have followed up the little spark I obtained with my coil and never developed my best invention." ↑



**(14) Education, learning, reading, mental exercises:**

a) "Of all things I liked books best. My father had a large library and whenever I could manage I tried to satisfy my passion for reading." ↑

b) "I was also passionately fond of mathematical studies and often won the professor's praise for rapid calculation. This was due to my acquired facility of visualizing the figures and performing the operation, not in the usual intuitive manner, but as in actual life. Up to a certain degree of complexity it was absolutely the same to me whether I wrote the symbols on the board or conjured them before my mental vision. But freehand drawing, to which many hours of the course were devoted, was an annoyance I could not endure. This was rather remarkable as most of the members of the family excelled in it." ↑

c) "Although I must trace to my mother's influence whatever inventiveness I possess, the training he gave me must have been helpful. It comprised all sorts of exercises - as, guessing one another's thoughts, discovering the defects of some form of expression, repeating long sentences or performing mental calculations. These daily lessons were intended to strengthen memory and reason, and especially to develop the critical sense, and were undoubtedly very beneficial." ↑

d) "In the course of time this vigorous mental exercise became second to nature. At the outset my wishes had to be subdued but gradually desire and will grew to be identical. After years of such discipline I gained so complete a mastery over myself that I toyed with passions which have meant destruction to some of the strongest men." ↑

**(15) Schools, matematics, physics:**

a) "In the department of physics were various models of classical scientific apparatus, electrical and mechanical. The demonstrations and experiments performed from time to time by the instructors fascinated me and were undoubtedly a powerful incentive to invention." ↑

b) "My first year's showing had won me the appreciation and friendship of several professors. Among these, Professor Rogner, who was teaching arithmetical subjects and geometry; Professor Poeschl, who held the chair of theoretical and experimental physics, and Dr. Alle, who taught integral calculus and specialized in differential equations. This scientist was the most brilliant lecturer to whom I ever listened. He took a special interest in my progress and would frequently remain for an hour or two in the lecture room, giving me problems to solve, in which I delighted." ↑

**(16) Inventions, AC motors and generators, the polyphase transmission system:**

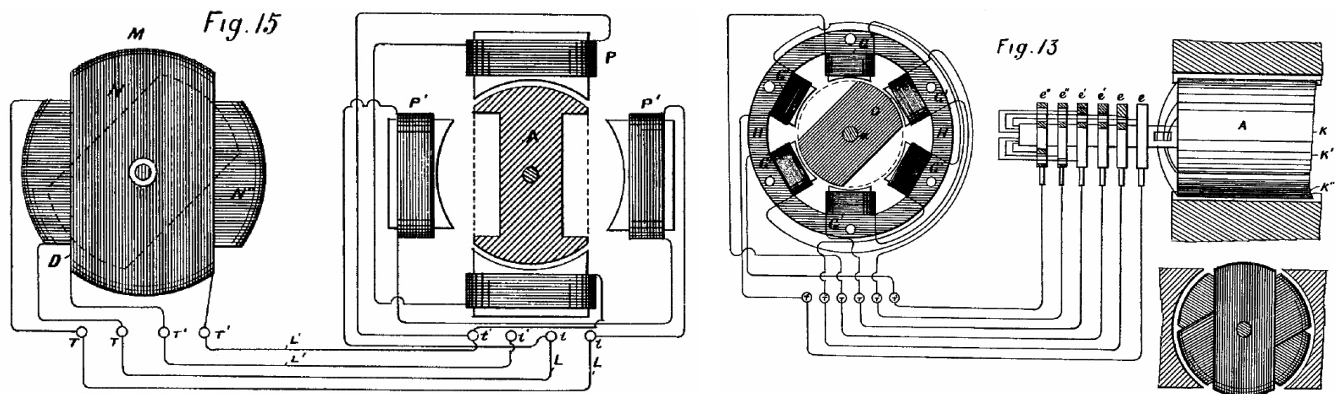
a) "I must dwell, however reluctantly, on the impressions of my youth and the circumstances and events which have been instrumental in determining my career. Our first endeavors are purely instinctive promptings of an imagination vivid and undisciplined. As we grow older, reason asserts itself and we become more and more systematic and designing. But those early impulses, though not immediately productive, are of the greatest moment and may shape our very destinies. Indeed, I feel now that had I understood and cultivated instead of suppressing them, I would have added substantial value to my bequest to the world. But not until I had attained manhood did I realize that I was an inventor." ↑

b) "I started by first picturing in my mind a direct-current machine, running it and following the changing flow of the currents in the armature. Then I would imagine an alternator and investigate the progresses taking place in a similar manner. Next I would visualize systems comprising motors and generators and operate them in various ways.

The images I saw were to me perfectly real and tangible. All my remaining term in Gratz was passed in intense but fruitless efforts of this kind, and I almost came to the conclusion that the problem was insolvable." ↑

c) "It was in that city that I made a decided advance, which consisted in detaching the commutator from the machine and studying the phenomena in this new aspect, but still without result." ↑

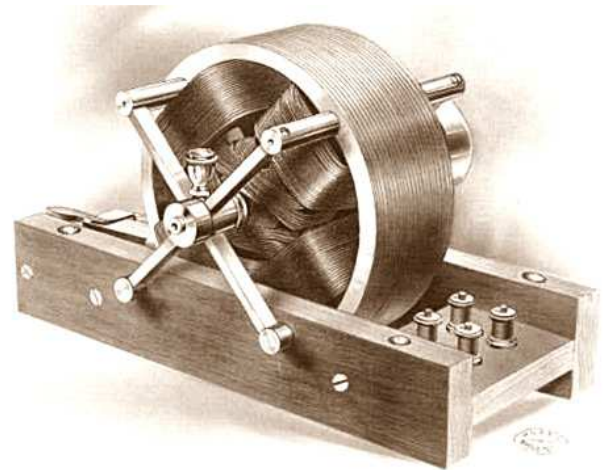
d) "In attacking the problem again, I almost regretted that the struggle was soon to end. I had so much energy to spare. When I undertook the task, it was not with a resolve such as men often make. With me it was a sacred vow, a question of life and death. I knew that I would perish if I failed. Now I felt that the battle was won. Back in the deep recesses of the brain was the solution, but I could not yet give it outward expression." ↑



AC motor drawing from Nikola Tesla's patent no. US382,280

e) "One afternoon, which is ever present in my recollection, I was enjoying a walk with my friend in the City Park and reciting poetry. At that age, I knew entire books by heart, word for word. One of these was Goethe's Faust. The sun was just setting and reminded me of the glorious passage:

"Sie rückt und weicht, der Tag ist überlebt,  
 Dort eilt sie hin und fordert neues Leben.  
 Oh, das kein Flügel mich vom Boden hebt  
 Ihr nach und immer nach zu streben!  
 Ein schöner Traum indessen sie entweicht,  
 Ach, au des Geistes Flügelin wird so leicht  
 Kein körperlicher Flügel sich gesellen!"



Tesla's AC motor

As I uttered these inspiring words the idea came like a flash of lightning and in an instant the truth was revealed. I drew with a stick on the sand, the diagram shown six years later in my address before the American Institute of Electrical Engineers, and my companion understood them perfectly. The images I saw were wonderfully sharp and clear and had the solidity of metal and stone, so much so that I told him, "See my motor here; watch me reverse it." I cannot begin to describe my emotions. Pygmalion seeing his statue come to life could not have been more deeply moved. A thousand secrets of nature which I might have stumbled upon accidentally, I would have given for that one which I had wrested from her against all odds and at the peril of my existence."↑

**(17) Scientific research, verification of theories in practice, positive science, rotating magnetic field and electromotive force:**

a) "The mind is sharper and keener in seclusion and uninterrupted solitude. No big laboratory is needed in which to think. Originality thrives in seclusion free of outside influences beating upon us to cripple the creative mind. Be alone, that is the secret of invention; be alone, that is when ideas are born. That is why many of the earthly miracles have had their genesis in humble surroundings." ↑

b) "Engineering, electrical and mechanical, is positive in results. There is scarcely a subject that cannot be examined beforehand, from the available theoretical and practical data. The carrying out into practice of a crude idea as is being generally done, is, I hold, nothing but a waste of energy, money, and time." ↑

c) "Then again, nature has given me a vivid imagination which, through incessant exercise and training, study of scientific subjects and verification of theories through experiment, has become very accurate and precise, so that I have been able to dispense, to a large extent, with the slow, laborious, wasteful and expensive process of practical development of the ideas I conceive. It has made it possible for me to explore extended fields with great rapidity and get results with the least expenditure of vital energy. By this means I have it in my power to picture the objects of my desires in forms real and tangible and so rid myself of that morbid craving for perishable possessions to which so many succumb." ↑

d) "No subject to which I have ever devoted myself has called for such concentration of mind, and strained to so dangerous a degree the finest fibers of my brain, as the systems of which the "Magnifying Transmitter" is the foundation. I put all the intensity and vigor of youth in the development of the rotating field discoveries, but those early labors were of a different character. Although strenuous in the extreme, they did not involve that keen and exhausting discernment which had to be exercised in attacking the many problems of the wireless." ↑

**(18) War of currents:**

a) "Had the Edison companies not finally adopted my invention they would have been wiped out of existence, and yet not the slightest acknowledgment of my labors has ever been made by any of them, a most remarkable instance of the proverbial unfairness and ingratitude of corporations." ↑

b) "In truth, my system has not only provided energy for all purposes throughout the world but also revolutionized electric lighting and made it a great commercial success by reducing the cost of power and increasing enormously the distance of transmission. The greater part of the \$60,000,000,000 which, according to President Hoover's statement, represented the value of electric business, can be traced to my system and its effect on the lighting and other industries." ↑

**(19) Arc lighting:**

"Immediately thereafter, some people approached me with the proposal of forming an arc light company under my name, to which I agreed. Here finally, was an opportunity to develop the motor, but when I broached the subject to my new associates they said, "No, we want the arc lamp. We don't care for this alternating current of yours." In 1886, my system of arc lighting was perfected and adopted for factory and municipal lighting, and I was free, but with no other possession than a beautifully engraved certificate of stock of hypothetical value." ↑

**(20) High frequency high voltage generators:**

"There are a number of ways in which the current may be varied at a rate exceeding the limit of audition, but probably the most practicable know to me at present is by the use of an alternating-current generator with a large number of poles, and specially constructed for the purpose." ↑

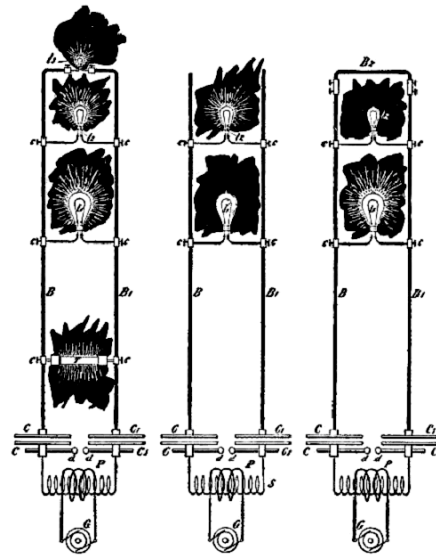
**(21) Experiments with high frequency and high potential:**

"In fact, if our present views be true, the (electrostatic force is the) most important force for us to consider in Nature. As the term *electrostatic* might imply a steady electric condition, it should be remarked, that in these experiments the force is not constant, but varies at a rate which may be considered moderate, about one million times a second, or thereabouts. This enables me to produce many effects which are not producible with an unvarying force." ↑

"I have said before, that when the medium between two oppositely electrified bodies is strained beyond a certain limit it gives way and, stated in popular language, the opposite electric charges unite and neutralize each other. This breaking down of the medium occurs principally when the force acting between the bodies is steady, or varies at a moderate rate. Were the variation sufficiently rapid, such a destructive break would not occur, no matter how great the force, for all the energy would be spent in radiation, convection and mechanical and chemical action." ↑

"It is of special interest for the thinker who inquires into the nature of these forces to note that whereas the actions between individual molecules or atoms occur seemingly under any conditions, the attractions and repulsions of bodies of measurable dimensions imply a medium possessing insulating properties. So, if air, either by being rarefied or heated, is rendered more or less conducting, these actions between two electrified bodies practically cease, while the actions between the individual atoms continue to manifest themselves." ↑

"Among the various current phenomena observed, perhaps the most interesting are those of impedance presented by conductors to currents varying at a rapid rate. In my first paper before the American Institute of Electrical Engineers, I have described a few striking observations of this kind. Thus I showed that when such currents or sudden discharges are passed through a thick metal bar there may be points on the bar only a few inches apart, which have a sufficient potential difference between them to maintain at bright incandescence an ordinary filament lamp." ↑



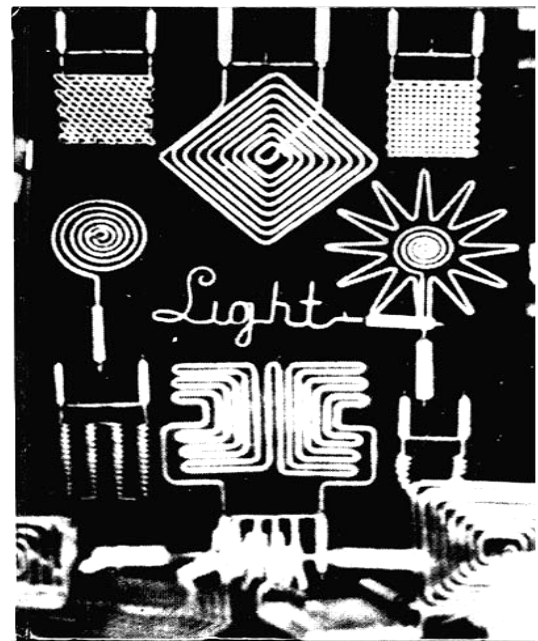
Potential difference on conductors caused by high frequency currents

**(22) Vacuum tubes and light bulbs**

a) "When my tubes were first publicly exhibited, they were viewed with amazement impossible to describe. From all parts of the world, I received urgent invitations and numerous honors and other flattering inducements were offered to me, which I declined. But in 1892 the demand became irresistible and I went to London where I delivered a lecture before the Institution of Electrical Engineers." ↑

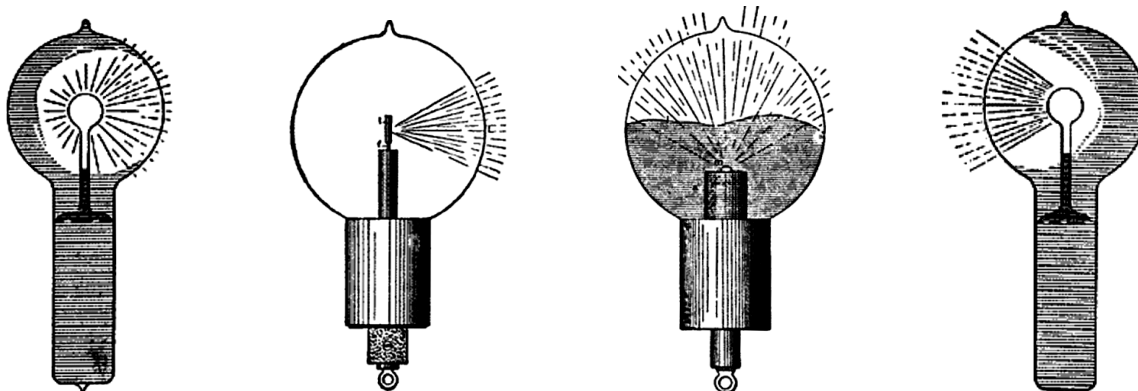
b) "I gained this conviction through the discovery of a singular electrical phenomenon, which I described early in 1892, in lectures delivered before some scientific societies abroad, and which I have called a "rotating brush." This is a bundle of light which is formed, under certain conditions, in a vacuum-bulb, and which is of a sensitiveness to magnetic and electric influences bordering, so to speak, on the supernatural. This light-bundle is rapidly rotated by the earth's magnetism as many as twenty thousand times per second, the rotation in these parts being opposite to what it would be in the southern hemisphere, while in the region of the magnetic equator it should not rotate at all.

In its most sensitive state, which is difficult to attain, it is responsive to electric or magnetic influences to an incredible degree. The mere stiffening of the muscles of the arm and consequent slight electrical change in the body of an observer standing at some distance from it, will perceptibly affect it. When in this highly sensitive state it is capable of indicating the slightest magnetic and electric changes taking place in the earth." ↑



Nikola Tesla's special light bulbs on the Columbian World Fair in Chicago





Nikola Tesla's sensitive indicator or rotating "brush" light

**(23) Electrical and mechanical vibrations, oscillation, resonance, positive feedback:**

a) "It is very likely that resonant vibration plays a most important part in all manifestations of energy in nature. Throughout space all matter is vibrating, and all rates of vibration are represented, from the lowest musical note to the highest pitch of the chemical rays, hence an atom, or complex of atoms, no matter what its period, must find a vibration with which it is in resonance." ↑

b) "In 1856, Lord Kelvin had exposed the theory of the condenser discharge, but no practical application of that important knowledge was made. I saw the possibilities and undertook the development of induction apparatus on this principle." ↑

c) "The question first to answer is, then, whether pure resonance effects are producible. Theory and experiment both show that such is impossible in Nature, for as the oscillation becomes more and more vigorous, the losses in the vibrating bodies and environing media rapidly increase and necessarily check the vibration which otherwise would go on increasing forever. It is a fortunate circumstance that pure resonance is not producible, for if it were there is no telling what dangers might not lie in wait for the innocent experimenter. But to a certain degree resonance is producible, the magnitude of the effects being limited by the imperfect conductivity and imperfect elasticity of the media or, generally stated, by frictional losses. The smaller these losses, the more striking are the effects." ↑

**(24) Tesla coil, resonant energy conversion:**

a) "If my memory serves me right, it was in November, 1890, that I performed a laboratory experiment which was one of the most extraordinary and spectacular ever recorded in the annal of Science. In investigating the behavior of high frequency currents, I had satisfied myself that an electric field of sufficient intensity could be produced in a room to light up electrodeless vacuum tubes. Accordingly, a transformer was built to test the theory and the first trial proved a marvelous success." ↑

b) "Briefly stated in general terms, the plan which I pursue in carrying out my invention is as follows: I employ a generator, preferably, of very high tension and capable of yielding either direct or alternating currents. This generator I connect up with a condenser or conductor of same capacity and discharge the accumulated electrical energy disruptively through an air-space or otherwise into a working circuit containing translating devices and, when required, condensers. These discharges may be of the same direction or alternating and intermittent, succeeding each other more or less rapidly or oscillating to and fro with extreme rapidity. In the working circuit, by reason of the condenser action, the current impulses or discharges of high tension and small volume are converted into currents of lower tension and greater volume. The production and application of a current of such rapid oscillations or alternations (the number may be many millions per second) secure, among others, the following exceptional advantages: First, the capacity of the condensers for a given output is much diminished; second, the efficiency of the condensers is increased and the tendency to become heated reduced, and, third, the range of conversion is enlarged. I have thus succeeded in producing a system of method of conversion radically different from what has been done heretofore – first, with respect to the number of impulses, alternations, or oscillations of current per unit of time, and, second, with respect to the manner in which the impulses are obtained. To express this result, I define the working current as one of an excessively small periode or of an excessively large number of impulses or alternations or oscillations per unit of time, by which I mean not a thousand or even twenty or thirty thousand per second, but many times that number, and one which is made intermittent, alternating, or oscillating of itself without the employment of mechanical devices." ↑

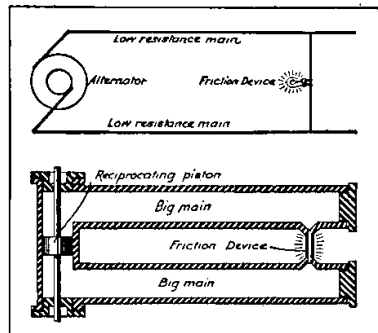
**(25) Transmission of energy and intelligence through one wire, "wirelessly":**

a) "The effects of resonance are being more and more noted by engineers and are becoming of great importance in the practical operation of apparatus of all kinds with alternating currents. A few general remarks may therefore be made concerning these effects. It is clear, that if we succeed in employing the effects of resonance practically in the operation of electric devices the return wire will, as a matter of course, become unnecessary, for the electric vibration may be conveyed with one wire just as well as, and sometimes even better than, with two." ↑

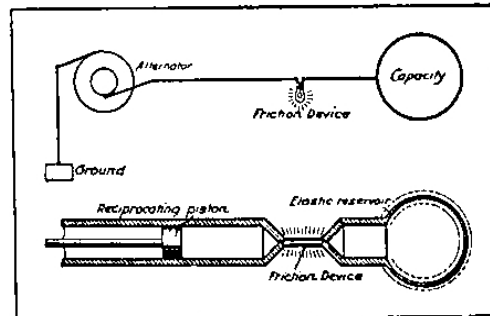
b) "The practical applications of this revolutionary principle have only begun. So far they have been confined to the use of oscillations which are quickly damped out in their passage through the medium. Still, even this has commanded universal attention. What will be achieved by waves which do not diminish with distance, baffles comprehension. It is difficult for a layman to grasp how an electric current can be propagated to distances of thousands of miles without diminution of intensity. But it is simple after all. Distance is only a relative conception, a reflection in the mind of physical limitation. A view of electrical phenomena must be free of this delusive impression. However surprising, it is a fact that a sphere of the size of a little marble offers a greater impediment to the passage of a current than the whole earth. Every experiment, then, which can be performed with such a small sphere can likewise be carried out, and much more perfectly, with the immense globe on which we live. This is not merely a theory, but a truth established in numerous and carefully conducted experiments." ↑

**(26) Apparatus for transmission of intelligence and energy through one wire, "wirelessly":**

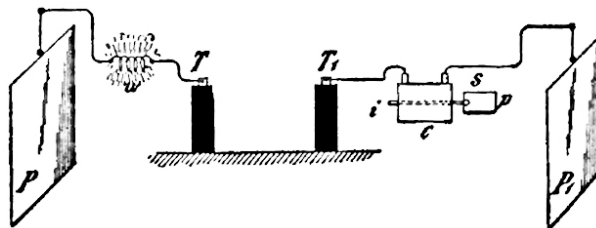
a) "It has been a long time customary, owing to the limited experience with vibratory currents, to consider an electric current as something circulating in a closed conducting path. It was astonishing at first to realize that a current may flow through the interrupted conducting path even if the latter be interrupted, and it was still more surprising to learn, that sometimes it may be even easier to make a current flow under such conditions than through a closed path." ↑



Electric Transmission Thru Two Wires and Hydraulic Analog. Fig. 3.



Electric Transmission Thru a Single Wire Hydraulic Analog. Fig. 4.

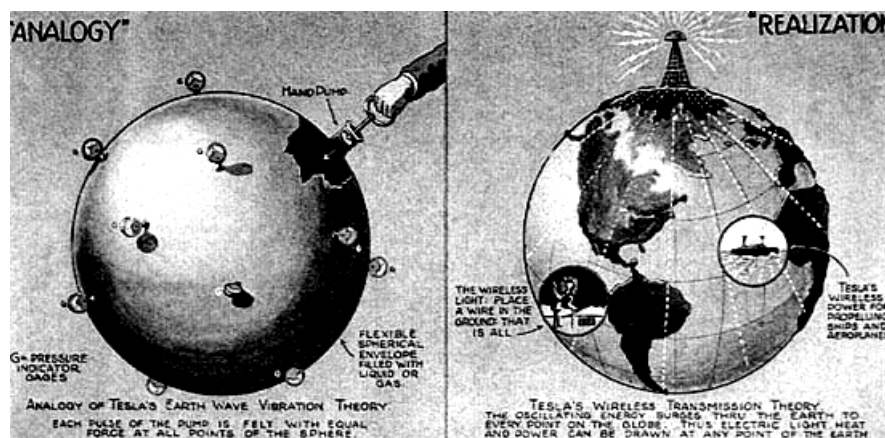


Hydraulic and electric analogy of transmission of energy through two- and one wire

b) "The investigations led to many other valuable observations and results, one of the more important of which was the demonstration of the practicability of supplying electrical energy through one wire without return. At first I was able to transmit in this novel manner only very small amounts of electrical energy, but in this line also my efforts have been rewarded with similar success. To what a degree the appliances have been perfected since my first demonstrations early in 1891 before a scientific society, when my apparatus was barely capable of lighting one lamp (which result was considered wonderful), will appear when I state that I have now no difficulty in lighting in this manner four or five hundred lamps, and could light many more. In fact, there is no limit to the amount of energy which may in this way be supplied to operate any kind of electrical device. After demonstrating the practicability of this method of transmission, the thought naturally occurred to me to use the earth as a conductor, thus dispensing with all wires." ↑

c) "The popular impression is that my wireless work was begun in 1893, but as a matter of fact I spent the two preceding years in investigations, employing forms of apparatus, some of which were almost like those of today. It was clear to me from the very start that the successful consummation could only be brought about by a number of radical improvements. Suitable high frequency generators and electrical oscillators had first to be produced. The energy of these had to be transformed in effective transmitters and collected at a distance in proper receivers. Such a system would be manifestly circumscribed in its usefulness if all extraneous interference were not prevented and exclusiveness secured. In time, however, I recognized that devices of this kind, to be most effective and efficient, should be designed with due regard to the physical properties of this planet and the electrical conditions obtaining on the same." ↑

d) "One of the terminals of the source (of alternating electric currents) would be connected to earth as, for instance, to the city water mains, the other to an insulated body of large surface. It is possible that the outer conducting air strata, or free space, contain an opposite charge and that, together with the earth, they form a condenser of very large capacity. In such case the period of vibration may be very low and an alternating dynamo machine might serve for the purpose of the experiment. I would then transform the current to a potential as high as it would be found possible and connect the ends of the high tension secondary to the ground and to the insulated body. By varying the frequency of the currents and carefully observing the potential of the insulated body and watching for the disturbance at various neighboring points of the earth's surface resonance might be detected. Should, as the majority of scientific men in all probability believe, the period be extremely small, then a dynamo machine would not do and a proper electrical oscillator would have to be produced and perhaps it might not be possible to obtain such rapid vibrations. But whether this be possible or not, and whether the earth contains a charge or not, and whatever may be its period of vibration, it certainly is possible — for of this we have daily evidence — to produce some electrical disturbance sufficiently powerful to be perceptible by suitable instruments at any point of the earth's surface." ↑



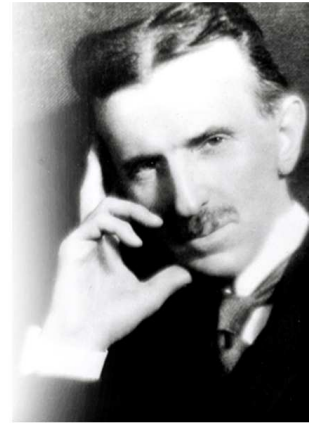
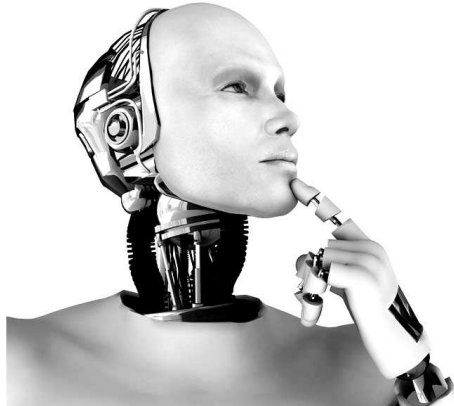
Analogy and realization of Tesla's one wire or "wireless" transmission system

e) "Some ten years ago, I recognized the fact that to convey electric currents to a distance it was not at all necessary to employ a return wire, but that any amount of energy might be transmitted by using a single wire. I illustrated this principle by numerous experiments, which, at that time, excited considerable attention among scientific men. This being practically demonstrated, my next step was to use the earth itself as the medium for conducting the currents, thus dispensing with wires and all other artificial conductors. So I was led to the development of a system of energy transmission and of telegraphy without the use of wires, which I described in 1893. The difficulties I encountered at first in the transmission of currents through the earth were very great. At that time I had at hand only ordinary apparatus, which I found to be ineffective, and I concentrated my attention immediately upon perfecting machines for this special purpose. This work consumed a number of years, but I finally vanquished all difficulties and succeeded in producing a machine which, to explain its operation in plain language, resembled a pump in its action, drawing electricity from the earth and driving it back into the same at an enormous rate, thus creating ripples or disturbances which, spreading through the earth as through a wire, could be detected at great distances by carefully attuned receiving circuits. In this manner I was able to transmit to a distance, not only feeble effects for purposes of signalling, but considerable amounts of energy, and later discoveries I made convince me that I shall ultimately succeed in conveying power without wires, for industrial purposes, with high economy, and to any distance, however great." ↑

**(27) Remote control and robotics:**

a) See also: 9 – 10: "With these experiences it was only natural that, long ago, I conceived the idea of constructing an automaton which would mechanically represent me, and which would respond; as I do myself, but, of course, in a much more primitive manner, to external influences. Such an automaton evidently had to have motive power, organs for locomotion, directive organs, and one or more sensitive organs so adapted as to be excited by external stimuli. This machine would, I reasoned, perform its movements in the manner of a living being, for it would have all the chief mechanical characteristics or elements of the same. There was still the capacity for growth, propagation, and, above all, the mind which would be wanting to make the model complete. But growth was not necessary in this case, since a machine could be manufactured full-grown, so to speak. As to the capacity for propagation, it could likewise be left out of consideration, for in the mechanical model it merely signified a process of manufacture. Whether the automaton be of flesh and bone, or of wood and steel, it mattered little, provided it could perform all the duties required of it like an intelligent being. To do so, it had to have an element corresponding to the mind, which would effect the control of all its movements and operations, and cause it to act, in any unforeseen case that might present itself, with knowledge, reason, judgment, and experience. But this element I could easily embody in it by conveying to it my own intelligence, my own understanding. So this invention was evolved, and so a new art came into existence, for which the name "telautomatics" has been suggested, which means the art of controlling the movements and operations of distant automatons. This principle evidently was applicable to any kind of machine that moves on land or in the water or in the air. In applying it practically for the first time, I selected a boat." ↑

b) "The idea of constructing an automaton, to bear out my theory, presented itself to me early, but I did not begin active work until 1895, when I started my wireless investigations. During the succeeding two or three years, a number of automatic mechanisms, to be actuated from a distance, were constructed by me and exhibited to visitors in my laboratory." ↑

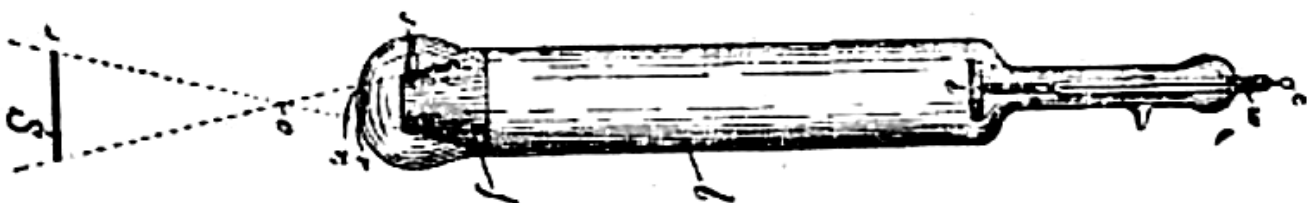


**(28) Cathode and Roentgen ray experiments, discovery of electron:**

a) "It is certainly more in accordance with many phenomena observed with high frequency currents to hold that all space is pervaded with free atoms, rather than to assume that it is devoid of these, and dark and cold, for so it must be, if filled with a continuous medium, since in such there can be neither heat nor light. Is then energy transmitted by independent carriers or by the vibration of a continuous medium? This important question is by no means as yet positively answered. But most of the effects which are here considered, especially the light effects, incandescence, or phosphorescence, involve the presence of free atoms and would be impossible without these." ↑

b) "After repeating Professor Roentgen's beautiful experiments, I have devoted my energies to the investigation of the nature of the radiations and to the perfecting of the means for their production." ↑

c) "The only possible explanation seems to me at present, that the bulb throws out streams of matter in some primary condition, and that the reflection of these streams is dependent upon some fundamental and electrical property of the metals. This would seem to lead to the inference that these streams must be of uniform electrification, that is, that they must be anodic or cathodic in character, but not both." ↑



Nikola Tesla's one wire roentgen tube with reflector



d) "I produced cathodic and other rays of transcending intensity. The effects, according to my view, were due to minute particles of matter carrying enormous electrical charges, which, for want of a better name, I designated as matter not further decomposable. Subsequently those particles were called electrons." ↑

**(29) Gasous ether theory, matter as ether vortex, no electromagnetic waves:**

a) "The demonstration of the fact — which still needs better experimental confirmation — that a vibrating gaseous column possesses rigidity, might greatly modify the views of thinkers. When with low frequencies and insignificant potentials indications of that property may be noted, how must a gaseous medium behave under the influence of enormous electrostatic stresses which may be active in the interstellar space, and which may alternate with inconceivable rapidity? The existence of such an electrostatic, rhythmically throbbing force — of a vibrating electrostatic field — would show a possible way how solids might have formed from the ultra-gaseous uterus, and how transverse and all kinds of vibrations may be transmitted through a gaseous medium filling all space." ↑

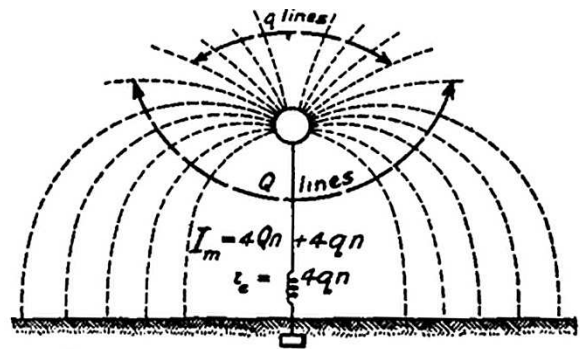
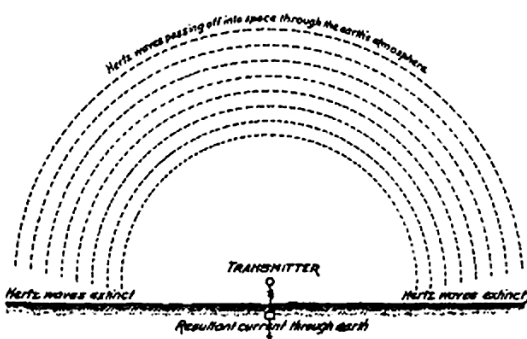
b) "One of the first striking observations made with my tubes was that a purplish glow for several feet around the end of the tube was formed, and I readily ascertained that it was due to the escape of the charges of the particles as soon as they passed out into the air; for it was only in a nearly perfect vacuum that these charges could be confined to them. The coronal discharge proved that there must be a medium besides air in the space, composed of particles immeasurably smaller than those of air, as otherwise such a discharge would not be possible. On further investigation I found that this gas was so light that a volume equal to that of the earth would weigh only about one-twentieth of a pound." ↑

c) "...All perceptible matter comes from a primary substance, of a tenuity beyond conception and filling all space - the Akasa or luminiferous ether - which is acted upon by the life-giving Prana or creative force, calling into existence, in never ending cycles, all things and phenomena." ↑

d) "According to an adopted theory, every ponderable atom is differentiated from a tenuous fluid, filling all space merely by spinning motion, as a whirl of water in a calm lake. By being set in movement this fluid, the ether, becomes gross matter. Its movement arrested, the primary substance reverts to its normal state. It appears, then, possible for man through harnessed energy of the medium and suitable agencies for starting and stopping ether whirls to cause matter to form and disappear, At his command, almost without effort on his part, old worlds would vanish and new ones would spring into being. He could alter the size of this planet, control its seasons, adjust its distance from the sun, guide it on its eternal journey along any path he might choose, through the depths of the universe. He could make planets collide and produce his suns and stars, his heat and light; he could originate life in all its infinite forms. To cause at will the birth and death of matter would be man's grandest deed, which would give him the mastery of physical creation, make him fulfill his ultimate destiny." ↑

e) " Nature has stored up in the universe infinite energy. The eternal recipient and transmitter of this infinite energy is the ether. The recognition of the existence of ether, and of the functions it performs, is one of the most important results of modern scientific research." ↑

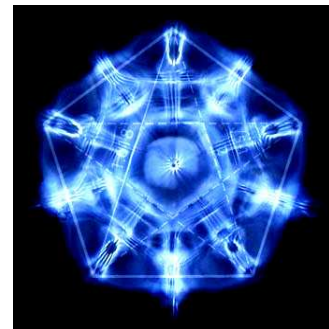
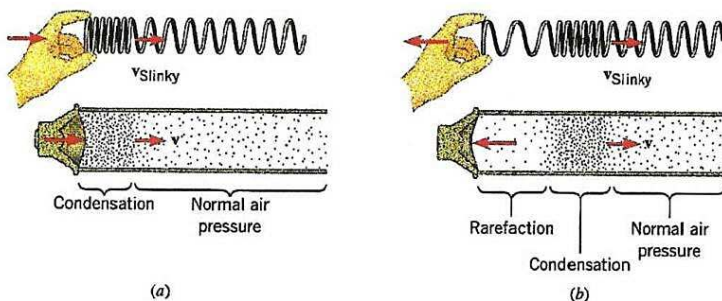
f) "My second discovery was a physical truth of the greatest importance. As I have searched the scientific records in more than half dozen languages for a long time without finding the least anticipation, I consider myself the original discoverer of this truth, which can be expressed by the statement: There is no energy in matter other than that received from the environment." ↑



Electromagnetism as misunderstanding of ether waves, figures from Nikola Tesla's article: The True Wireless

g) "The fascination of the electro-magnetic theory of light, advanced by Maxwell and subsequently experimentally investigated by Hertz, was so great that even now, although controverted, the scientific minds are under its sway. This theory supposed the existence of a medium which was solid, yet permitted bodies to pass through it without resistance; tenuous beyond conception, and yet, according to our conceptions of mechanical principles and ages of experience, such a medium was absolutely impossible. Nevertheless, light was considered essentially a phenomenon bound up in that kind of a medium, namely, one capable of transmitting transverse vibrations like a solid." ↑

h) "Since I described these simple principles of telegraphy without wires I have had frequent occasion to note that the identical features and elements have been used, in the evident belief that the signals are being transmitted to considerable distances by "Hertzian" radiations. This is only one of many misapprehensions to which the investigations of the lamented physicist have given rise. About thirty-three years ago Maxwell, following up a suggestive experiment made by Faraday in 1845, evolved an ideally simple theory which intimately connected light, radiant heat, and electrical phenomena, interpreting them as being all due to vibrations of a hypothetical fluid of inconceivable tenuity, called the ether. No experimental verification was arrived at until Hertz, at the suggestion of Helmholtz, undertook a series of experiments to this effect. Hertz proceeded with extraordinary ingenuity and insight, but devoted little energy to the perfection of his old-fashioned apparatus. The consequence was that he failed to observe the important function which the air played in his experiments, and which I subsequently discovered. Repeating his experiments and reaching different results, I ventured to point out this oversight. The strength of the proofs brought forward by Hertz in support of Maxwell's theory resided in the correct estimate of the rates of vibration of the circuits he used. But I ascertained that he could not have obtained the rates he thought he was getting. The vibrations with identical apparatus he employed are, as a rule, much slower, this being due to the presence of air, which produces a dampening effect upon a rapidly vibrating electric circuit of high pressure, as a fluid does upon a vibrating tuning-fork. I have, however, discovered since that time other causes of error, and I have long ago ceased to look upon his results as being an experimental verification of the poetical conceptions of Maxwell. The work of the great German physicist has acted as an immense stimulus to contemporary electrical research; but it has likewise, in a measure, by its fascination, paralyzed the scientific mind, and thus hampered independent inquiry. Every new phenomenon which was discovered was made to fit the theory, and so very often the truth has been unconsciously distorted." ↑



Rarefaction and condensation in gases caused by longitudinal or sound vibrations, and formation of systems by resonant moving particle, cymatics

i) "I consider this extremely important," said Mr. Tesla. "Light cannot be anything else but a longitudinal disturbance in the ether, involving alternate compressions and rarefactions. In other words, light can be nothing else than a sound wave in the ether."

"This appears clearly," Mr. Tesla explained, "if it is first realized that, there being no Maxwellian ether, there can be no transverse oscillation in the medium. The Newtonian theory, he believes, is in error, because it fails entirely in not being able to explain how a small candle can project particles with the same speed as the blazing sun, which has an immensely higher temperature." "We have made sure by experiment," said Mr. Tesla, "that light propagates with the same velocity irrespective of the character of the source. Such constancy of velocity can only be explained by assuming that it is dependent solely on the physical properties of the medium, especially density and elastic force." ↑

**(30) From the phenomena radioactivity discovering the cosmic radiation:**

a) "First, the highly exhausted bulb emits material streams which, impinging on a metallic surface, are reflected; second, these streams are formed of matter in some primary or elementary condition; third, these material streams are probably the same agent which is the cause of the electro-motive tension between metals in close proximity or actual contact, and they may possibly, to some extent, determine the energy of combination of the metals with oxygen; fourth, every metal or conductor is more or less a source of such streams; fifth, these streams or radiations must be produced by some radiations which exist in the medium; and sixth, streams resembling the cathodic must be emitted by the sun and probably also by other sources of radiant energy, such as an arc light or Bunsen burner."

"Now, since there exists an electric pressure of difference of potential between two metals in close proximity or contact, we must, when considering all the foregoing, come to the fourth conclusion, namely, that the metals emit similar streams, and I therefore anticipate that, if a sensitive film be placed between two plates, say, of magnesium and copper, a true Roentgen shadow picture would be obtained after a very long exposure in the dark."

"Obviously, such streams could not be forever emitted, unless there is a continuous supply of radiation from the medium in some other form; or possibly the streams which the bodies themselves emit are merely reflected streams coming from other sources."

"But if such streams exist all around us in the ambient medium, the question arises, whence do they come? The only answer is: From the sun. I infer, therefore, that the sun and other sources of radiant energy must, in a less degree, emit radiations or streams of matter similar to those thrown off by an electrode in a highly exhausted inclosure." ↑

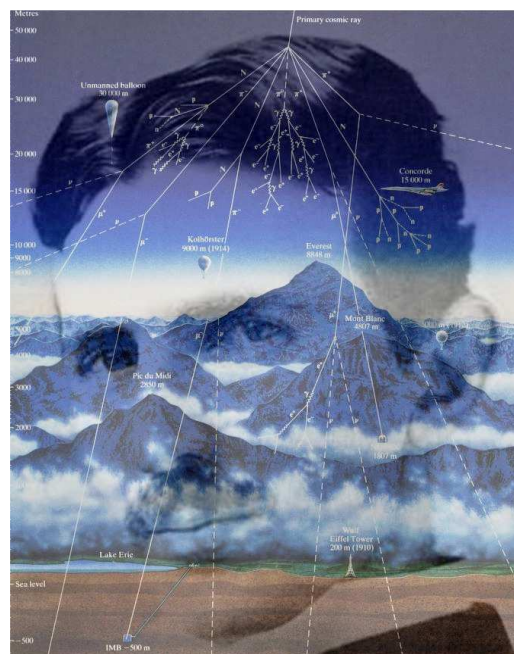
b) "Being perfectly satisfied that all energy in matter is drawn from the environment, it was quite natural that when radioactivity was discovered in 1896 I immediately started a search for the external agent which caused it. The existence of radioactivity was positive proof of the existence of external rays. I had previously investigated various terrestrial disturbances affecting wireless circuits but none of them or any others emanating from the earth could produce a steady sustained action and I was driven to the conclusion that the activating rays were of cosmic origin. This fact I announced in my papers On Roentgen Rays and Radiations contributed to the Electrical Review of New York, in 1897. However, as radioactivity was observed equally well in other widely separated parts of the world, it was obvious that the rays must be impinging on the earth from all directions." ↑

c) "When radioactivity was discovered, it was thought to be an entirely new manifestation of energy limited to a few substances. I obtained sufficient evidence to convince me that such actions were general and in nature the same as those exhibited by my tubes. In these, minute corpuscles, regarding which we are still in doubt, are shot from a highly electrified terminal against a target where they generate Rontgen or other rays by impact. Now, according to my theory, a radioactive body is simply a target which is continuously bombarded by infinitesimal bullets projected from all parts of the universe, and if this, then unknown, cosmic radiation could be wholly intercepted, radioactivity would cease." ↑

d) "Regarding radio-activity, it occurs exactly as required by my theory. The radio-active emanations from the globe are secondary effects of external rays and two-fold - one part coming from the energy stored, the other from that continuously supplied." ↑

e) "I am proud of these discoveries, because many have denied that I am the original discoverer of the cosmic ray. I was fifteen years ahead of other fellows who were asleep. Now no one can take away from me the credit of being the first discoverer of the cosmic ray on earth." ↑

f) "Light is a wave motion of definite velocity, determined by the elastic force and density of the medium. Cosmic rays are particles of matter, the speed of which depends on the propelling force and mass and may be much smaller or greater than that of light." ↑



Nikola Tesla, explorer of cosmic radiation

**(31) Dynamic theory of gravity:**

a) "During the succeeding two years of intense concentration I was fortunate enough to make two far-reaching discoveries. The first was a dynamic theory of gravity, which I have worked out in all details and hope to give to the world very soon. It explains the causes of this force and the motions of heavenly bodies under its influence so satisfactorily that it will put an end to idle speculations and false conceptions, as that of curved space. According to the relativists, space has a tendency to curvature owing to an inherent property or presence of celestial bodies. Granting a semblance of reality to this fantastic idea, it is still self-contradictory. Every action is accompanied by an equivalent reaction and the effects of the latter are directly opposite to those of the former. Supposing that the bodies act upon the surrounding space causing curvature of the same, it appears to my simple mind that the curved spaces must react on the bodies and, producing the opposite effects, straighten out the curves, Since action and reaction are coexistent, it follows that the supposed curvature of space is entirely impossible. But even if it existed it would not explain the motions of the bodies as observed. Only the existence of a field of force can account for them and its assumption dispenses with space curvature. All literature on this subject is futile and destined to oblivion. So are also all attempts to explain the workings of the universe without recognizing the existence of the ether and the indispensable function it plays in the phenomena." ↑

b) "I am working now upon two things," he said. "First, an explanation based upon pure mathematics of certain things which Professor Einstein has also attempted to explain. My conclusions in certain respects differ from and to that extent tend to disprove the Einstein Theory ....My explanations of natural phenomena are not so involved as his. They are simpler, and when I am ready to make a full announcement it will be seen that I have proved my conclusions." ↑

**(32) Measuring the electrical parameters of Earth, standing waves, telegeodynamics, ball lightnings:**

a) "We need not be frightened by the idea of distance. To the weary wanderer counting the mile-posts the earth may appear very large but to that happiest of all men, the astronomer, who gazes at the heavens and by their standard judges the magnitude of our globe, it appears very small. And so I think it must seem to the electrician, for when he considers the speed with which an electric disturbance is propagated through the earth all his ideas of distance must completely vanish.

A point of great importance would be first to know what is the capacity of the earth? and what charge does it contain if electrified? Though we have no positive evidence of a charged body existing in space without other oppositely electrified bodies being near, there is a fair probability 'that the earth is such a body, for by whatever process it was separated from other bodies — and this is the accepted view of its origin — it must have retained a charge, as occurs in all processes of mechanical separation. If it be a charged body insulated in space its capacity should be extremely small, less than one-thousandth of a farad. But the upper strata of the air are conducting, and so, perhaps, is the medium in free space beyond the atmosphere, and these may contain an opposite charge. Then the capacity might be incomparably greater. In any case it is of the greatest importance to get an idea of what quantity of electricity the earth contains. It is difficult to say whether we shall ever acquire this necessary knowledge, but there is hope that we may, and that is, by means of electrical resonance. If ever we can ascertain at what period the earth's charge, when disturbed, oscillates with respect to an oppositely electrified system or known circuit, we shall know a fact possibly of the greatest importance to the welfare of the human race." ↑

b) "The second fact which I have ascertained is that the upper air strata are permanently charged with electricity opposite to that of the earth. So, at least, I have interpreted my observations, from which it appears that the earth, with its adjacent insulating and outer conducting envelop, constitutes a highly charged electrical condenser containing, in all probability, a great amount of electrical energy which might be turned to the uses of man, if it were possible to reach with a wire to great altitudes." ↑





c) "When the earth is struck mechanically, as is the case in some powerful terrestrial upheaval, it vibrates like a bell, its period being measured in hours. When it is struck electrically, the charge oscillates, approximately, twelve times a second. By impressing upon it current waves of certain lengths, definitely related to its diameter, the globe is thrown into resonant vibration like a wire, stationary waves forming, the nodal and ventral regions of which can be located with mathematical precision. Owing to this fact and the spheroidal shape of the earth, numerous geodetical and other data, very accurate and of the greatest scientific and practical value, can be readily secured. Through the observation of these astonishing phenomena we shall soon be able to determine the exact diameter of the planet, its configuration and volume, the extent of its elevations and depressions, and to measure, with great precision and with nothing more than an electrical device, all terrestrial distances." ↑

d) "Popularly explained, it is exactly this: When we raise the voice and hear an echo in reply, we know that the sound of the voice must have reached a distant wall, or boundary, and must have been reflected from the same. Exactly as the sound, so an electrical wave is reflected, and the same evidence which is afforded by an echo is offered by an electrical phenomenon known as a "stationary" wave — that is, a wave with fixed nodal and ventral regions. Instead of sending sound-vibrations toward a distant wall, I have sent electrical vibrations toward the remote boundaries of the earth, and instead of the wall the earth has replied. In place of an echo I have obtained a stationary electrical wave, a wave reflected from afar.

Stationary waves in the earth mean something more than mere telegraphy without wires to any distance. They will enable us to attain many important specific results impossible otherwise. For instance, by their use we may produce at will, from a sending-station, an electrical effect in any particular region of the globe; we may determine the relative position or course of a moving object, such as a vessel at sea, the distance traversed by the same, or its speed; or we may send over the earth a wave of electricity traveling at any rate we desire, from the pace of a turtle up to lightning speed." ↑

e) One of the subjects, which he hoped, he said, will come to be recognized as his "greatest achievement in the field of engineering," was, he said, the perfection by him of "an apparatus by which mechanical energy can be transmitted to any part of the terrestrial globe."

This apparatus, he said, will have at least four practical possibilities. It will give the world a new means of unflinching communication; it will provide a new and by far the safest means for guiding ships at sea and into port; it will furnish a certain divining rod for locating ore deposits of any kind under the surface of the earth; and finally, it will furnish scientists with a means for laying bare the physical conditions of the earth, and will enable them to determine all of the earth's physical constants.

He called this discovery "tele-geodynamics," motion of earth-forces at a distance. It is of this, he said, that it would "appear almost preposterous." The apparatus, he added, is "ideally simple," consisting of a stationary part and a cylinder of fine steel "floating" in air. He has found means, he said, of "impressing upon the floating part powerful impulses which react on the stationary part, and through the latter to transmit energy through the earth." To do this he has "found a new amplifier for a known type of energy," and the "purpose is to produce impulses through the earth and then pick them up whenever needed." ↑



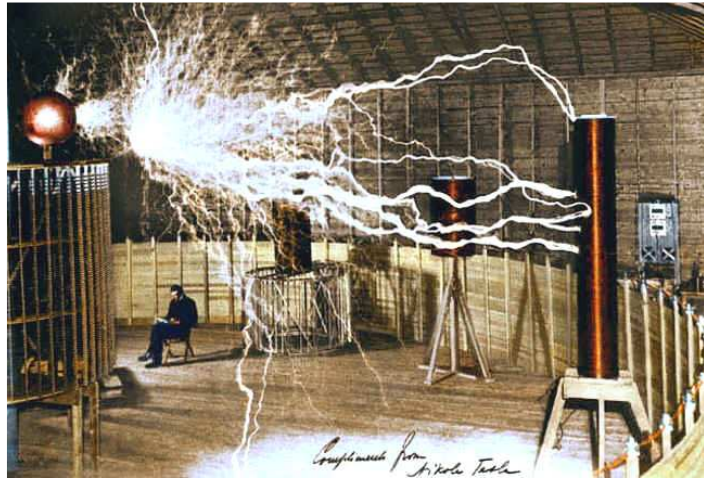
Nikola Tesla's earth "shaker"

f) "When the action is very energetic, owing to the power of the streamer and other causes, the luminous portion of the same becomes a veritable "fireball". This observation which, to my greatest astonishment, I have frequently observed in experiments with this apparatus, shows now clearly how "fireballs" are produced in lightning discharges and their nature is now quite plain."

"It being a fact that this phenomenon may now be artificially produced, it will not be difficult to learn more of its nature."

"With the present experiences I am satisfied that the phenomenon of the "fireball" is produced by the sudden heating, to high incandescence, of a mass of air or other gas as the case may be, by the passage of a powerful discharge." ↑

Double exposed photo in Nikola Tesla's laboratory in Colorado Springs: The scientist reading "in the mid" of lightnings. The primary of his high voltage coil is mounted on the outer plank and in the middle there are some resonant secondary coils; [www.frankgermano.com](http://www.frankgermano.com)



g) "The adjustment should be made with particular care when the transmitter is one of great power, not only on account of economy, but also in order to avoid danger. I have shown that it is practicable to produce in a resonating circuit immense electrical activities, measured by tens and even hundreds of thousands of horse-power, and in such case, if the points of maximum pressure should be shifted below the terminal, a ball of fire might break out and destroy the support or anything else in the way." ↑

### (33) Lectures, honors:

a) Lectures of Nikola Tesla:

- A New System of Alternate Current Motors and Transformers- A lecture delivered before the AIEE, May 16, 1888.
- Experiments with Alternate Currents of Very High Frequency and Their Application to Methods of Artificial Illumination- A lecture delivered before the AIEE, May 20, 1891.
- Experiments with Alternate Currents of High Potential and High Frequency- A lecture delivered before the IEE, London, February 1892.
- On Light and Other High Frequency Phenomena - A lecture delivered before the Franklin Institute, Philadelphia, February 1893, and the National Electric Light Association, St. Louis, March, 1893.
- On mechanical and electrical oscillators - A lecture delivered before the members of the Electrical Congress, in the hall adjoining the Agricultural Building, at the World's Fair, Chicago on Friday, August 25, 1893.
- On Electricity - Commemoration of the introduction of Niagara Falls power in Buffalo, New York, at the Ellicott Club - Electrical Review - January 27, 1897.
- The Streams of Lenard and Roentgen and Novel Apparatus for Their Production - Lecture Before the New York Academy of Sciences April 6, 1897 - Leland I. Anderson, Editor - April 6, 1897.
- High Frequency Oscillators for Electro-Therapeutic and Other Purposes - A lecture delivered before the American Electro-Therapeutic Association, Buffalo, September 13, 1898.
- Teleautomatics - address/demonstration before a meeting of the Commercial Club - May 13th, 1899.

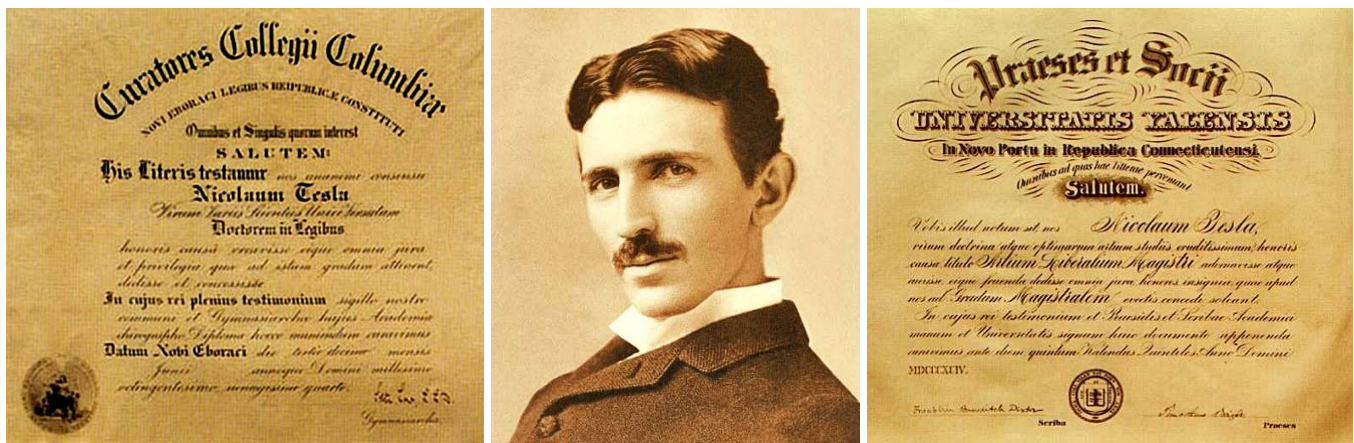
b) Dr. Tesla ↑

### Honorary Doctorates Awarded to Nikola Tesla

University of Columbia, 1894  
University of Yale, 1894  
Technical School, Vienna, 1908  
University of Belgrade, 1926  
University of Zagreb, 1926  
Technical School, Prague, 1936  
Technical School, Graz, 1937  
Université de Poitiers, 1937  
Technical School, Brno, 1937  
Université de Paris, 1937  
Polytechnical School, Bucharest, 1937  
Université de Grenoble, 1938  
University of Sofia, 1939

### Orders and Decorations

The Order of St. Sava, II Class, Government of Serbia, 1892  
The Order of Independence of Montenegro, 1895  
The Order of St. Sava, I Class, Government of Yugoslavia, 1926  
The Order of Yugoslav Crown, 1931  
The Order of the White Eagle, I Class, Government of Yugoslavia, 1936  
The Order of the White Lion, I Class, Government of Czechoslovakia, 1937  
The Medal of Université de Paris,, 1937  
The Medal of the University of St. Klement, Sofia, 1939



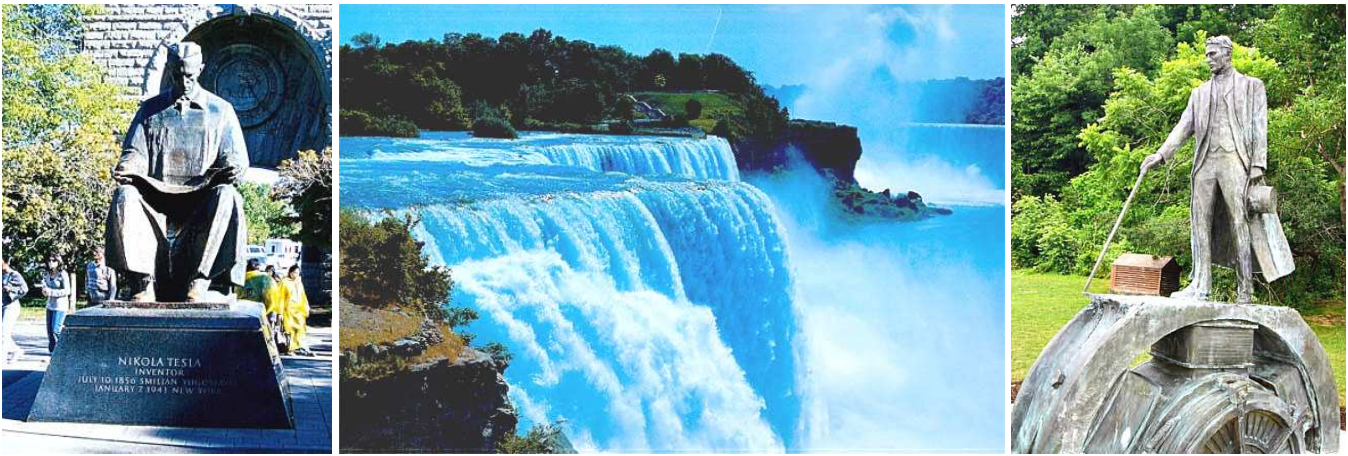
Honorary doctorates of University of Columbia and of Yale awarded to Nikola Tesla in 1894

### (34) Harnessing the energies of Nature, Niagara power plant, renewable energy sources:

a) "But there is a possibility of obtaining energy not only in the form of light, but motive power, and energy of any other form, in some more direct way from the medium. The time will be when this will be accomplished, and the time has come when one may utter such words before an enlightened audience without being considered a visionary. We are whirling through endless space with an inconceivable speed, all around us everything is spinning, everything is moving, everywhere is energy. There must be some way of availing ourselves of this energy more directly. Then; with the light obtained from the medium, with the power derived from it, with every form of energy obtained without effort, from the store forever inexhaustible, humanity will advance with giant strides. The mere contemplation of these magnificent possibilities expands our minds, strengthen our hopes and fills our hearts with supreme delight." ↑

b) "We shall have no need to transmit power at all. Ere many generations pass, our machinery will be driven by a power obtainable at any point of the universe." ↑





Nikola Tesla's statue at the stateside and canadian side of the Niagara Falls

c) "I was fascinated by a description of Niagara Falls I had perused, and pictured in my imagination a big wheel run by the falls. I told my uncle that I would go to America and carry out this scheme. Thirty years later I was able to see my ideas carried out at Niagara and marveled at the unfathomable mystery of the mind." ↑

d) "When I heard that such authorities as Lord Kelvin and Prof. W. C. Unwin had recommended - one the direct-current system and the other compressed air - for the transmission of power from Niagara Falls to Buffalo, I thought it was dangerous to let the matter go further, and I went to see Mr. Adams. I remember the interview perfectly. Mr. Adams was much impressed with what I told him. We had some correspondence afterwards, and whether it was in consequence of my enlightening him on the situation, or owing to some other influence, my system was adopted." ↑

e) "The simultaneous development of the Niagara project and the Tesla system was a fortuitous coincidence. No adequate method of handling large power was available in 1890... The polyphase method brought success to the Niagara project; and reciprocally Niagara brought immediate prestige to the new electric system... The evolution of electric power from the discovery of Faraday in 1831 to the initial great installation of the Tesla polyphase system in 1896 is undoubtedly the most tremendous event in all engineering history." ↑

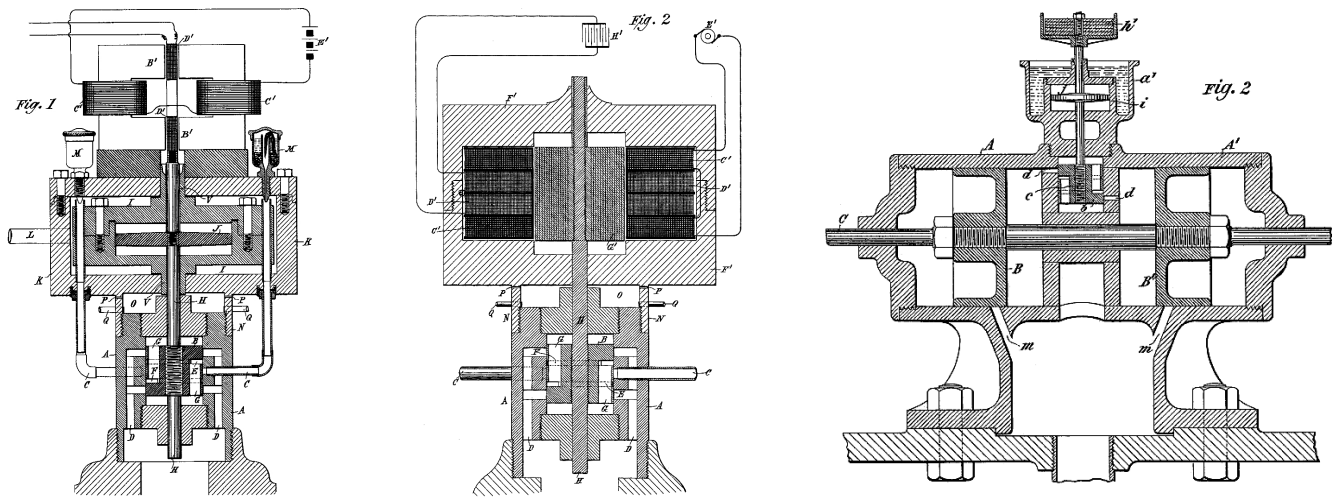
f) "Tesla has contributed more to electrical science than any man up to his time." ↑

g) "The world's internal reservoirs of heat, indicated by frequent volcanic eruptions, will be tapped for industrial purposes. In an article I wrote twenty years ago I defined a process for continuously converting to human use part of the heat received from the sun by the atmosphere. Experts have jumped to the conclusion that I am attempting to realize a perpetual-motion scheme. But my process has been carefully worked out. It is rational." ↑

**(35) Mechanical oscillator:**

The latest device of Mr. Tesla for generating electricity is his oscillator, described in briefly as follows: "The steam chest is situated on the bed-plate between the two electro-magnetic systems, each of wick consists of field coils between wick is to move the armature or coil of wire. There are two pistons to receive the impetus of the incoming steam in the chest, and in the present instance steam is supplied at a pressure of 350 pounds, although as low as 80 is also used in like oscillators, where steam of a higher pressure is not obtainable. We note immediately the absence of all governing appliances of the ordinary engine. They are non-existent. The steam chest in the engine, bared to the akin like a prize fighter, with every ounce counting. Besides easily utilizing steam at a remarkable high pressure the oscillator holds it under no less remarkably control, and, strangest of all, needs no packing to prevent leaks. It is a fair inference, too, that, denuded in this way of superfluous weight and driven at high pressure, the engine must have an economy far beyond the common. Moreover, for the same pressure and the same piston speed the engine has about one-thirtieth or one-fortieth of the usual weight, and occupies a proportionately smaller space. The engine piston carry at their end the armature coils, and these they trust reciprocally in and out of these magnetic fields of the field coils, thus generating current by their action." ↑



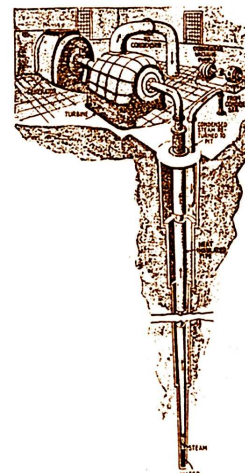
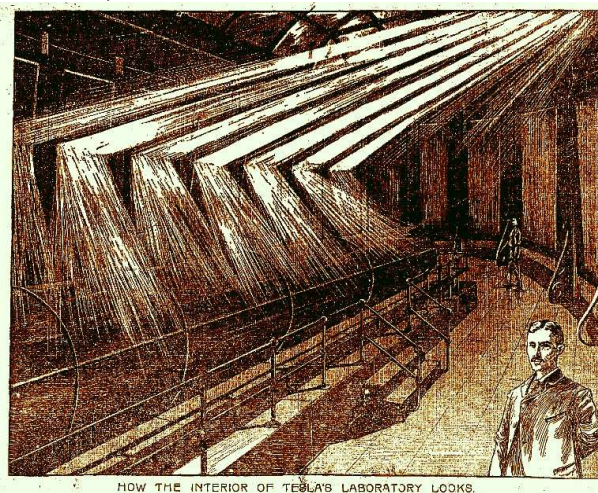


Drawings from Nikola Tesla's patents no. US511,916, Electric generator and no. US517,900, Steam engine

**(36) Solar power plant, Concentrated Solar Power:**

a) "The invention is still in the experimental stage, but he declares that there is not a possibility of its failure. He has discovered a means - of producing steam from the rays of the sun. The steam runs a steam, engine wick generates electricity. The first apparatus, which was made more than two years ago, had no more driving force than a New-foundland dog. It was a huge, unwieldy thing, entirely impossible for practical purposes, but it demonstrated the truth of the principle. He set about perfecting his invention. He has nearly completed a new engine with a twenty-four horse-power capacity. Its cost is so small, its dimensions make it so easily handled, that nothing now stands in the way of building the apparatus on a large scale." ↑

b) "Already he is planning to build an immense plant on Long island, to be commenced as soon as he receives his patent. Ho will elaborate and perfect his model in his laboratory. In the centre of a large room with a glass roof Tesla will place a huge cylinder of thick glass. This will repose on a bed of asbestos and be supported by a firm stone pedestal placed in the centre of the room. The circle will be laid lengthwise and will be surrounded by a cirele of complicated mirrors that may be covered with asbestos coats. These mirrors will refract the rays of the sun into the glass cylinder. The cylinder will always tie kept full of waiter wltch has been chemically treated by a secret, process which Tesla has devised, and which, he says, is the only complicated part of the discovery. All day long, while the sun shines, its rays will be refracted Into the great cylinder. The chemical treatment makes the water easily susceptible to heat and in a little time the vaporizing begins. The great quantity of steam which Is rapidly generated in the cylinder is carried to a steam engine of ordinary construction. The engine in turn will generate electricity, which will be stored in a large powerhouse, from which it will be transmitted by cables to the factory and to the home. The power-house will store sufficient electricity to meet all demands during the time that the sun does not shine, although it may be clouded for weeks at a time." ↑



Nikola Tesla's concentrated solar power plant (CSP) and his earth heat pump

c) "I do not care at this time to go into details. I have not yet begun the practical part of the work. I wish to have the experimental part so completed that no one can stick a pin into it. But I will say that the results so far achieved are all that I could desire and they place all possibility of a failure beyond the shadow of a doubt." ↑

**(37) Air-, earth-, ocean-heat pump:**

a) "Having recognized this truth, I began to devise means for carrying out my idea, and, after long thought, I finally conceived a combination of apparatus which should make possible the obtaining of power from the medium by a process of continuous cooling of atmospheric air. This apparatus, by continually transforming heat into mechanical work, tended to become colder and colder, and if it only were practicable to reach a very low temperature in this manner, then a sink for the heat could be produced, and energy could be derived from the medium." ↑

b) "...Soon I had in a fair state of perfection the engine which I have named "the mechanical oscillator." In this machine I succeeded in doing away with all packings, valves, and lubrication, and in producing so rapid a vibration of the piston that shafts of tough steel, fastened to the same and vibrated longitudinally, were torn asunder. By combining this engine with a dynamo of special design I produced a highly efficient electrical generator, invaluable in measurements and determinations of physical quantities on account of the unvarying rate of oscillation obtainable by its means. I exhibited several types of this machine, named "mechanical and electrical oscillator," before the Electrical Congress at the World's Fair in Chicago during the summer of 1893, in a lecture which, on account of other pressing work, I was unable to prepare for publication. On that occasion I exposed the principles of the mechanical oscillator, but the original purpose of this machine is explained here for the first time." ↑

c) "Virtually all our energies are derived from the sun, and the greatest triumph we have achieved in the utilization of its undying fire is the harnessing of waterfalls. The by-(to-) fro-electric (ide-oda/fel-le ) process, now universally employed enables us to obtain as much as eighty-five per cent of the solar energy with machines of elementary simplicity which, by resorting to the latest improvements in the technical arts, might be made capable of enduring for centuries. These advantages are entirely exceptional, very serious handicaps and great, unavoidable losses confronting us in all other transformations of the forces of nature." ↑

d) "Nature has provided an abundant supply of energy in various forms which might be economically utilized if proper means and ways can be devised. The sun's rays falling upon the earth's surface represent a quantity of energy so enormous that but a small part of it could meet all our demands." ↑

e) "The energy of light rays, constituting about 10% of the total radiation, might be captured by a cold and highly efficient process in photo-electric cells which may become, on this account, of practical importance in the future." ↑

f) "The force of the wind can be much more easily put to our service and has been in practical use since times immemorial. It is invaluable in ship propulsion and the windmill must be seriously regarded as its power generator. If the cost of this commodity should greatly increase we will be likely to see the countries dotted with these time-honored contrivances." ↑

e) "A shaft could be sunk in the midst of a densely populated district and a great saving effected in the cost of distribution. The shaft would be costly, of course, but the apparatus cheap, simple and efficient." ↑

**(38) Current interruptors:**

a) "The ideal medium for a discharge gap should only *crack*, and the ideal electrode should be of some material which cannot be disintegrated." ↑

b) "It is somewhat difficult to conceive of a solid body which would possess the property of closing instantly after it has been cracked. But a liquid, especially under great pressure, behaves practically like a solid, while it possesses the property of closing the crack. Hence it was thought that a liquid insulator might be more suitable as a dielectric than air. Following out this idea, a number of different forms of dischargers in which a variety of such insulators, sometimes under great pressure, were employed, have been experimented upon." ↑

c) "Subsequent investigation showed that no matter what medium is employed, be it air, hydrogen, mercury vapor, oil, or a stream of electrons, the efficiency is the same. It is a law very much like the governing of the conversion of mechanical energy." ↑

**(39) Invention of radio:**

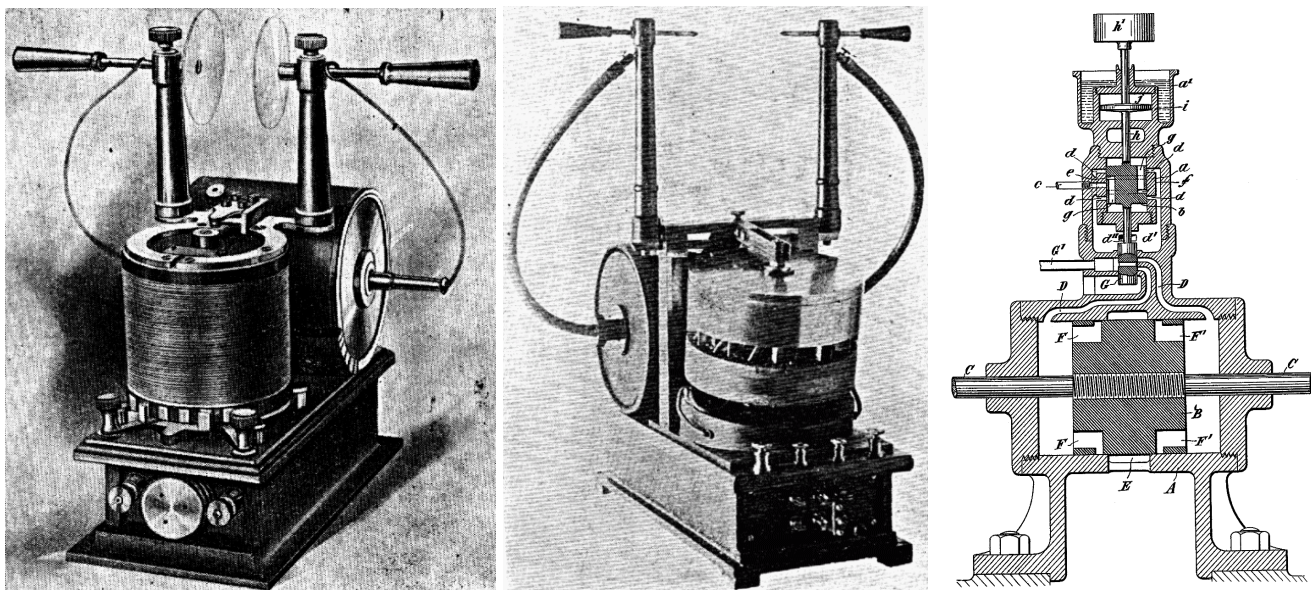
a) "In the first place the fundamental difference between the broadcasting system as now practiced and the one I expect to inaugurate is that at present the transmitter emits energy in all directions, while in the system I have devised only force is conveyed to all points of the earth, the energy itself traveling in definite paths determined beforehand. Perhaps the most wonderful feature is that the energy travels chiefly along an orthodromic line, that is, the shortest distance between two points at the surface of the globe, and reaches the receiver without the slightest dispersion, so that an incomparably greater amount is collected than is possible by radiations." ↑

b) "They laughed at me in 1897 when I told them about the cosmic ray," he said in a recent interview. "Fifty years ago they attempted to discredit my discovery of the rotating magnetic field and my system of power transmission by alternating currents. They called me crazy when I predicted the radio and when I sent the first impulse around the world they said it couldn't be done." ↑

c) "As a matter of fact, radio transmitters emit nothing else but sound waves in the ether, and if the experts will realize this they will find it very much easier to explain the curious observations made in the application of these waves. It being a fact that radio waves are essentially like sound waves in the air, it is evident that the shorter the waves the more penetrative they would be." ↑

**(40) Mechanical and electro therapy:**

a) "Fifty years ago, while investigating high frequency currents developed by me at that time, I observed that they produced certain physiological effects offering new and great possibilities in medical treatment. My first announcement spread like fire and experiments were undertaken by a host of experts here and in other countries." ↑



Nikola Tesla's electrical oscillators and his mechanical oscillator or steam engine from his patent no. US 517,900

b) "When I began to practice with my assistants Mechanical Therapy we used to finish our meals quickly and rush back to the laboratory. We suffered from dyspepsia and various stomach troubles, biliousness, constipation, flatulence and other disturbances, all natural results of such irregular habit. But after only a week of application, during which I improved the technique and my assistants learned how to take the treatment to their best advantage, all those forms of sickness disappeared as by enchantment and for nearly four years, while the machine was in use, we were all in excellent health. I cured a number of people, among them my great friend Mark Twain whose books saved my life. He came to the laboratory in the worst shape suffering from a variety of distressing and dangerous ailments but in less than two months he regained his old vigor and ability of enjoying life to the fullest extent." ↑



**(41) Weather control, war technologies, radio-astronomy:**

a) "One day, as I was roaming the mountains, I sought shelter from an approaching storm. The sky became overhung with heavy clouds, but somehow the rain was delayed until, all of a sudden, there was a lightening flash and a few moments after, a deluge. This observation set me thinking. It was manifest that the two phenomena were closely related, as cause and effect, and a little reflection led me to the conclusion that the electrical energy involved in the precipitation of the water was inconsiderable, the function of the lightening being much like that of a sensitive trigger. Here was a stupendous possibility of achievement. If we could produce electric effects of the required quality, this whole planet and the conditions of existence on it could be transformed. The sun raises the water of the oceans and winds drive it to distant regions where it remains in a state of most delicate balance. If it were in our power to upset it when and wherever desired, this mighty life sustaining stream could be at will controlled. We could irrigate arid deserts, create lakes and rivers, and provide motive power in unlimited amounts. This would be the most efficient way of harnessing the sun to the uses of man. The consummation depended on our ability to develop electric forces of the order of those in nature." ↑

b) "It seemed a hopeless undertaking, but I made up my mind to try it and immediately on my return to the United States in the summer of 1892, after a short visit to my friends in Watford, England; work was begun which was to me all the more attractive, because a means of the same kind was necessary for the successful transmission of energy without wires." ↑

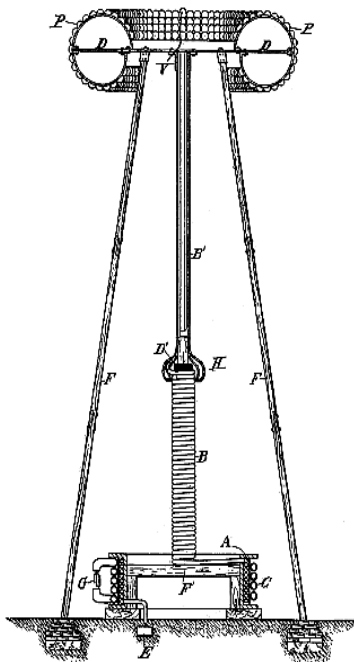


Figure from Nikola Tesla's patent no. US1,119,732 Apparatus for transmitting electrical energy; the construction of the Wardenclyffe tower and its planned outlook; [www.tesla.hu](http://www.tesla.hu), [www.teslasociety.com](http://www.teslasociety.com)

c) "We are on the eve of accomplishments which will be of tremendous consequence to the future advancement of the human race. One of these is the control of the precipitation of moisture. The water is evaporated and thus raised against the force of gravity. It is then held in suspension in the vapor which we call clouds. Air currents carry this vapor, hither and yon, often to distant regions, where it may remain for long periods at a height, in a state of delicate suspension. When the equilibrium is disturbed the water falls to earth [in the] form of rain and through rills and rivers flows back to the ocean. Thus the sun, those heat causes the evaporation, even maintains this life sustaining stream. The energy necessary to cause the precipitation of the rain, compared to that rain's potential energy when released, is like that of the spark setting off a charge of dynamite compared to the dynamite. If this part of the natural process were under the control of man he could transform the entire globe. Many schemes have been proposed to this end, none of which have knowledge offering the remotest chance of success. But I have ascertained that with proper apparatus this wonder can be performed. Any amount of power will then be at our disposal; we can make out of deserts fertile land and create lakes and rivers almost without effort on our part. However our triumph would not be complete if the power could not be conveyed to distances without limit. This achievement, to, is now within our reach. With my wireless system it is practicable to transmit electrical energy over a distance of 12,000 miles with a loss not exceeding 5 per cent. I can conceive of no advances which would be more desirable at this time and be more beneficial to the further progress of mankind." ↑



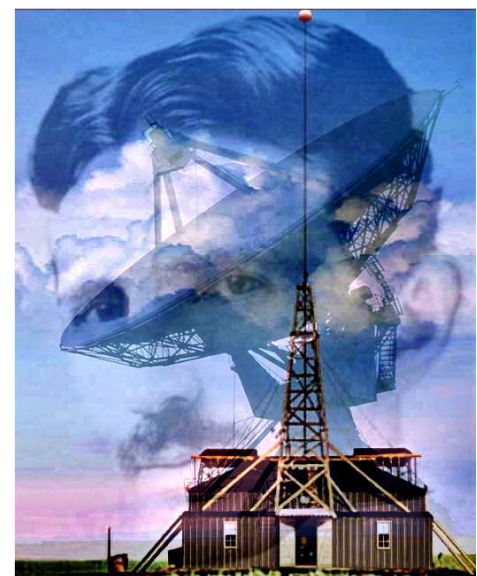
d) "Even now wireless power plants could be constructed by which any region of the globe might be rendered uninhabitable without subjecting the population of other parts to serious danger or inconvenience."

e) "It is perfectly practicable to transmit electrical energy without wires and produce destructive effects at a distance. I have already constructed a wireless transmitter which makes this possible, and have described it in my technical publications, among which I may refer to my patent 1,119,732 recently granted. With transmitters of this kind we are enabled to project electrical energy in any amount to any distance and apply it for innumerable purposes, both in peace and war. Through the universal adoption of this system, ideal conditions for the maintenance of law and order will be realized, for then the energy necessary to the enforcement of right and justice will be normally productive, yet potential, and in any moment available, for attack and defense. The power transmitted need not be necessarily destructive, for, if existence is made to depend upon it, its withdrawal or supply will bring about the same results as those now accomplished by force of arms. But when unavoidable, the same agent may be used to destroy property and life. The art is already so far developed that great destructive effects can be produced at any point on the globe, determined beforehand and with great accuracy. In view of this I have not thought it hazardous to predict a few years ago that the wars of the future will not be waged with explosives but with electrical means." ↑

f) "Invention of a "beam of matter moving at high velocity" which would act as a "beam of destructive energy" was announced today by Dr. Nikola Tesla, the inventor, in his annual birthday interview. Dr. Tesla is 78, and for the past several years has made his anniversary the occasion for announcement of scientific discoveries. The beam, as described by the inventor to rather bewildered reporters, would be projected on land from power houses set 200 miles or so apart and would provide an impenetrable wall for a country in time of war. Anything with which the ray came in contact would be destroyed, the inventor indicated. Planes would fall, armies would be wiped out and even the smallest country might so insure "security" against which nothing could avail." ↑

g) The production of the death-beam, Dr. Tesla said, involves four new inventions, which have not been announced by him. The scientific details of these inventions are to be given out by him before the proper scientific bodies in the near future. In the meantime he gave out a general statement outlining their nature. The first invention, he said, comprises a method and apparatus for producing rays and other manifestations of energy in free air, eliminating the high vacuum necessary at present for the production of such rays and beams. The second is a method and process for producing "very great electrical force." The third is a method for amplifying this process in the second invention. The fourth, he said, is "a new method for producing a tremendous electrical repelling force." The voltages to be employed in propelling the death-beam to their objective, Dr. Tesla said, will attain the lightning-like potential of 50,000,000 volts. With this enormous voltage, hitherto unattained by manmade means, microscopic particles of matter will be catapulted on their mission of defensive destruction, Dr. Tesla asserted. ↑

h) "I announced in an article, which was published in the Harvard Illustrated Magazine in 1906, that I was convinced that the radio signals which I received about six years before were from distant planets. I signalled back with my powerful radio transmitter, and I am certain that in my experiments in 1899 and 1900 I produced disturbances on Mars. Whether there were instruments to receive them and intelligence to recognize them as interplanetary messages is another question." ↑



Nikola Tesla, father of radio-astronomy

**(42) Fluid mechanics:**

"I have accomplished what mechanical engineers have been dreaming about ever since the invention of steam power," replied Dr. Tesla. "That is the perfect rotary engine. It happens that I have also produced an engine which will give at least twenty-five times as much power to a pound of weight as the lightest weight engine of any kind that has yet been produced. In doing this I have made use of two properties which have always been known to be possessed by all fluids, but which have not heretofore been utilized. These properties are adhesion and viscosity. Put a drop of water on a metal plate. The drop will roll off, but a certain amount of the water will remain on the plate until it evaporates or is removed by some absorptive means. The metal does not absorb any of the water, but the water adheres to it. The drop of water may change its shape, but until its particles are separated by some external power it remains intact. This tendency of all fluids to resist molecular separation is viscosity. It is especially noticeable in the heavier oils. It is these properties of adhesion and viscosity that cause the "skin friction" that impedes a ship in its progress through the water or an aeroplane in going through the air. All fluids have these qualities and you must keep in mind that air is a fluid, all gases are fluids, steam is fluid. Every known means of transmitting or developing mechanical power is through a fluid medium." ↑

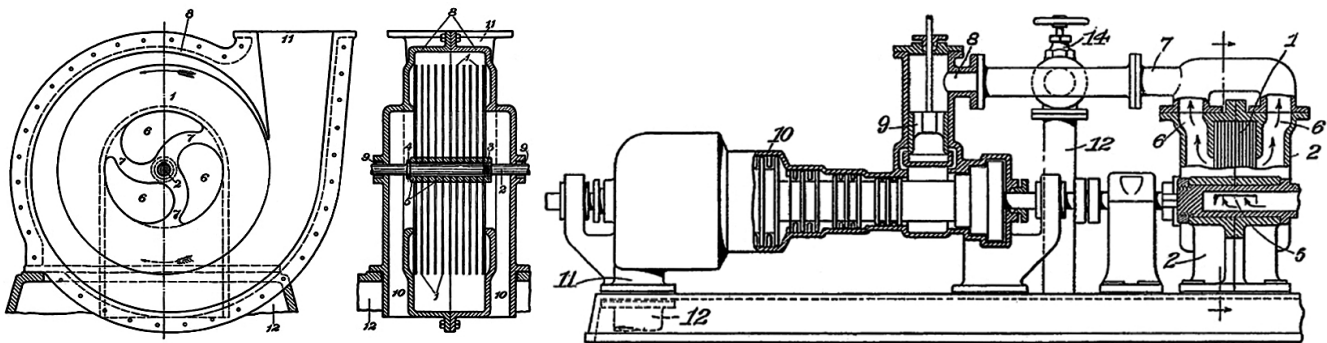
**(43) Bladeless turbine:**

"In my invention practically the whole surface is active. In the bucket turbine the action does not even extend all the way around; you must have a series of jets. But in my turbine you have the gas traveling all the way around in free spirals – always seeking the path of least resistance – and expending its full energy."

Here he laid aside the pencil with which he had been illustrating the point, and reverted to the beginning of what he evidently considers his "big idea."

"I have been working at this a long time. Many years ago I invented a pump for pumping mercury. Just a plain disk, like this, and it would work very well. "All right," I said, "that is friction." But one day I thought it out, and I thought, "No, that is not friction, it is something else. The particles are not always sliding by the disk, but some of them at least are carried along with it. Therefore it cannot be friction. It must be adhesion." And that, you see, was the real beginning.

"For if you can imagine a wheel rotating in a medium, whether the fluid is receiving or imparting energy, and moving at nearly the same velocity as the fluid, then you have a minimum of friction, you get little or no "slip". Then you are getting something very different from friction, you are making use of adhesion alone. It's all so simple, so very simple." ↑



Bladeless turbine. Drawings from Nikola Tesla's patents no. US1,061,142 and GB174,544

**(44) Flying machine:**

a) "One of the most important uses of wireless energy will be undoubtedly for the propulsion of flying machines to which power can be readily supplied without ground connection, for although the flow of the currents is confined to the earth an electro magnetic field is created in the atmosphere surrounding it. If conductors or circuits accurately attuned and properly positioned are carried by the plane, energy is drawn into these circuits much the same as a fluid will pass through a hole created in the container. With an industrial plant of great capacity sufficient power can be derived in this manner to propel any kind of aerial machine. This I have always considered as the best and permanent solution of the problems of flight. No fuel of any kind will be required as the propulsion will be accomplished by light electric motors operated at great speed. Nevertheless, anticipating slow progress, I am developing a novel type of flying machine which seems to be well suited for meeting the present necessity of a safe, small and compact "aerial fliver" capable of rising and descending vertically." ↑

b) "The flying machine of the future – my flying machine – will be heavier than air, but it will not be an aeroplane. It will have no wings. It will be substantial, solid, stable. You cannot have a stable airplane. The gyroscope can never be successfully applied to the airplane, for it would give a stability that would result in the machine being torn to pieces by the wind, just as the unprotected aeroplane on the ground is torn to pieces by a high wind. My flying machine will have neither wings nor propellers. You might see it on the ground and you would never guess that it was a flying machine. Yet it will be able to move at will through the air in any direction with perfect safety, higher speeds than have yet been reached, regardless of weather and oblivious of "holes in the air" or downward currents. It will ascend in such currents if desired. It can remain absolutely stationary in the air, even in a wind, for great length of time. Its lifting power will not depend upon any such delicate devices as the bird has to employ, but upon positive mechanical action." ↑

**(45) Planetary generator:** (Producing electricity transforming the rotational energy of large bodies.)

a) "My first and most important discovery concerns the harnessing of a new source of power, hitherto unavailable, to be developed through fundamentally novel machines of my invention. I am not yet prepared to dwell on the details of the project, for they must be checked before my findings can be formally announced. I have worked on the development of the underlying principles for many years. From the practical point of view of the engineer engaged in power development, the first investment will be relatively very great, but once a machine is installed it may be depended on to function indefinitely, and the cost of operation will be next to nothing. My power generator will be of the simplest kind, just a big mass of steel, copper and aluminum, comprising a stationary and rotating part, peculiarly assembled. I am planning to develop electricity and transmit it to a distance by my alternating system now universally established. The direct current system could also be employed if the heretofore insuperable difficulties of insulating the transmission lines can be overcome.

Such a source of power obtainable everywhere will solve many problems with which the human race is confronted. My alternating system has been the means of harnessing 30,000,000 horsepower of waterpower, and there are projects now going on all over the world which will eventually double that amount. But, unfortunately, there is not enough water power to satisfy the present needs, and everywhere inventors and engineers are endeavoring to unlock some additional store of energy."

Beyond adding that the new form of energy which he has been investigating many years would be available at any place in the world in unlimited quantities, and that the machinery for harnessing it would last more than 5,000 years. Mr. Tesla would say little more on the subject, just when the power will become available for practical purposes. ↑

b) "Secondly, I am working to develop a new source of power. When I say a new source, I mean that I have turned for power to a source which no previous scientist has turned, to the best of my knowledge. The conception, the idea when it first burst upon me was a tremendous shock."

"It will throw light on many puzzling phenomena of the cosmos, and may prove also of great industrial value, particularly in creating a new and virtually unlimited market for steel."

Tesla said it will come from an entirely new and unsuspected source, and will be for all practical purposes constant day and night, and at all times of the year. The apparatus for capturing the energy and transforming it will partake both of mechanical and electrical features, and will be of ideal simplicity. ↑

c) "The other invention would result in a saving of energy, he said. It had nothing to do, he explained, with the problem on which he has long been working - the tapping of a tremendous and thus far unused source of energy. He has been working on that during the last year, he said, and has made great advances both in its practical application and in the theory underlying it. As to this new source of power, he said;

"When the time is ripe I propose first to announce the scientific principles underlying it only. Later I shall show its practical application through the forms of power generating apparatus. If I succeed, the world will see machines against which the largest turbo-dynamos of today will be mere playthings." ↑

**(46) Developing extremely high voltage:**

a) "I have disintegrated atoms in my experiments with a high potential vacuum tube I brought out in 1896 which I consider one of my best inventions. I have operated it with pressures ranging from 4.000.000 to 18.000.000 volts. More recently I have designed an apparatus for 50.000.000 volts which should produce many results of great scientific importance." ↑

b) "However extraordinary the results shown may appear, they are but trifling compared with those which are attainable by apparatus designed on these same principles. I have produced electrical discharges the actual path of which, from end to end, was probably more than one hundred feet long; but it would not be difficult to reach lengths one hundred times as great. I have produced electrical movements occurring at the rate of approximately one hundred thousand horse-power, but rates of one, five, or ten million horse-power are easily practicable. In these experiments effects were developed incomparably greater than any ever produced by human agencies, and yet these results are but an embryo of what is to be." ↑

**(47) Cosmic generator:** (Producing electricity harnessing the cosmic radiation.)

a) "A principle by which power for driving the machinery of the world may be derived from the cosmic energy which operates the universe, has been discovered by Nikola Tesla, noted physicist and inventor of scientific devices, he announced today." ↑

b) "More than 25 years ago I began my efforts to harness the cosmic rays and I can now state that I have succeeded in operating a motive device by means of them." I was able to prevail upon Dr. Tesla to give me some idea of the principle upon which his cosmic ray motor works. "I will tell you in the most general way," he said. "The cosmic ray ionizes the air, setting free many charges - ions and electrons. These charges are captured in a condenser which is made to discharge through the circuit of the motor." ↑

**(48) Determining the electrical parameters of the Sun:**

"Now, of all bodies in the cosmos," states Dr. Tesla, "our sun was the most likely to furnish a clue as to their origin and character. Before the electron theory was advanced, I had established that radio-active rays consisted of particles of primary matter not further decomposable, and the first thing to find out was whether the sun is charged to a sufficiently high potential to produce the effects noted. This called for a prolonged investigation which culminated in my discovery that the sun's potential was 216,000,000,000 volts and that all such large and hot bodies emit cosmic rays." ↑

**(49) Discovery of neutrino radiation and faster than light particle:**

a) "My theory was strikingly confirmed when I found that the sun does, indeed, emit a ray marvelous in the inconceivable minuteness of its particles and transcending speed of their motion, vastly exceeding that of light. This ray, by impinging against the cosmic dust generates a secondary radiation, relatively very feeble but fairly penetrative, the intensity of which is, of course, almost the same in all directions." ↑



Nikola Tesla, explorer of cosmic and neutrino radiation

b) "...In 1899 I obtained mathematical and experimental proofs that the sun and other heavenly bodies similarly conditioned emit rays of great energy which consist of inconceivably small particles animated by velocities vastly exceeding that of light. So great is the penetrative power of these rays that they can traverse thousands of miles of solid matter with but slight diminution of velocity.

In passing through space, which is filled with cosmic dust, they generated a secondary radiation of constant intensity, day and night, and pouring upon the earth equally from all directions. As the primary rays projected from the suns and stars can pass through distances measured in light-years without great diminution of velocity, it follows that whether a secondary ray is generated near a sun or at any distance from it, however great, its intensity is the same. Consequently, if our sun, or any other, would be snuffed out of existence, it would have no appreciable effect on the secondary radiation. The latter is not very penetrative and is partly absorbed by the atmosphere." ↑

c) "All of my investigations seem to point to the conclusion that they are small particles, each carrying so small a charge that we are justified in calling them neutrons. They move with great velocity, exceeding that of light." ↑

d) "He has measured cosmic ray velocities from Antarus, he said, which he found to be fifty times greater than the speed of light, thus demolishing, he contended, one of the basic pillars of the structure of relativity, according to which there can be no speed greater than that of light." ↑



**(50) Interstellar transmission of energy and intelligence, transmutation of elements:**

a) "But with the novel means, proposed by myself, I can readily demonstrate that, with an expenditure not exceeding two thousand horse-power, signals can be transmitted to a planet such as Mars with as much exactness and certitude as we now send messages by wire-from New York to Philadelphia." ↑

b) "I have devoted much of my time during the year past," he said, "to the perfecting of a new small and compact apparatus by which energy in considerable amounts can now be flashed through interstellar space to any distance without the slightest dispersion." ↑

c) Recalling experiments with other tubes, he said he had been "rewarded with complete success and had produced a tube which it will be hard to improve further." "It is of ideal simplicity," he said, "not subject to wear and can be operated at any potential, however high - even 100,000,000 volts - that can be produced."

It will carry heavy currents, transform any amount of energy within practical limits and it permits easy control and regulation of the same.

"I expect that this invention, when it becomes known, will be universally adopted in preference to other form of tubes and that it will be the means of obtaining results undreamed of before.

Among others, it will enable the production of cheap radium substitutes in any desired quantity and will be, in general, immediately more effective in the smashing of atoms and the transmutation of matter. However, this tube will not open up a way to utilize atomic or subatomic energy for power purposes."

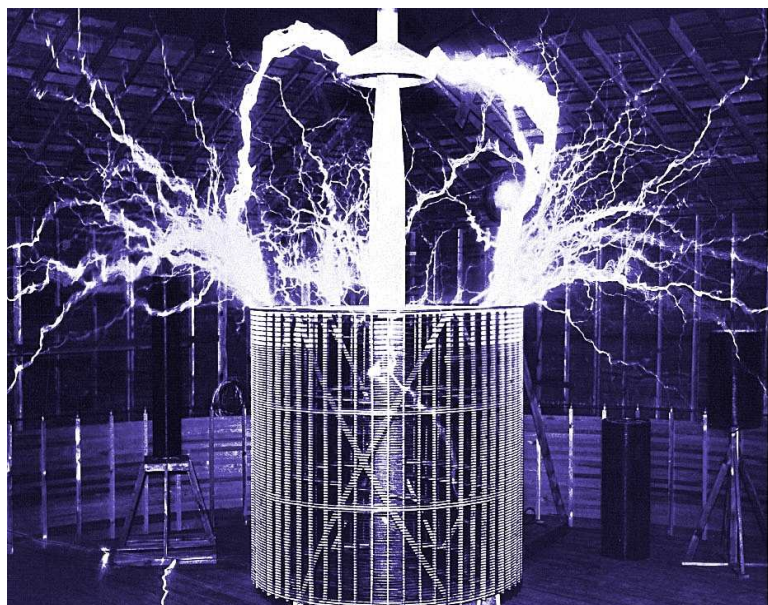
"It will cheapen radium so," Dr. Tesla added, "that it will be just a cheap – well, it will get down to \$1 a pound, in any quantity."

Expressing "annoyance" that some newspapers had indicated he would "give a full description" of his atom-smashing tube at yesterday's luncheon, Dr. Tesla said he was bound by financial obligations "involving vast sums of money" against releasing this information.

"But it is not an experiment," he declared. "I have built, demonstrated and used it. Only a little time will pass before I can give it to the world." ↑

d) "I have disintegrated atoms in my experiments with a high potential vacuum tube I brought out in 1896 which I consider one of my best inventions. I have operated it with pressures ranging from 4.000.000 to 18.000.000 volts. More recently I have designed an apparatus for 50.000.000 volts which should produce many results of great scientific importance." ↑

e) "But as to atomic energy, my experimental observations have shown that the process of disintegration is not accomptained by a liberation of such energy as might be expected from the present theories." ↑



**(51) Following the contemporary science:**

a) "The literature of cosmic rays is remarkable for its extent and almost as much for the erroneous views propounded. In this brief communication I can dwell on only a few of these." ↑

b) "My second discovery was a physical truth of the greatest importance. As I have searched the scientific records in more than half dozen languages for a long time without finding the least anticipation, I consider myself the original discoverer of this truth, which can be expressed by the statement: There is no energy in matter other than that received from the environment." ↑

**(52) Swami Vivekananda, vedic philosophy:**

a) "I myself have been told by some of the best scientific minds of the day, how wonderfully rational the conclusions of the Vedanta are. I know of one of them personally, who scarcely has time to eat his meal, or go out of his laboratory, but who would stand by the hour to attend my lectures on the Vedanta; for, as he expresses it, they are so scientific, they so exactly harmonize with the aspirations of the age and with the conclusions to which modern science is coming at the present time." ↑

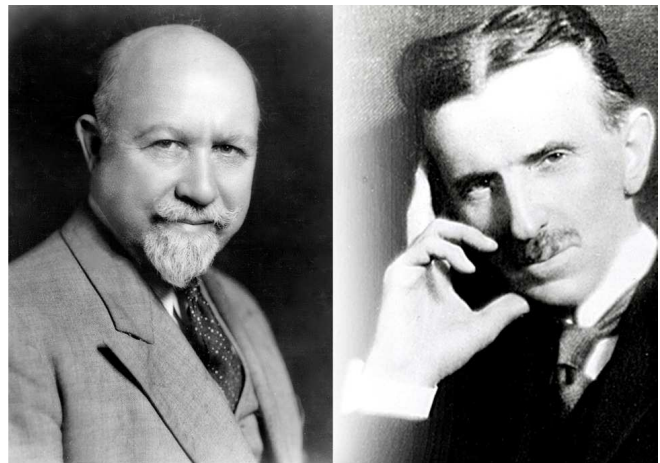
b) " Mr. Tesla was charmed to hear about the Vedantic Prâna and Âkâsha and the Kalpas, which according to him are the only theories modern science can entertain. Now both Akasha and Prana again are produced from the cosmic Mahat, the Universal Mind, the Brahmâ or Ishvara. Mr. Tesla thinks he can demonstrate mathematically that force and matter are reducible to potential energy. I am to go and see him next week to get this new mathematical demonstration. In that case the Vedantic cosmology will be placed on the surest of foundations. I am working a good deal now upon the cosmology and eschatology of the Vedanta. I clearly see their perfect union with modern science, and the elucidation of the one will be followed by that of the other." ↑

**(53) Walter Russell, russellian science:**

a) "Nikola Tesla and I exchanged inspirations for many years. He was an artist at heart whom the world knew as a scientist - while I was a scientist at heart whom the world knew as an artist.

He was my spiritual mainstay while I produced my greatest work in sculpture - The Mark Twain Memorial, and I likewise spiritually supported when his soul was low from doubtings and attacks by lesser minds." ↑

b) "About relativity theory: The weak point in this theory is the fact that electromagnetism is not an existent force in Nature; nor are there electromagnetic fields. Wave fields are electric – exclusively electric." ↑



Walter Russell and Nikola Tesla

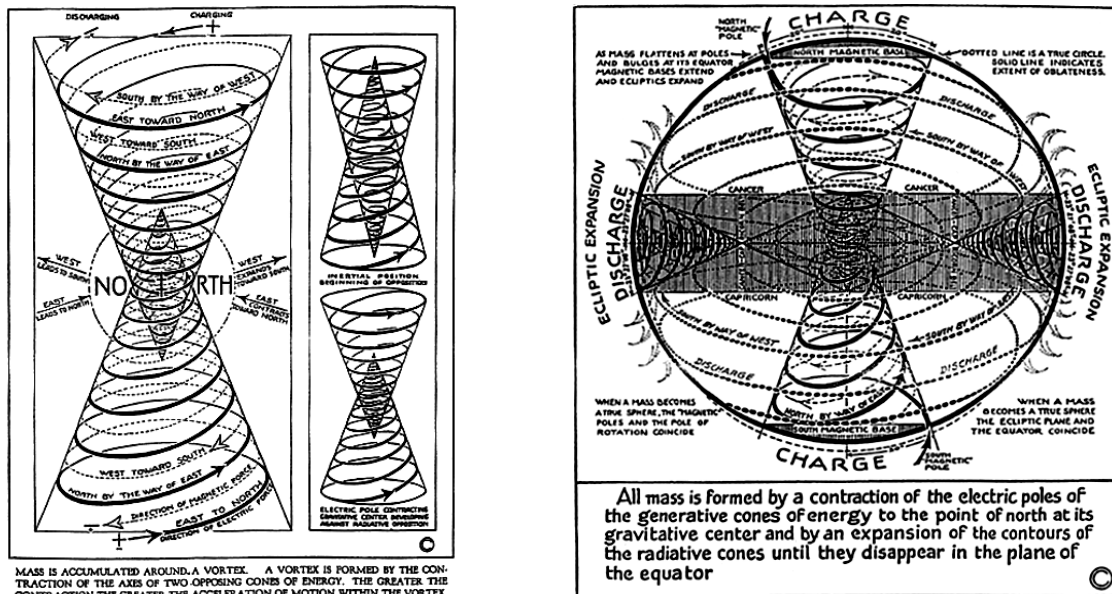
c) "Electricity is the only force which makes use of to create this universe. And the only two "tools" God makes use of for creating His universe of matter and motion are two pair of opposed spiral vortices. One of these opposite pairs meets at apices at wave amplitudes to create spheres of matter and the other opposed pair meets at cone basis upon wave axes to void both matter and motion.

These two pairs of opposed spiral vortices are the basic units which construct all matter. Together they form the electric wave of motion which create the various pressure conditions which are needed to produce the many seemingly different elements of visible and invisible matter." ↑

d) "This universe is substanceless. It consists of motion only. Motion simulates substance by the control of its opposing wave pressures of motion which deceive the senses into seeing substance where motion alone is. The senses do not reach beyond the illusion of motion, nor do those who believe that they can gain knowledge of the secrets of this vast make-believe universe even faintly comprehend the unreality of this mirage of polarized light-in-motion which they so firmly believe is real." ↑

e) "All matter is but pressure-conditioned motion. Varying pressure conditions yield varying states of motion. Varying states of motion are what science misinterprets as the elements of matter." ↑

f)



Formation of matter from light vortex. Drawings from Walter Russell's book: The Universal One  
[www.philosophy.org](http://www.philosophy.org)

g) "We sense electrically and mistake that electrical sensing of observed effects for thinking. Sensation is but an electrical awareness of wave motion by other waves." ↑

h) "We mistake the electrical records of the information which our brains have recorded as sensation, for thinking and for knowledge. Information thus acquired by the senses is not knowledge, however. A man may have vast information and skill but have very little knowledge." ↑

i) "Every happening anywhere happens everywhere. The milkweed fluff floating lazily in the summer sky affects the balance of the whole universe of suns and galaxies. Every part of the universe moves in interdependent unison as the wheels of a watch wheels are geared together mechanically. The rhythmic wave universe is geared together electrically. The entire universe is one and must be kept in balance as one. Changes of condition in any one part are simultaneously reflected in every other part, and are sequentially repeated in it." ↑

j) "The universal Mind centers every particle and mass in this universe: animal, vegetable or mineral, electron, atom or sun." ↑

k) "Every timeless flash of intense inspiration which comes to any man is a partial illumination, for inspiration is the manner in which new knowledge comes to man from the cosmos." ↑

l) "Man is still new. Out of millions of such years, he has had but a few thousand years since the dawn of consciousness awakened in him the slightest suspicion of his spiritual inheritance." ↑

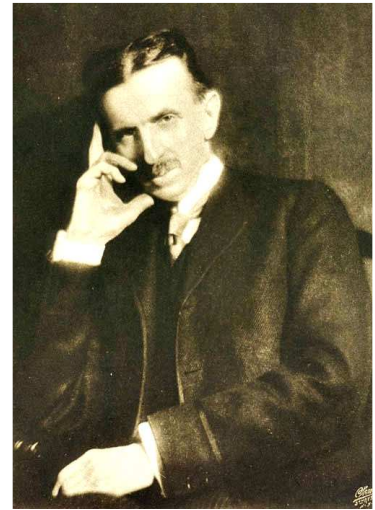
**(54) Philosophical views from the world, Nature, art, destiny, spiritualism:**

a) "But far beyond the limit of perception of our senses the spirit still can guide us, and so we may hope that even these unknown worlds—infinately small and great—may in a measure become known to us. Still, even if this knowledge should reach us, the searching mind will find a barrier, perhaps forever unsurpassable, to the true recognition of that which seems to be, the mere appearance of which is the only and slender basis of all our philosophy." ↑

b) "When we look at the world around us, on Nature, we are impressed with its beauty and grandeur. Each thing we perceive, though it may be vanishingly small, is in itself a world, that is, like the whole of the universe, matter and force governed by law, — a world, the contemplation of which fills us with feelings of wonder and irresistibly urges us to ceaseless thought and inquiry. But in all this vast world, of all objects our senses reveal to us, the most marvelous, the most appealing to our imagination, appears no doubt a highly developed organism, a thinking being." ↑



c) "In no way can we get such an overwhelming idea of the grandeur of Nature, as when we consider, that in accordance with the law of the conservation of energy, throughout the infinite, the forces are in a perfect balance, and hence the energy of a single thought may determine the motion of a Universe." ↑



d) "I may say, also, that I am deeply religious at heart, although not in the orthodox meaning, and that I give myself to the constant enjoyment of believing that the greatest mysteries of our being are still to be fathomed and that, all the evidence of the senses and the teachings of exact and dry sciences to the contrary notwithstanding, death itself may not be the termination of the wonderful metamorphosis we witness. In this way I have managed to maintain an undisturbed peace of mind, to make myself proof against adversity, and to achieve contentment and happiness to a point of extracting some satisfaction even from the darker side of life, the trials and tribulations of existence." ↑

e) \*"My belief is firm in a law of compensation. The true rewards are ever in proportion to the labor and sacrifices made. This is one of the reasons why I feel certain that of all my inventions, the magnifying transmitter will prove most important and valuable to future generations. I am prompted to this prediction, not so much by thoughts of the commercial and industrial revolution which it will surely bring about, but of the humanitarian consequences of the many achievements it makes possible."↑

f) "Man, however, is not an ordinary mass, consisting of spinning atoms and molecules, and containing merely heat-energy. He is a mass possessed of certain higher qualities by reason of the creative principle of life with which he is endowed." ↑

g) "As nearly as I am able to define it in this restricted meaning, artistic effort is beautiful expression of the painful striving of the human mind to free itself from the material and to attain the ideal."

"To my mind a work of art must embody, first, a noble idea born of this painful striving for dematerialization, second, its expression in beautiful form, and, third, something, however little, of the artist individuality."

I would prefer to qualify original investigation or research, discovery, and invention as "creative" scientific effort, which is equivalent to that of the artist, though it spring from a different, if not opposite, motive. Both the artist and man of science are striving for independence from the material world in the two ways possible – one by its casting of, the other by its complete mastery. " ↑

h) "Exactly so it is with wars, revolutions and similar exceptional states of society. Though it may seem so, a war can never be caused by arbitrary acts of man. It is invariably the more or less direct result of cosmic disturbance in which the sun is chiefly concerned. In many international conflicts of historical record which were precipitated by famine, pestilence or terrestrial catastrophes the direct dependence of the sun is unmistakable. But in most cases the underlying primary causes are numerous and hard to trace." ↑



i) "I had always thought of woman," says Mr. Tesla, "as possessing these delicate qualities of mind and soul that made her in these respect superior to man. I had put her on a lofty pedestal, figuratively speaking, and ranked her in certain important attributes considerably higher than man. I worshiped at the feet of the creature I had raised to this height, and, like every true worshiper, I felt myself unworthy of the object of my worship. But all this was in past. Now the soft-voiced gentle woman of my reverent worship has all but vanished. In her place has come the woman who thinks that her chief success in life lies in making herself as much as possible like man – in dress, voice and action, in sports and achievements of every kind." ↑



j) "...The female mind has demonstrated a capacity for all the mental acquirements and achievements of men, and as generations ensue that capacity will be expanded; the average woman will be as well educated as the average man, and then better educated, for the dormant faculties of her brain will be stimulated to an activity that will be all the more intense and powerful because of centuries of repose. Woman will ignore precedent and startle civilization with their progress. The acquisition of new fields of endeavor by women, their gradual usurpation of leadership, will dull and finally dissipate feminine sensibilities, will choke the maternal instinct, so that marriage and motherhood may become abhorrent and human civilization draw closer and closer to the perfect civilization of the bee. The significance of this lies in the principle dominating the economy of the bee – the most highly organized and intelligently coordinated system of any form of nonrational animal life – the all-governing supremacy of the instinct for immortality which makes divinity out of motherhood." ↑

k) "Sure enough, one fine morning a body of engineers from the Ford Motor Company presented themselves with the request of discussing with me an important project. As soon as these hard-headed men were seated, I of course, immediately began to extol the wonderful features of my turbine, when the spokesman interrupted me and said, "We know all about this, but we are on a special errand. We have formed a psychological society for the investigation of psychic phenomena and we want you to join us in this undertaking." I suppose these engineers never knew how near they came to being fired out of my office." ↑

**From the last quote of Nikola Tesla and from his whole life the conclusion can be drawn such as: he was far from spirituality, and that may seem accurate, but the fact that true science means the same as as the highest level of spirituality proves otherwise, however this will be explained in another story...**

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a) – b) – c) Nikola Tesla: My inventions

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**13)**    ↑

a) – b) Nikola Tesla: My inventions

**14)**    ↑

a) – b) – c) – d) Nikola Tesla: My inventions

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**20)** ↑

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**21)** ↑

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