A black and white photograph of Nikola Tesla in his laboratory. He is sitting on a folding chair in the center, looking down at a book or document. The room is filled with his inventions, including a large cylindrical coil on the right, a smaller one on the left, and a complex network of wires and coils hanging from the ceiling. The background shows a wooden wall and a window.

MY INVENTIONS

NIKOLA TESLA

“The progressive development of man is vitally dependent on invention. It is the most important product of his creative brain. Its ultimate purpose is the complete mastery of mind over the material world, the harnessing of the forces of nature to human needs.

This is the difficult task of the inventor, who is often misunderstood and unrewarded. But he finds ample compensation in the pleasing exercises of his powers and in the knowledge of being one of that exceptionally privileged class without whom the race would have long ago perished in the bitter struggle against pitiless elements.

Speaking for myself, I have already had more than my full measure of this exquisite enjoyment, so much that for many years, my life was little short of continuous rapture. I am credited with being one of the hardest workers and perhaps I am, if thought is the equivalent of labor, for I have devoted to it almost all of my waking hours. But if work is interpreted to be a definite performance in a specified time according to a rigid rule, then I may be the worst of idlers. Every effort under compulsion demands a sacrifice of life energy. I never paid such a price. On the contrary, I have thrived on my thoughts.”

- *Nikola Tesla*

MY INVENTIONS

NIKOLA TESLA

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MY INVENTIONS

by Nikola Tesla

Edited by David Major

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I

My Early Life

The progressive development of man is vitally dependent on invention. It is the most important product of his creative brain. Its ultimate purpose is the complete mastery of mind over the material world, the harnessing of the forces of nature to human needs. This is the difficult task of the inventor, who is often misunderstood and unrewarded. But he finds ample compensation in the pleasing exercises of his powers and in the knowledge of being one of that exceptionally privileged class without whom the race would have long ago perished in the bitter struggle against pitiless elements.

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In attempting to give a connected and faithful account of my activities in this series of articles which will be presented with the assistance of the editors of the *Electrical Experimenter*, 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 importance 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.

This was due to a number of causes. In the first place 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 parents disconsolate.

We owned a horse which had been presented to us by a dear friend. It was a magnificent animal of Arabian breed, possessed of almost human intelligence, and was cared for and petted by the whole family, having on one occasion saved my father's life under remarkable circumstances. My father had been called one winter night to perform an urgent duty and while crossing the mountains, which were infested by wolves, the horse became frightened and ran away, throwing him violently to the ground. It arrived home bleeding and exhausted, but after the alarm was sounded immediately dashed off again, returning to the spot, and before the search party were far on the way they were met by my father, who had recovered consciousness and remounted, not realizing that he had been lying in the snow for several hours. This same horse was responsible for my brother's injuries, from which he died. I witnessed the tragic scene and although 56 years have elapsed since, my visual impression of it has lost none of its force. The recollection of his attainments makes every effort of mine seem dull in comparison.

Anything I did that was creditable merely caused my parents to feel their loss more keenly. So I grew up with little confidence in myself. But I was far from being considered a stupid boy, if I am to judge from an incident of which I have still a strong remembrance.

One day the aldermen were passing through a street, where I was at play with other boys. The oldest of these venerable gentlemen — a wealthy citizen — paused to give a silver piece to each of us. Coming to me he stopped and commanded, "Look in my eyes." I met

his gaze, my hand outstretched to receive the much-valued coin, when, to my dismay, he said, "No, you can get nothing from me, you are too smart."

They used to tell a funny story about me. I had two old aunts with wrinkled faces, one of them having two teeth protruding like the tusks of an elephant, which she buried in my cheek every time she kissed me. Nothing would scare me more than the prospect of being hugged by these relatives, as affectionate as they were unattractive. It happened that while being carried in my mother's arms they asked me who was the prettier of the two. After examining their faces intently, I answered thoughtfully, pointing to one of them, "This one here is not as ugly as the other."

Then again, I was intended from my very birth for the clerical profession, and this thought constantly oppressed me. I longed to be an engineer, but my father was inflexible. He was the son of an officer who served in the army of the great Napoleon and, in common with his brother, who was a professor of mathematics in a prominent institution, he 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 á 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 would be able to restore them. His style of writing was much admired; he penned sentences that were short and terse, and was full of wit and satire. The humorous remarks he made were always peculiar and characteristic. Just to illustrate, I may mention one or two instances.

Among the help there was a cross-eyed man called Mane, employed to do work around the farm. He was chopping wood one day. As he swung the axe my father, who stood nearby and felt very uncomfortable, cautioned him, "For God's sake, Mane, do not strike at what you are looking at, but at what you intend to hit."

On another occasion, he was taking out for a drive a friend who carelessly permitted his costly fur coat to rub on the carriage wheel. My father reminded him of it saying, "Pull in your coat, you are ruining my tyre."

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.

Although I must attribute to my mother's influence whatever inventiveness I possess, the training he gave me must have been helpful. It comprised all sorts of exercises — such as guessing one another's thoughts, discovering the defects of some form or 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.

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.

When she was sixteen, a virulent pestilence swept the country. Her father was called away to administer the last sacraments to the dying, and during his absence she went alone to the assistance of a neighboring family who were stricken by the dread disease. All of the members of the family, five in number, succumbed in rapid succession. She bathed, clothed and laid out the bodies, decorating them with flowers according to custom, and when her father returned he found everything ready for a Christian burial.

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 daybreak till late at night, and most of the clothing 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.

There was another and still more important reason for my late awakening. 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 thought and action. They were pictures of things and scenes which I had really seen, never of those I 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.

This caused me great discomfort and anxiety. None of the students of psychology or physiology whom I have consulted could ever explain satisfactorily these phenomena. They seem to have been unique, although I was probably predisposed, as I know that my brother experienced similar trouble.

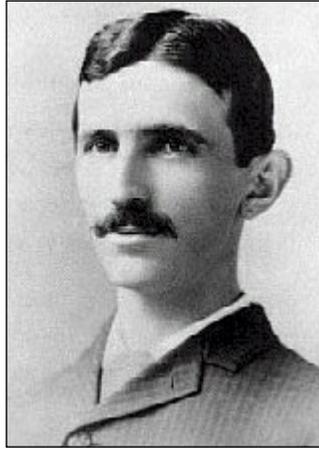
The theory I have formulated is that the images were the result of a reflex action from the brain on the retina under great excitation. They certainly were not hallucinations such as are produced in diseased and anguished minds, for in other respects I was normal and composed.

To give an idea of my distress, suppose that I had witnessed a funeral or some such nerve-racking spectacle. Then, inevitably, in the stillness of night, a vivid picture of the scene would thrust itself before my eyes and persist, despite all my efforts to banish it. Sometimes it would even remain fixed in space though I pushed my hand through it.

If my explanation is correct, it should be possible to project on a screen the image of any object one conceives, and so make it visible. Such an advance would revolutionize all human relations. I am convinced that this wonder can, and will, be accomplished in times to come; I may add that I have devoted much thought to the solution of the problem.

To free myself of these tormenting appearances, I tried to concentrate my mind on something else I had seen, and in this way I would often obtain temporary relief; but in order to achieve it, I had to conjure continuously new images. It was not long before I found that I had exhausted all of those at my command; my 'reel' had run out, as it were, because I had seen so little of the world — only objects in my home and the immediate surroundings. 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 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, but by and by I succeeded in fixing 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



A YOUNG TESLA

on in my vision farther and farther, getting new impressions all the time, and so I began to travel — of course, in my mind. Every night (and sometimes during the day), when alone, I would start on my journeys — see new places, cities and countries — live there, meet people and form friendships, and meet acquaintances and — however unbelievable — it is a fact that they were just as dear to me as those in real life, and not a bit less intense in their manifestations.

This I did constantly until I was about seventeen, when my thoughts turned seriously to invention. 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 had been led unconsciously to evolve what I consider to be a new method of materializing inventive concepts and ideas, which is radically opposite to the purely experimental, and is in my opinion ever so much more expeditious and efficient. The moment one constructs a device to carry into practice a crude idea, he finds himself unavoidably engrossed with the details and defects of the apparatus. As he goes on improving and reconstructing, his force of concentration diminishes, and he loses sight of the great underlying principle. Results may be obtained, but always at the sacrifice of quality.

My method is different. I do not rush into actual work. 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 entirely in my mind. It is absolutely immaterial to me whether I run

my turbine in my thoughts, 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. In twenty years there has not been a single exception. Why should it be otherwise? Engineering, electrical and mechanical, is positive in results. There is scarcely a subject that cannot be mathematically treated and the effects calculated or the results determined beforehand from the available theoretical and practical data. The carrying out into practice of a crude idea as is being generally done is, I maintain, nothing but a waste of energy, money and time.

My early affliction had another compensation. 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.

Soon I became aware, to my surprise, that every thought I conceived was suggested by an external impression. Not only this, but all my actions were prompted in a similar way. In the course of time it became perfectly evident to me that I was merely an automaton, endowed with power of movement, responding to the stimuli of the sense organs and thinking and acting accordingly. The practical result of this was the art of 'telautomatics', which has been so far carried out only in an imperfect manner. Its latent possibilities will, however, be eventually shown. For years I have been planning self-controlled automata, and I believe that mechanisms can be produced which will act as if possessed of reason, to a limited degree, and will create a revolution in many commercial and industrial enterprises.

I was about twelve years old when I first succeeded in banishing an image from my vision by willful effort, but I never had any control over the flashes of light to which I have referred. They were, perhaps, my strangest experience, and were inexplicable. They usually

occurred when I found myself in a dangerous or distressing situation, or when I was greatly exhilarated. In some instances I have seen all the air around me filled with tongues of living flame. Their intensity, instead of diminishing, increased with time and attained a maximum when I was about 25 years old.

While in Paris, in 1883, a prominent French manufacturer sent me an invitation to a shooting expedition, which I accepted. I had been long confined to the factory, and the fresh air had a wonderfully invigorating effect on me. On my return to the city that night, I felt as though my brain had caught fire. I saw a light as though a small sun was located in it, and I spent the whole night applying cold compresses to my tortured head. Finally the flashes diminished in frequency and strength, but it took more than three weeks before they subsided entirely. When a second invitation was extended to me, my answer was an emphatic 'no'!

These luminous phenomena still manifest themselves from time to time, for example when a new idea opening up possibilities strikes me, but they are no longer exciting, being of relatively small intensity. 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 my field of vision, and in about ten seconds vanishes to the left, leaving behind a ground of rather unpleasant and inert grey which quickly gives way to a billowing sea of clouds, seemingly trying to mould themselves into living shapes. It is curious that I cannot project a form into this grey until the second phase is reached.

Without fail, before falling asleep, images of people or objects flit before my view. When I see them, I know that I am about to lose consciousness. If they are absent and refuse to come, it means a sleepless night!

To what an extent imagination played a part in my early life, I may illustrate with another odd experience. Like most children I was fond of jumping, and developed an intense desire to support myself

in the air. Occasionally a strong wind richly charged with oxygen blew from the mountains, rendering my body as light as cork, and then I would leap and float in space for a long time. It was a delightful sensation and my disappointment was keen when later I undeceived myself.

During that period I contracted many strange likes, dislikes and habits, some of which I can trace to external impressions, while others are unaccountable. I had a violent aversion to the earrings of women, but other ornaments, such as bracelets, pleased me more or less according to design. The sight of a pearl would almost give me a fit, but I was fascinated with the glitter of crystals, or objects with sharp edges and plane surfaces. I would not touch the hair of other people except, perhaps, at the point of a revolver. I would get a fever by looking at a peach, and if a piece of camphor was anywhere in the house it caused me the keenest discomfort.

Even now I am not insensible to some of these upsetting impulses. When I drop little squares of paper in a dish filled with liquid, I always sense a peculiar and awful taste in my mouth. I counted my steps in my walks and calculated the cubical contents of soup plates, coffee cups and pieces of food — otherwise my meal was unenjoyable. All repeated acts or operations I performed had to be divisible by three, and if I missed, I felt impelled to do it all over again, even if it took hours.

Up to the age of eight years, my character was weak and vacillating. I had neither the courage nor strength to form a firm resolve. My feelings came in waves and surges, and vibrated unceasingly between extremes. My wishes were of all-consuming power, and like the heads of the hydra, they multiplied. I was oppressed by thoughts of pain in life, of death, and religious fear. I was swayed by superstitious belief and lived in constant dread of spirits of evil, of ghosts and ogres and other unholy monsters of the dark.

Then, all at once, there came a tremendous change which altered the course of my whole existence.

Of all things, I liked books the best. My father had a large library, and whenever I could manage to, I tried to satisfy my passion for reading. He did not permit it, and would fly into 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 cover the keyhole and the cracks in the door

and read, often till dawn, when the rest of the family slept and my mother started on her daily tasks.

On one occasion, I came across a novel entitled *Abafi* (The Son of Aba), a Serbian translation of a well known Hungarian writer, Josika. This work somehow awakened my dormant powers of will, and I began to practice self-control. At first, my resolutions faded like snow in April, but soon I conquered my weakness, and felt a pleasure I never knew before — *that of doing as I willed*. In the course of time, this vigorous mental exercise became second nature to me. 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.

At a certain age I contracted a mania for gambling, which greatly worried my parents. To sit down to a game of cards was for me the quintessence of pleasure. My father led an exemplary life, and could not excuse the senseless waste of time and money in which I indulged. I had a strong resolve, but my philosophy was bad. I would say to him, "I can stop whenever I please, but is it worthwhile to give up that which I would purchase with the joys of Paradise?"

On frequent occasions he gave vent to his anger and contempt, but my mother was different. She understood the character of men, and knew that one's salvation could only be brought about through his own efforts. One afternoon, I remember, when I had lost all my money and was craving for a game, she came to me with a roll of bills and said, "Go and enjoy yourself. The sooner you lose all we possess, the better it will be. I know that you will get over it." She was right. I conquered my passion then and there, and only regretted that it had not been a hundred times as strong. I not only vanquished but tore it from my heart so as not to leave even a trace of desire. Ever since that time I have been as indifferent to any form of gambling as to picking teeth.

During another period I smoked excessively, threatening to ruin my health. Then my will asserted itself and I not only stopped, but destroyed all inclination. Long ago I suffered from heart trouble, until I discovered that it was due to the innocent cup of coffee I consumed every morning. I discontinued at once, though I confess it was not an easy task. In this way I checked and bridled other habits and passions, and have not only preserved my life but derived an immense amount of satisfaction from what most men would consider privation and sacrifice.

My First Efforts at Invention

After finishing my studies at the Polytechnic Institute and University, I had a complete nervous breakdown, and while the malady lasted I observed many phenomena that were strange and unbelievable.

I shall dwell briefly on these extraordinary experiences, on account of their possible interest to students of psychology and physiology and also because this period of agony was of the greatest consequence to my mental development and subsequent labors. But it is indispensable to first relate the circumstances and conditions which preceded them, and in which might be found their partial explanation.

From childhood, I was compelled to concentrate attention upon myself. This caused me much suffering, but it was a blessing in disguise, for it has taught me to appreciate the inestimable value of introspection in the preservation of life, as well as a means of achievement. The pressure of occupation and the incessant stream of impressions pouring into our consciousness through all the gateways of knowledge make modern existence hazardous in many ways. Most persons are so absorbed in the contemplation of the outside world that they are wholly oblivious to what is passing on within themselves.

The premature death of millions is primarily traceable to this cause. Even among those who exercise care, it is a common mistake to deny the imagination, and ignore the real dangers.

And what is true of an individual also applies, more or less, to a people as a whole. Witness, as an illustration, the prohibition movement. A drastic, if not unconstitutional, measure is now being put through in this country to prevent the consumption of alcohol, and yet it is a positive fact that coffee, tea, tobacco, chewing gum and other stimulants, which are freely indulged in even at tender ages, are vastly more injurious to the national body, judging from the number of those who succumb. So, for instance, during my student years, I

learned from the published necrologues in Vienna, the home of coffee drinkers, that deaths from heart trouble sometimes reached 67 per cent of the total. Similar observations might probably be made in cities where the consumption of tea is excessive. These delicious beverages excite and gradually exhaust the fine fibers of the brain. They also interfere seriously with arterial circulation, and should be enjoyed all the more sparingly as their deleterious effects are slow and imperceptible. Tobacco, on the other hand, is conducive to easy and pleasant thinking, and detracts from the intensity and concentration necessary to all original and vigorous effort of the intellect. Chewing gum is helpful for a short while, but soon drains the glandular system and inflicts irreparable damage, not to speak of the revulsion it creates. Alcohol in small quantities is an excellent tonic, but is toxic in its action when absorbed in larger amounts, quite immaterial as to whether it is taken as whiskey or produced in the stomach from sugar. But it should not be overlooked that all these are great eliminators, assisting Nature in upholding her stern but just law of the survival of the fittest. Eager reformers should also be mindful of the eternal perversity of mankind which makes the indifferent *laissez-faire* by far preferable to enforced restraint.

The truth about this is that we need stimulants to do our best work under present living conditions, and that we must exercise moderation and control our appetites and inclinations in every direction. That is what I have been doing for many years, in this way maintaining myself young in both body and mind. Abstinence was not always to my liking, but I find ample reward in the agreeable experiences I am now having. Just in the hope of converting some to my precepts and convictions, I will recall one or two.

A short time ago I was returning to my hotel. It was a bitter cold night, the ground slippery, and no taxi to be had. Half a block behind me followed another man, evidently as anxious as myself to get under cover. Suddenly my legs went up in the air. In the same instant there was a flash in my brain, the nerves responded, the muscles contracted, I swung through 180 degrees and landed on my hands. I resumed my walk as though nothing had happened, until the stranger caught up with me.

“How old are you?” he asked, surveying me critically.

“Oh, about fifty-nine,” I replied. “What of it?”

“Well,” said he, “I have seen a cat do this, but never a man.”

About a month ago, I wanted to order new eyeglasses and went

to an oculist who put me through the usual tests. He looked at me incredulously as I read off with ease the smallest print at considerable distance. But when I told him that I was past sixty he gasped in astonishment. Friends of mine often remark that my suits fit me like a glove, but they do not know that all my clothing is made to measurements which were taken nearly 35 years ago, and have never changed. During this period, my weight has not varied one pound.

In this connection I will tell an amusing story. One evening, in the winter of 1885, Mr. Edison, Edward H. Johnson, the president of the Edison Illuminating Company, Mr. Batchellor, manager of the works, and myself entered a little place opposite 65 Fifth Avenue, where the offices of the company were located. Someone suggested guessing weights, and I was induced to step on a scale.

Edison felt me all over and said: "Tesla weighs 152 lbs. to an ounce," and he guessed it exactly.

I whispered to Mr. Johnson: "How is it possible that Edison could guess my weight so closely?"

"Well," he said, lowering his voice. "I will tell you, confidentially, but you must not say anything. He was employed for a long time in a Chicago slaughter-house, where he weighed thousands of hogs every day! That's why."

My friend, the Hon. Chauncey M. Depew, tells of an Englishman on whom he sprung one of his original anecdotes and who listened with a puzzled expression but — a year later — laughed out loud. I will frankly confess it took me longer than that to appreciate Johnson's joke.

Now, my wellbeing is simply the result of a careful and measured mode of living, and perhaps the most astonishing thing is that three times in my youth I was rendered by illness a hopeless physical wreck and given up by physicians. More than this, through ignorance and lightheartedness, I got into all sorts of difficulties, dangers and scrapes from which I extricated myself as if by enchantment. I was almost drowned a dozen times; was nearly boiled alive and just missed being cremated. I was entombed, lost and frozen. I had hair-breadth escapes from mad dogs, hogs, and other wild animals. I passed through dreadful diseases and met with all kinds of odd mishaps; that I am hale and hearty today seems like a miracle. But as I recall these incidents, I feel convinced that my preservation was not altogether accidental.

An inventor's endeavor is essentially lifesaving. Whether he

harnesses forces, improves devices, or provides new comforts and conveniences, he is adding to the safety and quality of our existence. He is also better qualified than the average individual to protect himself in peril, for he is observant and resourceful. If I had no other evidence that I was, in some measure, possessed of such qualities, I would find it in these personal experiences. The reader will be able to judge for himself if I mention one or two instances.

On one occasion, when about 14 years old, I wanted to scare some friends who were bathing with me. My plan was to dive under a long floating structure and slip out quietly at the other end. Swimming and diving came to me as naturally as to a duck, and I was confident that I could perform the feat. Accordingly, I plunged into the water and, when out of view, turned around and proceeded rapidly towards the opposite side. Thinking that I was safely beyond the structure, I rose to the surface, but to my dismay struck a beam. Of course, I quickly dived and forged ahead with rapid strokes, until my breath was beginning to give out. Rising for the second time, my head came again in contact with a beam. Now I was becoming desperate. However, summoning all my energy, I made a third frantic attempt, but the result was the same. The torture of suppressing my breathing was getting unendurable, my brain was reeling and I felt myself sinking.

At that moment, when my situation seemed absolutely hopeless, I experienced one of those previously mentioned flashes of light, and the structure above me appeared before my vision. I either discerned or guessed that there was a little space between the surface of the water and the boards resting on the beams and, with consciousness nearly gone, I floated up, pressed my mouth close to the planks and managed to inhale a little air, unfortunately mingled with a spray of water which nearly choked me. Several times I repeated this procedure as in a dream until my heart, which was racing at a terrible rate, quietened down and I gained composure. After that I made a number of unsuccessful dives, having completely lost my sense of direction, but finally succeeded in getting out of the trap when my friends had already given me up, and were fishing for my body.

That bathing season was spoiled for me through recklessness, but I soon forgot the lesson and only two years later I fell into a worse predicament.

There was a large flour mill with a dam across the river near the city where I was studying at that time. As a rule, the height of the

water was only two or three inches above the dam, and to swim out to it was a sport, not very dangerous, in which I often indulged. One day I went to swim in the river, to enjoy myself as usual. When I was a short distance from the masonry, however, I was horrified to observe that the water had risen and was carrying me along swiftly. I tried to get away, but it was too late. Luckily, though, I saved myself from being swept over by taking hold of the wall with both hands. The pressure against my chest was great, and I was barely able to keep my head above the surface. Not a soul was in sight, and my voice was lost in the roar of the fall. Slowly and gradually, I became exhausted and unable to withstand the strain longer.

Just as I was about to let go and be dashed against the rocks below, I saw in a flash of light a familiar diagram illustrating the hydraulic principle that the pressure of a fluid in motion is proportionate to the area exposed, and automatically I turned onto my left side. As if by magic, the pressure was reduced and I found it comparatively easy in that position to resist the force of the stream. But the danger still confronted me. I knew that sooner or later I would be carried down, as it was not possible for any help to reach me in time, even if I attracted attention. I am ambidextrous now, but then I was left-handed, and had comparatively little strength in my right arm. For this reason I did not dare to turn on the other side to rest, and nothing remained but to slowly push my body along the dam. I had to get away from the mill — towards which my face was turned — as the current there was much swifter and deeper. It was a long and painful ordeal, and I came near to failing at its very end, for I was confronted with a depression in the masonry. I managed to get over with the last ounce of my strength, and fell in a swoon when I reached the bank, which is where I was found. I had torn virtually all the skin from my left side, and it took several weeks before the fever subsided and I was well.

These are only two of many instances, but they may be sufficient to show that had it not been for the inventor's instinct, I would not have lived to tell this tale.

People have often asked me how and when I began to invent.

The first attempt I can recall was rather ambitious, for it involved the invention of both an apparatus and a method. In the former I was anticipated, but the latter was original. It happened in this way.

One of my playmates had come into possession of a hook and fishing-tackle which created some excitement in the village, and the

next morning my friends all set out to catch frogs. I was left alone and deserted, owing to a quarrel with this boy. I had never seen a real hook, and pictured it as something wonderful, endowed with peculiar qualities. I was in despair at not being one of the party. Urged by necessity, I somehow got hold of a piece of soft iron wire, hammered the end to a sharp point between two stones, bent it into shape, and fastened it to a strong string. I then cut a rod, gathered some bait, and went down to the brook where there were frogs in abundance.

But I could not catch any, and was almost discouraged when it occurred to me to dangle the empty hook in front of a frog sitting on a stump. At first he collapsed, but by and by his eyes bulged out and became bloodshot, he swelled to twice his normal size, and made a vicious snap at the hook. Immediately I pulled him up. I tried the same thing again and again, and the method proved infallible. When my comrades, who in spite of their fine outfit had caught nothing, came to me they were green with envy. For a long time, I kept my secret and enjoyed the monopoly but finally yielded to the spirit of Christmas. Every boy could then do the same and the following summer brought disaster to the frogs.

In my next attempt, I seem to have acted under an 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 with the sheer weight of their bodies. The bushes were black with them. I would attach as many as four of them to a crosspiece, 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 insufficient sense to stop, and continued whirling for hours and hours, and the hotter it was the harder they worked. All went well until a strange boy came to the place. He was the son of a retired officer in the Austrian Army. That urchin ate May-bugs alive, and enjoyed them as though they were the finest blue-point oysters. That disgusting sight terminated my endeavors in this promising field, and I have never since been able to touch a May-bug or any other insect for that matter.

After that, I believe, I undertook to take apart and reassemble my grandfather's clocks. In the former operation I was always successful,

but often failed in the latter. So my grandfather brought my work to a sudden halt in a manner that was not too delicate, and it took thirty years before I tackled another clockwork again.

Shortly thereafter, I began the manufacture of a kind of pop-gun which comprised a hollow tube, a piston, and two plugs of hemp. When firing the gun, the piston was pressed against the stomach and the tube was pushed back quickly with both hands. The air between the plugs was compressed and raised to a high temperature, and one of them was expelled with a loud report. The art consisted of selecting a tube of the proper taper from the hollow stalks. I did very well with that gun, but my activities interfered with the window panes in our house, and soon met with the most painful discouragement.

If I remember rightly, I then took to carving swords from pieces of furniture which I could conveniently obtain. At that time I was under the sway of the Serbian national poetry, and therefore full of admiration for the feats of the heroes. I used to spend hours in mowing down my enemies — in the form of corn-stalks, which ruined the crops, and netted me several spankings from my mother. Moreover, these were not of the formal kind, but the genuine article.

I had all this and more behind me before I was six years old and had passed through one year of elementary school in the village of Smiljan, where I was born. At this juncture we moved to the little city of Gospic nearby. This change of residence was like a calamity to me. It almost broke my heart to part from our pigeons, chickens and sheep, and our magnificent flock of geese which used to rise to the clouds in the morning and return from the feeding grounds at sundown in battle formation, so perfect that it would have put a squadron of the best aviators of the present day to shame.

In our new house I was but a prisoner, watching the strange people I saw through the window blinds. My bashfulness was such that I would rather have faced a roaring lion than one of the city dudes who strolled about. But my hardest trial came on Sunday, when I had to dress up and attend church. There, I met with an accident, the mere thought of which made my blood curdle like sour milk for years afterwards.

It was my second adventure in a church. Not long before, I had been entombed for a night in an old chapel on an inaccessible mountain which was visited only once a year. It was an awful experience, but this one was worse. There was a wealthy lady in town,

a good but pompous woman, who used to come to the church gorgeously painted up, and attired with an enormous train and attendants. One Sunday, I had just finished ringing the bell in the belfry and rushed downstairs, when this grand dame was sweeping out and I jumped on her train. It tore off with a ripping noise which sounded like a salvo of musketry fired by raw recruits. My father was livid with rage. He gave me a gentle slap on the cheek, the only corporal punishment he ever administered to me but I almost feel it now. The embarrassment and confusion that followed are indescribable. I was practically ostracized until something else happened which redeemed me in the estimation of the community.

An enterprising young merchant had organized a fire department. A new fire engine was purchased, uniforms provided, and the men drilled for service and parade. The engine was, in reality, a pump to be worked by sixteen men and was beautifully painted red and black. One afternoon the official trial was prepared for, and the machine was transported to the river. The entire population turned out to witness the great spectacle. When all the speeches and ceremonies were concluded, the command was given to pump, but not a drop of water came from the nozzle. The professors and experts tried in vain to locate the trouble.

The failure seemed complete by the time I arrived at the scene. My knowledge of the mechanism was nil and I knew next to nothing of air pressure, but instinctively I felt for the suction hose in the water and found that it had collapsed. When I waded into the river and opened it up, the water rushed forth and not a few Sunday clothes were spoiled. Archimedes running naked through the streets of Syracuse and shouting *Eureka!* at the top of his voice did not make a greater impression than I did that day. I was carried aloft on the peoples' shoulders, and was the hero of the day.

Upon settling in the city, I began a four year course in the so-called 'Normal School', as preparation to my studies at the College, or Real Gymnasium. During this period my boyish efforts and exploits, as well as troubles, continued.

Among other things, I attained the unique distinction of becoming the champion crow catcher in the country. My method of procedure was extremely simple. I would go into the forest, hide in the bushes, and imitate the call of the bird. Usually, I would get several answers and in a short while a crow would flutter down into the shrubbery near me. After that, all I needed to do was to throw a

piece of cardboard to distract its attention, and then jump up and grab it before it could extricate itself from the undergrowth. In this way I would capture as many as I desired.

But on one occasion, something occurred which made me respect them. I had caught a fine pair of birds, and was returning home with a friend. As we left the forest, thousands of crows gathered, making a frightful racket. In a few minutes, they rose in pursuit and soon enveloped us. The fun lasted until all of a sudden, I received a blow on the back of my head which knocked me down. Then they attacked me viciously. I was compelled to release the two birds, and was glad to join my friend who had taken refuge in a cave.

In the schoolroom, there were a few mechanical models which interested me and turned my attention to water turbines. I constructed many of these and found great pleasure in operating them. My uncle had no use for this kind of pastime, and more than once rebuked me. 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 saw my ideas carried out at Niagara.

I made all kinds of other contrivances and contraptions, and among these the arbalists (crossbows) I produced were the best. My arrows, when shot, disappeared from sight and at close range could pierce a plank of pine one inch thick. Through the continuous tightening of the bows, I developed skin on my stomach very much like that of a crocodile and I am often wondering whether it is due to this exercise that I am able even now to digest cobble-stones!

Nor can I pass in silence my performances with the sling, which would have enabled me to give a stunning exhibit at the Hippodrome. One of my feats with this antique implement of war will perhaps test the credulity of the reader. I was practicing while walking with my uncle alongside the river. The sun was setting, the trout were playful, and from time to time one would shoot up into the air, its glistening body sharply defined against a projecting rock beyond. Of course any boy might have hit a fish under these propitious conditions, but I undertook a much more difficult task and I foretold to my uncle, to the minutest detail, what I intended doing. I was to hurl a stone to meet the fish, press its body against the rock, and cut it in two. It was no sooner said than done. My uncle looked at me, almost scared out of his wits, and exclaimed *vade retro Satanas!* It was a few days before he spoke to me again.

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