



PRODIGAL GENIUS

THE EXTRAORDINARY LIFE OF NIKOLA TESLA

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LIGHT AND POWER

ONE

"SPECTACULAR" is a mild word for describing the strange experiment with life that comprises the story of Nikola Tesla, and "amazing" fails to do adequate justice to the results that burst from his experiences like an exploding rocket. It is the story of the dazzling scintillations of a superman who created a new world; it is a story that condemns woman as an anchor of the flesh which retards the development of man and limits his accomplishment—and, paradoxically, proves that even the most successful life, if it does not include a woman, is a dismal failure.

Even the gods of old, in the wildest imaginings of their worshipers, never undertook such gigantic tasks of worldwide dimension as those which Tesla attempted and accomplished. On the basis of his hopes, his dreams, and his achievements he rated the status of the Olympian gods, and the Greeks would have so enshrined him. Little is the wonder that so-called practical men, with their noses stuck in profit-and-loss statements, did not understand him and thought him strange.

The light of human progress is not a dim glow that gradually becomes more luminous with time. The panorama of human evolution is illumined by sudden bursts of dazzling brilliance in intellectual accomplishments that throw their beams far ahead to give us a glimpse of the distant future, that we may more correctly guide our wavering steps today. Tesla, by virtue of the amazing discoveries and inventions which he showered on the world, becomes one of the most resplendent flashes that has ever brightened the scroll of human advancement.

Tesla created the modern era; he was unquestionably one of the world's greatest geniuses, but he leaves no offspring, no legatees of his brilliant mind, who might aid in administering that world; he created fortunes for multitudes of others but himself died penniless, spurning wealth that might be gained from his discoveries. Even as he walked among

the teeming millions of New York he became a fabled individual who seemed to belong to the far-distant future or to have come to us from the mystical realm of the gods, for he seemed to be an admixture of a Jupiter or a Thor who hurled the shafts of lightning; an Ajax who defied the Jovian bolts; a Prometheus who transmuted energy into electricity to spread over the earth; an Aurora who would light the skies as a terrestrial electric lamp; a Mazda who created a sun in a tube; a Hercules who shook the earth with his mechanical vibrators; a Mercury who bridged the ambient realms of space with his wireless waves—and a Hermes who gave birth to an electrical soul in the earth that set it pulsating from pole to pole.

This spark of intellectual incandescence, in the form of a rare creative genius, shot like a meteor into the midst of human society in the latter decades of the past century; and he lived almost until today. His name became synonymous with magic in the intellectual, scientific, engineering and social worlds, and he was recognized as an inventor and discoverer of unrivaled greatness. He made the electric current his slave. At a time when electricity was considered almost an occult force, and was looked upon with terror-stricken awe and respect, Tesla penetrated deeply into its mysteries and performed so many marvelous feats with it that, to the world, he became a master magician with an unlimited repertoire of scientific legerdemain so spectacular that it made the accomplishments of most of the inventors of his day seem like the work of toy-tinkers.

Tesla was an inventor, but he was much more than a producer of new devices: he was a discoverer of new principles, opening many new empires of knowledge which even today have been only partly explored. In a single mighty burst of invention he created the world of power of today; he brought into being our electrical power era, the rock-bottom foundation on which the industrial system of the entire world is built; he gave us our mass-production system, for without his motors and currents it could not exist; he created the race of robots, the electrical mechanical men that are replacing human labor; he gave us every essential of modern radio; he invented the radar forty years before its

use in World War II; he gave us our modern neon and other forms of gaseous-tube lighting; he gave us our fluorescent lighting; he gave us the high-frequency currents which are performing their electronic wonders throughout the industrial and medical worlds; he gave us remote control by wireless; he helped give us World War II, much against his will—for the misuse of his superpower system and his robot controls in industry made it possible for politicians to have available a tremendous surplus of power, production facilities, labor and materials, with which to indulge in the most frightful devastating war that the maniacal mind could conceive. And these discoveries are merely the inventions made by the master mind of Tesla which have thus far been utilized—scores of others remain still unused.

Yet Tesla lived and labored to bring peace to the world. He dedicated his life to lifting the burdens from the shoulders of mankind; to bringing a new era of peace, plenty and happiness to the human race. Seeing the coming of World War II, implemented and powered by his discoveries, he sought to prevent it; offered the world a device which he maintained would make any country, no matter how small, safe within its borders—and his offer was rejected.

More important by far, however, than all his stupendously significant electrical discoveries is that supreme invention—Nikola Tesla the Superman—the human instrument which shoved the world forward with an accelerating lunge like an airplane cast into the sky from a catapult. Tesla, the scientist and inventor, was himself an invention, just as much as was his alternating-current system that put the world on a superpower basis.

Tesla was a superman, a self-made superman, invented and designed specifically to perform wonders; and he achieved them in a volume far beyond the capacity of the world to absorb. His life he designed on engineering principles to enable him to serve as an automaton, with utmost efficiency, for the discovery and application of the forces of Nature to human welfare. To this end he sacrificed love and pleasure, seeking satisfaction only in his accomplishments, and limiting his body solely to serving as a tool of his technically creative mind.

With our modern craze for division of labor and specialization of effort to gain efficiency of production in our industrial machine, one hesitates to think of a future in which Tesla's invention of the superman might be applied to the entire human race, with specialization designed for every individual from birth.

The superman that Tesla designed was a scientific saint. The inventions that this scientific martyr produced were designed for the peace, happiness and security of the human race, but they have been applied to create scarcity, depressions and devastating war. Suppose the superman invention were also developed and prostituted to the purposes of war-mongering politicians? Tesla glimpsed the possibilities and suggested the community life of the bee as a threat to our social structure unless the elements of individual and community lives are properly directed and personal freedom protected.

Tesla's superman was a marvelously successful invention — for Tesla — which seemed, as far as the world could observe, to function satisfactorily. He eliminated love from his life; eliminated women even from his thoughts. He went beyond Plato, who conceived of a spiritual companionship between man and woman free from sexual desires; he eliminated even the spiritual companionship. He designed the isolated life into which no woman and no man could enter; the self-sufficient individuality from which all sex considerations were completely eliminated; the genius who would live entirely as a thinking and a working machine.

Tesla's superman invention was a producer of marvels, and he thought that he had, by scientific methods, succeeded in eliminating love from his life. That abnormal life makes a fascinating experiment for the consideration of the philosopher and psychologist, for he did not succeed in eliminating love. It manifested itself despite his conscientious efforts at suppression; and when it did so it came in the most fantastic form, providing a romance like of which is not recorded in the annals of human history.

Tesla's whole life seems unreal, as if he were a fabled creature of some Olympian world. A reporter, after writing a story of his discoveries and inventions, concluded, "His accomplishments seem like the dream of an

intoxicated god." It was Tesla's invention of the polyphase alternating-current system that was directly responsible for harnessing Niagara Falls and opened the modern electrical superpower era in which electricity is transported for hundred of miles, to operate the tens of thousands of mass-production factories of industrial systems. Every one of the tall Martian-like towers of the electrical transmission lines that stalk across the earth, and whose wires carry electricity to distant cities, is a monument to Tesla; every powerhouse, every dynamo and every motor that drives every machine in the country is a monument to him.

Superseding himself, he discovered the secret of transmitting electrical power to the utmost ends of the earth without wires, and demonstrated his system by which useful amounts of power could be drawn from the earth anywhere merely by making a connection to the ground; he set the entire earth in electrical vibration with a generator which spouted lightning that rivaled the fiery artillery of the heavens. It was as a minor portion of this discovery that he created the modern radio system; he planned our broadcasting methods of today, forty years ago when others saw in wireless only the dot-dash messages that might save ships in distress.

He produced lamps of greater brilliance and economy than those in common use today; he invented the tube, fluorescent and wireless lamps which we now consider such up-to-the-minute developments; and he essayed to set the entire atmosphere of the earth aglow with his electric currents, to change our world into a single terrestrial lamp and to make the skies at night shine as does the sun by day.

If other first-magnitude inventors and discoverers may be considered torches of progress, Tesla was a conflagration. He was the vehicle through which the blazing suns of a brighter tomorrow focused their incandescent beams on a world that was not prepared to receive their light. Nor is it remarkable that this radiant personality should have led a strange and isolated life. The value of his contributions to society cannot be overrated. We can now analyze, to some extent, the personality that produced them. He stands as a synthetic genius, a self-made superman, the greatest invention of the greatest inventor of all times.

But when we consider Tesla as a human being, apart from his charming and captivating social manners, it is hard to imagine a worse nightmare than a world inhabited entirely by geniuses.

When Nature makes an experiment and achieves an improvement it is necessary that it be accomplished in such a way that the progress will not be lost with the individual but will be passed on to future generations. In man, this requires a utilization of the social values of the race, cooperation of the individual with his kind, that the improved status may be propagated and become a legacy of all. Tesla intentionally engineered love and women out of his life, and while he achieved gigantic intellectual stature, he failed to achieve its perpetuation either through his own progeny or through disciples. The superman he constructed was not great enough to embrace a wife and continue to exist as such. The love he sought to suppress in his life, and which he thought was associated only with women, is a force which, in its various aspects, links together all members of the human race.

In seeking to suppress this force entirely Tesla severed the bonds which might have brought to him the disciples who would, through other channels, have perpetuated the force of his prodigal genius. As a result, he succeeded in imparting to the world only the smallest fraction of the creative products of his synthetic superman.

The creation of a superman as demonstrated by Tesla was a grand experiment in human evolution, well worthy of the giant intellect that grew out of it, but it did not come up to Nature's standards; and the experiment will have to be made many times more before we learn how to create a super race with the minds of Teslas that can tap the hidden treasury of Nature's store of knowledge, yet endowed too with the vital power of love that will unlock forces, more powerful than any which we now glimpse, for advancing the status of the human race.

There was no evidence whatever that a superman was being born when the stroke of midnight between July 9 and 10, in the year 1856, brought a son, Nikola, to the home of the Rev. Milutin Tesla and Djouka, his wife, in the hamlet of Smiljan, in the Austro-Hungarian border province of Lika, now a part of Yugoslavia. The father of the new arrival,

pastor of the village church, was a former student in an officers' training school who had rebelled against the restrictions of Army life and turned to the ministry as the field in which he could more satisfactorily express himself. The mother, although totally unable to read or write, was nevertheless an intellectually brilliant woman, who without the help of literal aids became really well educated.

Both father and mother contributed to the child a valuable heritage of culture developed and passed on by ancestral families that had been community leaders for many generations. The father came from a family that contributed sons in equal numbers to the Church and to the Army. The mother was a member of the Mandich family whose sons, for generations without number, had, with very few exceptions, become ministers of the Serbian Orthodox Church, and whose daughters were chosen as wives by ministers.

Djouka, the mother of Nikola Tesla (her given name in English translation would be Georgina), was the eldest daughter in a family of seven children. Her father, like her husband, was a minister of the Serbian Orthodox Church. Her mother, after a period of failing eyesight, had become blind shortly after the seventh child was born; so Djouka, the eldest daughter, at a tender age was compelled to take over the major share of her mother's duties. This not alone prevented her from attending school: her work at home so completely consumed her time that she was unable to acquire even the rudiments of reading and writing through home study. This was a strange situation in the cultured family of which she was a member. Tesla, however, always credited his unlettered mother rather than his erudite father with being the source from which he inherited his inventive ability. She devised many household labor-saving instruments. She was, in addition, a very practical individual, and her well-educated husband wisely left in her hands all business matters involving both the church and his household.

An unusually retentive memory served this remarkable woman as a good substitute for literacy. As the family moved in cultured circles she absorbed by ear much of the cultural riches of the community. She could repeat, without error or omission, thousands of verses of the national

poetry of her country — the sagas of the Serbs — and could recite long passages from the Bible. She could narrate from memory the entire poetical-philosophical work *Gorski Vijenac* (Mountain Wreath), written by Bishop Petrovich Njegosh. She also possessed artistic talent and a versatile dexterity in her fingers for expressing it. She earned wide fame throughout the countryside for her beautiful needlework. According to Tesla, so great were her dexterity and her patience that she could, when over sixty, using only her fingers, tie three knots in an eyelash.

The remarkable abilities of this clever woman who had no formal education were transmitted to her five children. The elder son, Dane Tesla, born seven years before Nikola, was the family favorite because of the promise of an outstanding career which his youthful cleverness indicated was in store for him. He foreshadowed in his early years the strange manifestations which in his surviving brother were a prelude to greatness.

Tesla's father started his career in the military service, a likely choice for the son of an officer; but he apparently did not inherit his father's liking for Army life. So slight an incident as criticism for failure to keep his brass buttons brightly polished caused him to leave military school. He was probably more of a poet and philosopher than a soldier. He wrote poetry which was published in contemporary papers. He also wrote articles on current problems which he signed with a pseudonym, "Srbin Pravichich." This, in Serb, means "Man of Justice." He spoke, read and wrote Serbo-Croat, German and Italian. It was probably his interest in poetry and philosophy that caused him to be attracted to Djouka Mandich. She was twenty-five and Milutin was two years older. He married her in 1847. His attraction to the daughter of a pastor probably influenced his next choice of a career, for he then entered the ministry and was soon ordained a priest.

He was made pastor of the church at Senj, an important seaport with facilities for a cultural life. He gave satisfaction, but apparently he achieved success among his parishioners on the basis of a pleasing personality and an understanding of problems rather than by using any great erudition in theological and ecclesiastical matters.

A few years after he was placed in charge of this parish, a new archbishop, elevated to head of the diocese, wished to survey the capabilities of the priests in his charge and offered a prize for the best sermon preached on his official visit. The Rev. Milutin Tesla was bubbling over, at the time, with interest in labor as a major factor in social and economic problems. To preach a sermon on this topic was, from the viewpoint of expediency, a totally impractical thing to do. Nobody, however, had ever accused the Rev. Mr. Tesla of being practical, so doing the impractical thing was quite in harmony with his nature. He chose the subject which held his greatest interest; and when the archbishop arrived, he listened to a sermon on "Labor."

Months later Senj was surprised by an unanticipated visit from the archbishop, who announced that the Rev. Mr. Tesla had preached the best sermon, and awarded him a red sash which he was privileged to wear on all occasions. Shortly afterward he was made pastor at Smiljan, where his parish then embraced forty homes. He was later placed in charge of the much larger parish in the nearby city of Gospic. His first three children, Milka, Dane and Angelina, were born at Senj. Nikola and his younger sister, Marica, were born at Smiljan.

Tesla's early environment, then, was that of an agricultural community in a high plateau region near the eastern shore of the Adriatic Sea in the Velebit Mountains, a part of the Alps, a mountain chain stretching from Switzerland to Greece. He did not see his first steam locomotive until he was in his teens, so his aptitude for mechanical matters did not grow out of his environment.

Tesla's homeland is today called Yugoslavia, a country whose name means "Land of the Southern Slavs." It embraces several former separate countries, Serbia, Bosnia, Croatia, Montenegro, Dalmatia and also Slovenia. The Tesla and Mandich families originally came from the western part of Serbia near Montenegro. Smiljan, the village where Tesla was born, is in the province of Lika, and at the time of his birth this was a dependent province held by the Austro-Hungarian Empire as part of Croatia and Slovenia.

Tesla's surname dates back more than two and a half centuries. Before

that time the family name was Draganic (pronounced as if spelled Drag'-a-nitch). The name Tesla (pronounced as spelled, with equal emphasis on both syllables), in a purely literal sense, is a trade name like Smith, Wright or Carpenter. As a common noun it describes a woodworking tool which, in English, is called an adz. This is an axe with a broad cutting blade at right angles to the handle, instead of parallel as in the more familiar form. It is used in cutting large tree trunks into squared timbers. In the Serbo-Croat language, the name of the tool is tesla. There is a tradition in the Draganic family that the members of one branch were given the nickname "Tesla" because of an inherited trait which caused practically all of them to have very large, broad and protruding front teeth which greatly resembled the triangular blade of the adz.

The name Draganic and derivatives of it appear frequently in other branches of the Tesla family as a given name. When used as a given name it is frequently translated "Charlotte," but as a generic term it holds the meaning "dear" and as a surname is translated "Darling."

The majority of Tesla's ancestors for whom age records are available lived well beyond the average span of life for their times, but no definite record has been found of the ancestor who, Tesla claimed, lived to be one hundred and forty years of age. (His father died at the age of fifty-nine, and his mother at seventy-one.)

Although many of Tesla's ancestors were dark eyed, his eyes were a gray-blue. He claimed his eyes were originally darker, but that as a result of the excessive use of his brain their color changed. His mother's eyes, however, were gray and so are those of some of his nephews. It is probable, therefore, that his gray eyes were inherited, rather than faded by excessive use of the brain.

Tesla grew to be very tall and very slender—tallness was a family and a national trait. When he attained full growth he was exactly two meters, or six feet two and one-quarter inches tall. While his body was slender, it was built within normal proportions. His hands, however, and particularly his thumbs, seemed unusually long.

Nikola's older brother Dane was a brilliant boy and his parents gloried in their good fortune in being blessed with such a fine son. There

was, however, a difference of seven years in the two boys' ages, and since the elder brother died as the result of an accident at the age of twelve, when Nikola was but five years old, a fair comparison of the two seems hardly possible. The loss of their first-born son was a great blow to his mother and father; the grief and regrets of the family were manifest in idealizing his talents and predicting possibilities of greatness he might have realized, and this situation was a challenge to Nikola in his youth.

The superman Tesla developed out of the superhero Nikola. Forced to rise above the normal level by an urge to carry on for his dearly beloved departed brother, and also on his own account to exceed the great accomplishment his brother might have attained had he lived, he unconsciously drew upon strange resources within. The existence of these resources might have remained unsuspected for a lifetime, as happens with the run of individuals, if Nikola had not felt the necessity for creating a larger sphere of life for himself.

He was aware as a boy that he was not like other boys in his thoughts, in his amusements and in his hobbies. He could do the things that other lads his age usually do, and many things that they could not do. It was these latter things that interested him most, and he could find no companions who would share his enthusiasms for them. This situation caused him to isolate himself from contemporaries, and made him aware that he was destined for an unusual place if not great accomplishments in life. His boyish mind was continually exploring realms which his years had not reached, and his boyhood attainments frequently were worthy of men of mature age.

He had, of course, the usual experience of unusual incidents that fall to the lot of a small boy. One of the earliest events which Tesla recalled was a fall into a tank of hot milk that was being scalded in the process used by the natives of that region as a hygienic measure, anticipating the modern process of pasteurizing.

Shortly afterward he was accidentally locked in a remote mountain chapel which was visited only at widely separated intervals. He spent the night in the small building before his absence was discovered and his possible hiding place determined.

Living close to Nature, with ample opportunity for observing the flight of birds, which has ever filled men with envy, he did what many another boy has done with the same results. An umbrella, plus imagination, offered to him a certain solution of the problem of free flight through the air. The roof of a barn was his launching platform. The umbrella was large, but its condition was much the worse for many years of service; it turned inside out before the flight was well started. No bones were broken, but he was badly shaken up and spent the next six weeks in bed. Probably, though, he had better reason for making this experiment than most of the others who have tried it. He revealed that practically all his life he experienced a peculiar reaction when breathing deeply. When he breathed deeply he was overcome by a feeling of lightness, as if his body had lost all weight; and he should, he concluded, be able to fly through the air merely by his will to do so. He did not learn, in boyhood, that he was unusual in this respect.

One day when he was in his fifth year, one of his chums received a gift of a fishing line, and all the boys in the group planned a fishing trip. On that day he was on the outs with his chums for some unremembered reason. As a result, he was informed he could not join them. He was not permitted even to see the fishing line at close range. He had glimpsed, however, the general idea of a hook on the end of a string. In a short time he had fashioned his own interpretation of a hook. The refinement of a barb had not occurred to him and he also failed to evolve the theory of using bait when he went off on his own fishing expedition. The baitless hook failed to attract any fish but, while dangling in the air, much to Tesla's surprise and satisfaction it snared a frog that leaped at it. He came home with a bag of nearly two dozen frogs. It may have been a day on which the fish were not biting, but at any rate his chums came home from the use of their new hook and line without any fish. His triumph was complete. When he later revealed his technique, all the boys in the neighborhood copied his hook and method, and in a short time the frog population of the region was greatly depleted.

The contents of birds' nests always excited Tesla's curiosity. He rarely disturbed their contents or occupants. On one occasion, however, he

climbed a rocky crag to investigate an eagle's nest and took from it a baby eagle which he kept locked in a barn. A bird on the wing he considered fair prey for his sling shot, with which he was a star performer.

About this time he became intrigued with a piece of hollow tube cut from a cane growing in the neighborhood. This he played with until he had evolved a blow gun and later, by making a plunger and plugging one end of the tube with a wad of wet hemp, a pop gun. He then undertook the making of larger pop guns, and contrived one in which the end of the plunger was held against the chest and the tube pulled energetically toward the body. He engaged in the manufacture of this article for his chums, as a five-year-old businessman. When a number of window panes happened to get broken accidentally by getting in the way of his hemp wad, his inventive proclivities in this field were quickly curbed by the destruction of the pop guns and the administration of the parental rod.

Tesla started his formal education by attending the village school in Smiljan before he reached his fifth birthday. A few years later his father received his appointment as pastor of a church in the nearby city of Gospic, so the family moved there. This was a sad day for young Tesla. He had lived close to Nature, and loved the open country and the high mountains among which he had thus far spent all of his life. The sudden transition to the artificialities of the city was a very definite shock to him. He was out of harmony with his new surroundings.

His advent into the city life of Gospic, at the age of seven, got off to an unfortunate start. As the new minister in town, his father was anxious to have everything move smoothly. Tesla was required to dress in his best clothes and attend the Sunday services. Naturally, he dreaded this ordeal and was very happy when assigned the task of ringing the bell summoning the worshipers to the service and announcing the close of the ceremonies. This gave him an opportunity to remain unseen in the belfry while the parishioners, their daughters and dude sons were arriving and departing.

Thinking he had waited long enough after the close of the service for the church to be cleared on this first Sunday, he came downstairs three

steps at a time. A wealthy woman parishioner wearing a skirt with a long train that fashionably dragged along the ground, and who had come to the service with a retinue of servants, remained after the other parishioners to have a talk with the new pastor. She was just making an impressive exit when Tesla's final jump down the stairs landed him on the train, ripping this dignity-preserving appendage from the woman's dress. Her mortification and rage and his father's anger came upon him simultaneously. Parishioners loitering outside rushed back to revel in the spectacle. Thereafter no one dared be pleasant to this youngster who had enraged the wealthy dowager who domineered it over the social community. He was practically ostracized by the parishioners, and continued so until he redeemed himself in a spectacular manner.

Tesla felt strange and defeated in his ignorance of city ways. He met the situation first by avoidance. He did not care to leave his home. The boys of his age were neatly dressed every day. They were dudes and he did not belong. Even as a child Tesla was meticulously careful in dress. At the earliest moment, however, he would slip work clothes over his dress clothes and go wandering in the woods or engage in mechanical work. He could not enjoy life if limited to the activities in which he could engage while dressed up. Tesla, however, possessed ingenuity, and there was rarely a situation in which he was not able to use it. He also possessed knowledge of the ways of Nature. These gave him a distinct superiority over the city boys.

About a year after the family moved to Gospic a new fire company was organized. It was to be supplied with a pump which would replace the useful but inadequate bucket brigade. The members of the new organization obtained brightly colored uniforms and practiced marching for parades. Eventually the new pump arrived. It was a man-power pump to be operated by sixteen men. A parade and demonstration of the new apparatus was arranged. Almost everyone in Gospic turned out for the event and followed to the river front for the pump demonstration. Tesla was among them. He paid no attention to the speeches but was all eyes for the brightly painted apparatus. He did not know how it worked but would have loved to take it apart and investigate the insides.

The time for the demonstration came when the last speaker, finishing his dedicatory address, gave the order to start the pumping operation that would send a stream of water shooting skyward from the nozzle. The eight men regimented on either side of the pump bowed and rose in alternate unison as they raised and lowered the bars that operated the pistons of the pump. But nothing else happened, not a drop of water came from the nozzle!

Officials of the fire company started feverishly to make adjustments and, after each attempt, set the sixteen men oscillating up and down at the pump handles, but each time without results. The lines of hose between the pump and the nozzle were straightened out, they were disconnected from the pump and connected again. But no water came from the far end of the hose to reward the efforts of the perspiring firemen.

Tesla was among the usual group of urchins that always manages to get inside the lines on such occasions. He tried to see everything that was going on from the closest possible vantage point and undoubtedly got on the nerves of the vexed officials when their repeated efforts were frustrated by continuous failures. As one of the officials turned for the tenth time to vent his frustration on the urchins and order them away from his range of action, Tesla grabbed him by the arm.

“I know what to do, Mister,” said Tesla. “You keep pumping.”

Dashing for the river, Tesla peeled his clothes off quickly and dove into the water. He swam to the suction hose that was supposed to draw the water supply from the river. He found it kinked, so that no water could flow into it, and flattened by the vacuum created by the pumping. When he straightened out the kink, the water rushed into the line. The nozzle-men had stood at their post for a long time, receiving a continuous repetition of warnings to be prepared each time an adjustment was made, but, as nothing happened on these successive occasions, they had gradually relaxed their attention and were giving little thought to the direction in which the nozzle was pointed. When the stream of water did shoot skyward, down it came on the assembled officials and townspeople. This item of unexpected drama excited the crowd at the other end of the line near the pump, and to give vent to their joy they seized

the scantily dressed Tesla, boosted him to the shoulders of a couple of the firemen, and led a procession around the town. The seven-year-old Tesla was the hero of the day.

Later on Tesla, in explaining the incident, said that he had had not the faintest idea of how the pump worked; but as he watched the men struggle with it, he got an intuitive flash of knowledge that told him to go to the hose in the river. On looking back to that event, he said, he knew how Archimedes must have felt when, after discovering the law of the displacement of water by floating objects, he ran naked through the streets of Syracuse shouting “Eureka!”

At the age of seven, Tesla had tasted the pleasures of public acclaim for his ingenuity. And further, he had done something which the dudes, the boys of his age in the city, could not do and which even their fathers could not do. He had found himself. He was now a hero, and it could be forgotten that he had jumped on a woman's skirt and ripped the train off.

Tesla never lost an opportunity to hike through the nearby mountains where he could again enjoy the pleasures of his earlier years spent so close to Nature. On these occasions he would often wonder if there was still operating a crude water wheel which he made and installed, when he was less than five years old, across the mountain brook near his home in Smiljan.

The wheel consisted of a not too well-smoothed disk cut from a tree trunk in some lumbering operations. Through its center he was able to cut a hole and force into it a somewhat straight branch of a tree, the ends of which he rested in two sticks with crotches which he forced into the rock on either bank of the brook. This arrangement permitted the lower part of the disk to dip in the water and the current caused it to rotate. To the lad there was a great deal of originality employed in making this ancient device. The wheel wobbled a bit but to him it was a marvelous piece of construction, and he got no end of pleasure out of watching his water wheel obtain power from the brook.

This experiment undoubtedly made a life-long impression on his young plastic mind and endowed him with the desire, ever afterward mani-

fested in his work, of obtaining power from Nature's sources which are always being dissipated and always being replenished.

In this smooth-disk water wheel we find an early clue to his later invention of the smooth-disk turbine. In his later experience, he discovered that all water wheels have paddles—but his little water wheel had operated without paddles.

Tesla's first experiment in original methods of power production was made when he was nine years old. It demonstrated his ingenuity and originality, if nothing else. It was a sixteen-bug-power engine. He took two thin slivers of wood, as thick as a toothpick and several times as long, and glued them together in the form of a cross, so they looked like the arms of a windmill. At the point of intersection they were glued to a spindle made of another thin sliver of wood. On this he slipped a very small pulley with about the diameter of a pea. A piece of thread acting as a driving belt was slipped over this and also around the circumference of a much larger but light pulley which was also mounted on a thin spindle. The power for this machine was furnished by sixteen May bugs (June bugs in the United States). He had collected a jar full of the insects, which were very much of a pest in the neighborhood. With a little dab of glue four bugs were affixed, heading in the same direction, to each of the four arms of the windmill arrangement. The bugs beat their wings, and if they had been free would have flown away at high speed. They were, however, attached to the cross arms, so instead they pulled them around at high speed. These, being connected by the thread belt to the large pulley, caused the latter to turn at low speed; but it developed, Tesla reports, a surprisingly large torque, or turning power.

Proud of his bug-power motor and its continuous operation—the bugs did not cease flying for hours—he called in one of the boys in the neighborhood to admire it. The lad was a son of an Army officer. The visitor was amused for a short time by the bug motor, until he spied the jar of still unused May bugs. Without hesitation he opened the jar, fished out the bugs, and ate them. This so nauseated Tesla that he chased the boy out of the house and destroyed the bug motor. For years he could not tolerate the sight of May bugs without a return of

this unpleasant reaction.

This event greatly annoyed Tesla because he had planned to add more spindles to the shaft and stick on more fliers until he had more than a one-hundred-bug-power motor.

TWO

TESLA'S YEARS IN school were more important for the activities in which he engaged in after-school hours than for what he learned in the classroom. At the age of ten, having finished his elementary studies in the Normal School, Tesla entered the college, called the Real Gymnasium, at Gospic. This was not an unusually early age to enter the Real Gymnasium, as that school corresponds more to our grammar school and junior high school than to our college.

One of the requirements, and one to which an unusually large percentage of the class time was devoted throughout the four years, was freehand drawing. Tesla detested the subject almost to the point of open rebellion, and his marks were accordingly very low, but not entirely owing to a lack of ability.

Tesla was left-handed as a boy, but later became ambidextrous. Left-handedness was a definite handicap in the freehand-drawing studies, but he could have done much better work than he actually produced and would have gotten higher marks if it were not for a piece of altruism in which he engaged. A student whom he could excel in drawing was striving hard for a scholarship. Were he to receive the lowest marks in freehand drawing, he would be unable to obtain the scholarship. Tesla sought to help his fellow student by intentionally getting the lowest rating in the small class.

Mathematics was his favorite subject and he distinguished himself in that study. His unusual proficiency in this field was not considered a counterbalancing virtue to make amends for his lack of enthusiasm for freehand drawing. A strange power permitted him to perform unusual feats in mathematics. He possessed it from early boyhood, but had considered it a nuisance and tried to be rid of it because it seemed beyond his control.

If he thought of an object it would appear before him exhibiting the

appearance of solidity and massiveness. So greatly did these visions possess the attributes of actual objects that it was usually difficult for him to distinguish between vision and reality. This abnormal faculty functioned in a very useful fashion in his school work with mathematics.

If he was given a problem in arithmetic or algebra, it was immaterial to him whether he went to the blackboard to work it out or whether he remained in his seat. His strange faculty permitted him to see a visioned blackboard on which the problem was written, and there appeared on this blackboard all of the operations and symbols required in working out the solution. Each step appeared much more rapidly than he could work it out by hand on the actual slate. As a result, he could give the solution almost as quickly as the whole problem was stated.

His teachers, at first, had some doubts about his honesty, thinking he had worked out some clever deceit for getting the right answers. In due time their skepticism was dispelled and they accepted him as a student who was unusually apt at mental arithmetic. He would not reveal this power to anyone and would discuss it only with his mother, who in the past had encouraged him in his efforts to banish it. Now that the power had demonstrated some definite usefulness, though, he was not so anxious to be completely rid of it, but desired to bring it under his complete control.

Work that Tesla did outside school hours interested him much more than his school work. He was a rapid reader and had a memory that was retentive to the point, almost, of infallibility. He found it easy to acquire foreign languages. In addition to his native Serbo-Croat language he became proficient in the use of German, French and Italian. This opened to him great stores of knowledge to which other students did not have access, yet this knowledge, apparently, was of little use to him in his school work. He was interested in things mechanical but the school provided no manual training course. Nevertheless, he became proficient in the working of wood and metals with tools and methods of his own contriving.

In the classroom of one of the upper grades of the Real Gymnasium, models of water wheels were on exhibition. They were not working models but nevertheless they aroused Tesla's enthusiasm. They recalled

to him the crude wheel he had constructed in the hills of Smiljan. He had seen pictures of the magnificent Niagara Falls. Coupling the power possibilities presented by the majestic waterfalls and the intriguing possibilities he saw in the models of the water wheels, he aroused in himself a passion to accomplish a grand achievement. Waxing eloquent on the subject, he told his father, "Some day I am going to America and harness Niagara Falls to produce power." Thirty years later he was to see this prediction fulfilled.

There were many books in his father's library. The knowledge in those books interested him more than that which he received in school and he wished to spend his evenings reading them. As in other matters, he carried this to an extreme, so his father forbade him to read them, fearing that he would ruin his eyes in the poor light of tallow candles then used for illumination. Nikola sought to circumvent this ruling by taking candles to his room and reading after he was sent to bed, but his violation of orders was soon discovered and the family candle supply was hidden. Next he fashioned a candle mould out of a piece of tin and made his own candles. Then, by plugging the keyhole and the chinks around the door, he was able to spend the night hours reading volumes purloined from his father's bookshelves. Frequently, he said, he would read through the entire night and feel none the worse for the loss of sleep. Eventual discovery, however, brought paternal discipline of a vigorous nature. He was about eleven years old at this time.

Like other boys of his age he played with bows and arrows. He made bigger bows, and better, straighter shooting arrows, and his marksmanship was excellent. He was not willing to stop at that point. He started building arbalists. These could be described as bow-and-arrow guns. The bow is mounted on a frame and the string pulled back and caught on a peg from which it is released by a trigger. The arrow is laid on the midpoint of the bow, its end against the taut string. The bow lies horizontal on the frame whereas in ordinary manual shooting the bow is held in vertical position. For this reason the device is sometimes called the crossbow. In setting an arbalist the beam is placed against the abdomen and the string pulled back with all possible force. Tesla did this

so often, he said, that his skin at the point of pressure became calloused until it was more like a crocodile's hide. When shot into the air the arrows from his arbalest were never recovered, for they went far out of sight. At close range they would pass through a pine board an inch thick.

Tesla got a thrill out of archery not experienced by other boys. He was, in imagination, riding those arrows which he shot out of sight into the blue vault of the heavens. That sense of exhilaration he experienced when breathing deeply gave him such a feeling of lightness he convinced himself that in this state it would be relatively easy for him to fly through the air if he only could devise some mechanical aid that would launch him and enable him to overcome what he thought was only a slight remaining weight in his body. His earlier disastrous jump from the barn roof had not disillusioned him. His conclusions were in keeping with his sensations; but a twelve-year-old lad exploring this difficult field alone cannot be condemned too severely for not discovering that our senses sometimes deceive us, or rather that we sometimes deceive ourselves in interpreting what our senses tell us.

In breathing deeply he was overventilating his lungs, taking out some of the residual carbon dioxide which is chemical "ashes," and largely inert, and replacing it with air containing a mixture of equally inert nitrogen and very active oxygen. The latter being present in more than normal proportions immediately began to upset chemical balances throughout the body. The reaction on the brain produces a result which does not differ greatly from alcohol intoxication. A number of cults use this procedure to induce "mystical" or "occult" experiences. How was a twelve-year-old boy to know all these things? He could see that birds did an excellent job in flying. He was convinced that some day man would fly, and he wanted to produce the machine that would get him off the ground and into the air.

The big idea came to him when he learned about the vacuum—a space within a container from which all air had been exhausted. He learned that every object exposed to the air was under a pressure of about fourteen pounds per square inch, while in a vacuum objects were free of such pressure. He figured that a pressure of fourteen pounds should turn a

cylinder at high speed and he could arrange to get advantage of such pressure by surrounding one half of a cylinder with a vacuum and having the remaining half of its surface exposed to air pressure. He carefully built a box of wood. At one end was an opening into which a cylinder was fitted with a very high order of accuracy, so that the box would be airtight; and on one side of the cylinder the edge of the box made a right-angle contact. On the cylinder's other side the box made a tangent, or flat, contact. This arrangement was made because he wanted the air pressure to be exerted at a tangent to the surface of the cylinder—a situation that he knew would be required in order to produce rotation. If he could get that cylinder to rotate, all he would have to do in order to fly would be to attach a propeller to a shaft from the cylinder, strap the box to his body and obtain continuous power from his vacuum box that would lift him through the air. His theory of course was fallacious, but he had no means of knowing that at the time.

The workmanship on this box was undoubtedly of a very high order, considering it was made by a self-instructed twelve-year-old mechanic. When he connected his vacuum pump, an ordinary air pump with its valves reversed, he found the box was airtight, so he pulled out all the air, watching the cylinder intently while doing so. Nothing happened for many strokes of the pump except that it made his back lame to pull the pump handle upward while he created the most “powerful” possible vacuum. He rested for a moment. He was breathing deeply from exertion, overventilating his lungs, and getting that joyous, dizzy, light-as-air feeling which was a highly satisfactory mental environment for his experiment.

Suddenly the cylinder started to turn—slowly! His experiment was a success! His vacuum-power box was working! He would fly!

Tesla was delirious with joy. He went into a state of ecstasy. There was no one with whom he could share this joy, as he had taken no one into his confidence. It was his secret and he was forced to endure its joys alone. The cylinder continued to turn slowly. It was no hallucination. It was real. It did not speed up, however, and this was disappointing. He had visualized it turning at a tremendous speed but it was actu-

ally turning extremely slowly. His idea, at least, he figured, was correct. With a little better workmanship, perhaps he could make the cylinder turn faster. He stood spellbound watching it turn at a snail's pace for less than half a minute—and then the cylinder stopped. That broke the spell and ended for the time his mental air flights.

He hunted for the trouble and quickly located what he was sure was the cause of the difficulty. Since the vacuum, he theorized, is the source of power, then, if the power stops, it must be because the vacuum is gone. His pump, he felt sure, must be leaking air. He pulled up the handle. It came up easily and that meant very definitely he had lost the vacuum in the box. He again pumped out the air—and again when he reached a high vacuum the cylinder started to turn slowly and continued to do so for a fraction of a minute. When it stopped he again pumped a vacuum and again the cylinder turned. This time he continued to operate the pump and the cylinder continued to turn. He could keep it turning as long as he desired by continuing to pump the vacuum.

There was nothing wrong with his theory, as far as he could see. He went over the pump very carefully, making improvements which would give him a high vacuum, and studied the valve to make that a better guard of the vacuum in the box. He worked on the project for weeks but despite his best efforts he could get no better results than the slow movement of the cylinder.

Finally the truth came to him in a flash—he was losing the vacuum in the box because the air was leaking in around the cylinder on that side where the flat board was tangent to the surface of the cylinder. As the air flowed into the box it pulled the cylinder around with it very slowly. When the air stopped flowing into the box the cylinder stopped turning. He knew now his theory was wrong. He had supposed that even with the vacuum being maintained, and no air leaking in, the air pressure would be exerted at a tangent to the surface of the cylinder and the pressure would produce motion in the same way as pushing on the rim of a wheel will cause it to turn. He discovered later, however, that the air pressure is exerted at right angles to the surface of the cylinder at all points, like the direction of the spokes of a wheel, and therefore

it could not be used to produce rotation in the way he planned.

This experiment, nevertheless, was not a total loss, even though it greatly disheartened him. The knowledge that the air leaking into a vacuum had actually produced even a small amount of rotation in a cylinder remained with him and led directly, many years later, to his invention of the “Tesla turbine,” the steam engine that broke all records for horsepower developed per pound of weight — what he called “a power house in a hat.”

Nature seemed to be constantly engaged in staging spectacular demonstrations for young Tesla, revealing to him samples of the secret of her mighty forces.

Tesla was roaming in the mountains with some chums one winter day after a storm in which the snow fell moist and sticky. A small snowball rolled on the ground quickly gathered more snow to itself and soon became a big one that was not too easy to move. Tiring of making snowmen and snow houses on level stretches of ground, the boys took to throwing snowballs down the sloping ground of the mountain. Most of them were duds — that is, they got stalled in the soft snow before they accumulated additional volume. A few rolled a distance, grew larger and then bogged down and stopped. One, however, found just the right conditions; it rolled until it was a large ball and then spread out, rolling up the snow at the sides as if it were rolling up a giant carpet, and then suddenly it turned into an avalanche. Soon an irresistible mass of snow was moving down the steep slope. It stripped the mountainside clean of snow, trees, soil and everything else it could carry before it and with it. The great mass landed in the valley below with a thud that shook the mountain. The boys were frightened because there was snow above them on the mountain that might have been shaken into a downward slide, carrying them along buried in it.

This event made a profound impression on Tesla and it dominated a great deal of his thinking in later life. He had witnessed a snowball weighing a few ounces starting an irresistible, devastating movement of thousands of tons of inert matter. It convinced him that there are tremendous forces locked up in Nature that can be released in gigantic

amounts, for useful as well as destructive purposes, by the employment of small trigger forces. He was always on the lookout for such triggers in his later experiments.

Tesla even as a boy was an original thinker and he never hesitated to think thoughts on a grand scale, always carrying everything to its largest ultimate dimension as a means of exploring the cosmos. This is demonstrated by another event that took place the following summer. He was wandering alone in the mountains when storm clouds started to fill the sky. There was a flash of lightning and almost immediately a deluge of rain descended on him.

There was implanted in his thirteen-year-old mind on that occasion a thought which he carried with him practically all his life. He saw the lightning flash and then saw the rain come down in torrents, so he reasoned that the lightning flash produced the downpour. The idea became firmly fixed in his mind that electricity controlled the rain, and that if one could produce lightning at will, the weather would be brought under control. Then there would be no dry periods in which crops would be ruined; deserts could be turned into vineyards, the food supply of the world would be greatly increased, and there would be no lack of food anywhere on the globe. Why could he not produce lightning?

The observation and the conclusions drawn from it by young Tesla were worthy of a more mature mind, and it would require a genius among the adults to have evolved the project of controlling the world's weather through such means. There was, however, a flaw in his observation. He saw the lightning come first and the rain afterward. Further investigation would have revealed to him that the order of events was reversed higher in the air. It was the rain that came first and the lightning afterward up in the cloud. The lightning, however, arrived first because it made the trip from the cloud in less than 1/100,000 of a second, while the raindrops required several seconds to fall to the ground.

At this time there was planted in Tesla's mind the seed of a project which matured more than thirty years later when, in the mountains of Colorado, he actually produced bolts of lightning, and planned later to use them to bring rain. He never succeeded in convincing the U.S.

Patent Office of the practicability of the rain-making plan.

Tesla, as a boy, knew no limits to the universe of his thinking; and as a result he built an intellectual realm sufficiently large to provide ample space in which his more mature mind could operate without encountering retarding barriers.

Tesla finished his course at the Real Gymnasium in Gospic in 1870, at the age of fourteen. He had distinguished himself as a scholar. In one grade, however, his mathematics professor gave him less than a passing mark for his year's work. Tesla felt an injustice had been done him, so he went to the director of the school and demanded that he be given the strictest kind of examination in the subject. This was done in the presence of the director and the professor, and Tesla passed it with an almost perfect mark.

His fine work at school and the recognition by the towns-people that he possessed a broader scope of knowledge than any other youth in town led the trustees of the public library to ask him to classify the books in their possession and make a catalogue. He had already read most of the books in his father's extensive library, so he was pleased to have close access to a still larger collection and undertook the task with considerable enthusiasm. He had scarcely begun work on this project when it was interrupted by a long intermittent illness. When he felt too depressed to go to the library he had quantities of the books brought to his home, and these he read while confined to his bed. His illness reached a critical stage and physicians gave up hope of saving his life.

Tesla's father knew that he was a delicate child and, having lost his other son, tried to throw every possible safeguard around this one. He was greatly pleased over his son's brilliant accomplishments in almost every activity in which he engaged, but he recognized as a danger to Nikola's health the great intensity with which he tackled projects. Nikola's trend toward engineering was to him a dangerous development, as he thought work in that field would make too heavy demands upon him, not only because of the nature of the work but in the extended years of study in which he would have to engage. If, however, the boy entered the ministry, it would not be necessary for him to extend his studies beyond



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