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Almost as popular was the *Nick Carter Library*.

The Revolutionary War, the Civil War, and the Wild West were featured in the early dime novels; later they dealt with desperadoes and detectives, foreign adventures and polite young men seeking success, but it all added up to entertainment, and boys saved up their money to buy them and read them in the woodshed or under the covers at night because dime novels had a bad reputation.

The Pulp Magazine Spread the Romance of Progress

As the nineteenth century became the twentieth, the United States was ready for progress and the romance of progress and for the fiction that would sum up these dreams as meaningful human adventures.

Senator Chauncey Depew of New York said, "There is not a man here who does not feel 400 percent bigger in 1900 than he did in 1896, bigger intellectually, bigger hopefully, bigger patriotically." And Senator Mark Hanna of Ohio said, "Furnaces are glowing, spindles are singing their song. Happiness comes to us all with prosperity."

And Henry James said of that time, "The will to grow was everywhere written large, and to grow at no matter what or whose expense."

In France Jules Verne was still turning out his two books a year, although his hand and his powers of invention were growing weary, and in England H. G. Wells had just completed his anti-utopian novels, with their gloomy view of progress, and was beginning his comedies. H. Rider Haggard was writing his novels of adventure placed in remote corners of the world or the past, Sir Arthur Conan Doyle was trying to escape Sherlock Holmes by writing historical

novels, and M. P. Shiel was developing his novels of future war and catastrophe.

But the mood of the United States was Vernian. Wages were low but rising, and prices were not exorbitant: eggs were a penny apiece, butter was twenty-four cents a pound, sirloin steak sold for the same, and a turkey dinner cost twenty cents. Everywhere machinery was being introduced to do old things better or to do things that no one had ever done before: ride in an automobile or a subway, see a motion picture.

If Americans were optimistic and self-confident at the turn of the century, they had good reason. Over the past 100 years, the nation had expanded from five million people in a few Eastern states to 76 million spread across a continent. A nation of farms had become the world's leading industrial power with literate, productive workers educated in a newly built system of public education. Every fact and figure produced by a recently completed census suggested an even more glorious future.

The promise, in most of its outline, was not an illusion: each year brought new discoveries and inventions, and each technological advance provided new impetus for accelerating change and subtly altered day by day the ways in which people thought about their lives, their societies, their political structures, their communities, their families, and themselves.

In 1900 came the invention of cellophane, the dirigible, and the caterpillar tractor; in 1901, the mercury vapor lamp—and President McKinley was assassinated by an anarchist. In 1902 the radio telephone was invented; in 1903, the Wright brothers flew the first heavier-than-air machine. Just nine days before, Samuel Langley, the secretary of the Smithsonian Institution, had failed to launch a flying machine from the roof of a houseboat on the Potomac; it had cost the War Department \$50,000 and Langley five years of effort. Almost everybody was sure that man would never fly. Not until 1908, in fact, was there a general awakening to

the fact that man was flying, and then the air became filled with men.

In 1904 came the invention of the vacuum-tube diode and the signing of the Entente Cordiale by England and France, which became the Triple Entente when Russia signed in 1907.

In 1905 an obscure Swiss patent-office examiner named Einstein announced a new theory of physics called relativity.

In 1906 the vacuum-tube triode was invented and Britain launched the *Dreadnaught*, the first large battleship. In 1907 came the invention of the helicopter, Bakelite, and the vacuum cleaner.

In 1909 Robert Peary reached the North Pole. In 1911 Roald Amundsen reached the South Pole; and the combine, air conditioning, and the gyrocompass were invented. In 1913 came the invention of the hot filament x-ray tube and the multimotored airplane.

In 1914 the Panama Canal was opened, World War I began, and the tank was invented, bearing a strong resemblance to the description in a 1904 H. G. Wells story in the *Strand* called "The Land Ironclads."

They were essentially long, narrow, and very strong steel frameworks carrying the engines, and borne upon eight pairs of big pedrail wheels, each about ten feet in diameter, each a driving wheel and set upon long axles free to swivel round a common axis. This arrangement gave them the maximum of adaptability to the contours of the ground. They crawled level along the ground with one foot high upon a hillock and another deep in a depression, and they could hold themselves erect and steady sideways upon even a steep hillside. The engineers directed the engines under the command of the captain, who had look-out points at small ports all round the upper edge of the adjustable skirt of twelve-inch iron-plating which protected the whole affair, and who could also raise or depress a conning-tower set about the port-holes through the centre of the iron top cover. The riflemen each occupied a small cabin of peculiar construction, and these cabins were slung along the sides of and before and behind the great main framework, in a manner suggestive of the slinging of the seats of an Irish jaunting-car....

Although Wells was incorrect in extrapolating from the seagoing warships of his time—his "land ironclads" were 80 to 100 feet long and contained a substantial crew—rather than the

truck or tractor, he was right about the tank's revolutionary effect on warfare, and in his autobiography he criticized the reluctant, unimaginative use of it in World War I.

In 1915 came the invention of the radio-tube oscillator and the arc search-light, and in 1916, stainless steel.

In 1917 the Communist Revolution broke out in Russia.

In 1918 an armistice ended World War I, and the mass spectroscopy and the automatic electric toaster were invented. In 1920 the League of Nations was established in Geneva. In 1922 the Union of Soviet Socialist Republics was created, Mussolini became premier of Italy, and radar was invented. In 1923 Hitler was imprisoned after the Beer Hall Putsch and wrote *Mein Kampf*, and the iconoscope scanner and the bulldozer were invented.

In 1924 Lenin died and Stalin won the power struggle that followed.

World War I with its trench warfare had stripped battle of any remaining glamor (except in the air, where a kind of romantic knighthood had a brief new flowering) and had ended the easy optimism of the twentieth century's first decade; that disillusion would breed a lost generation and an entire genre of anti-utopias.

But all that was still in the future. Also in the future, for the United States at the turn of the century, were six decades of remarkable expansion interrupted by periods of wartime and economic dislocation. The expansion would fuel a basic belief in progress into which the dislocations would insert moments of uncertainty and self-doubt. By 1960 population would increase by more than 100 million over the 76 million of 1900, high-school graduates from 100,000 to nearly 2 million, college enrollments from 238,000 to more than 3 million, life expectancy from 47.3 years to 69.7 years, the average wage from 22 cents per hour for a 59-hour week to \$2.26 an hour for a 39.7-hour week, and the gross national product from under \$17

billion to more than \$500 billion.

In 1900 people in the United States had good reason for looking at the future with optimism; they knew the world was changing, but change looked like a friend bringing gifts rather than a thief coming to steal away their inheritance. Years later, in *The Lonely Crowd*, Riesman would speak of “inner-directed” and “other-directed” people and societies, but the American people were becoming future-directed.

Teddy Roosevelt summed up some of the spirit of that time, a spirit that would seep into science fiction as well. H. G. Wells visited Roosevelt in 1906, and the President brought up *The Time Machine* to disagree with its pessimism. Wells recalled their conversation: “If one chose to say America must presently lose the impetus of her ascent, that she and all mankind must culminate and pass, he [Roosevelt] could not conclusively deny that possibility. Only he chose to live as if this were not so.” And he continued, as Wells remembered:

“Suppose, after all,” he said slowly, “that should prove to be right, and it all ends in your butterflies and morlocks. *That doesn't matter now*. The effort's real. It's worth going on with. It's worth it. It's worth it—even so.”

Specialization Reaches the Magazines

In the last decade of the nineteenth century, the low-priced monthly magazines demonstrated that the growing middle class of the nation would buy magazines in quantity. In the first two decades of the twentieth century, the pulp magazines demonstrated a sufficient demand for fiction to support a variety of cheap monthly and even weekly magazines. Now the twenties were to feel the narrowing currents of specialization which were producing assembly lines, the division and subdivision of professions and disciplines, hobbies, entertainments, fads, fashions, increasing college attendance and proliferating programs of instruction, and the genre

pulps, including science fiction and fantasy.

The decade of the twenties began in a mood of prosperity: the gross national product had doubled in the previous ten years and now was more than \$71 billion, and the ordinary citizen was sharing some of the abundance of the maturing industrial society: Americans bought some 10 million cars between 1910 and 1920. The use of electric power and the internal-combustion engine created a revolution as great as that created by the use of steam in the 1750s.

Part of the reason for general prosperity in 1920 was the engineering genius and social invention of a self-taught engineer. His impact upon the nature of our society and the world was far greater than we recognize. Think what a science fiction story could have been written in 1880 about “an imaginary vehicle that can move without horses by some internal source of power; a horseless carriage, in other words.” In fact, Isaac Asimov thought about it and came up with not one story but three, which distinguish among adventure science fiction, gadget science fiction, and social science fiction. He has even made up a word for his horseless carriage; he calls it an automobile.

Writer X spends most of his time describing how the machine would run, explaining the workings of an internal-combustion engine, painting a word-picture of the struggles of the inventor, who after numerous failures, comes up with a successful model. The climax of the yarn is the drama of the machine, chugging its way along at the gigantic speed of twenty miles an hour, possibly beating a horse and carriage which have been challenged to a race. This is gadget science fiction.

There were, of course, many such stories written in the late nineteenth century. They were called dime novels. In the early twentieth century they would have been called *Tom Swift and His . . .*

Writer Y invents the automobile in a hurry, but now there is a gang of ruthless

crooks intent on stealing this valuable invention. First they steal the inventor's beautiful daughter, whom they threaten with every dire eventuality but rape (in these adventure stories, girls exist to be rescued and have no other uses). The inventor's young assistant goes to the rescue. He can accomplish his purpose only by the use of the newly perfected automobile. He dashes into the desert at an unheard-of speed of twenty miles an hour to pick up the girl who otherwise would have died of thirst if he had relied on a horse, however rapid and sustained the horse's gallop. This is adventure science fiction.

And this, of course, would have been the approach of Jules Verne, and the approach of a hundred science fiction motion pictures.

Writer Z has the automobile already perfected. A society exists in which it is already a problem. Because of the automobile, a gigantic oil industry has grown up, highways have been paved across the nation, America has become a land of travelers, cities have spread into the suburbs—and what do we do about automobile accidents? Men, women, and children are being killed by automobiles faster than by artillery shells or air-plane bombs. What can be done? What is the solution? This is social science fiction.

As Asimov comments, "It is easy to predict an automobile in 1880; it is very hard to predict a traffic problem." That is the science fiction writer's challenge. (Robert Heinlein has suggested that a greater science fiction accomplishment would have been to predict the change created by the automobile in the nation's courting habits, and in a later article about "Futuristics," Asimov agreed that the side effect often was more important than the first-order prediction: in the case of the automobile, the traffic jam; in the case of radio, the soap opera; in the case of the income tax, the expense account.)

The hero of the science fiction story that was never written about the automobile was Henry Ford. He was no mysterious Robur, no confident Barbicane, no doom-ridden Captain Nemo, even though the bare outline of his early life would have fit the early Verne's ideas of the engineer-inventor. But Verne never dealt in detail with the social implications of his inventions; his story-telling instincts turned him toward adventure and the individual.

No science fiction writer could have created the complex, contradictory character that

Ford really was (Aldous Huxley, in his 1932 novel *Brave New World*, recognized through his invented vocabulary some of the implications of the assembly line—Before Ford, After Ford, in the Year of Our Ford, “Ford’s in his flivver; all’s well with the world”—but he did not deal with the man himself).

Henry Ford came out with the Model T, the flivver, in 1908 and advertised it as “The Universal Car.” Until then automobiles had been so expensive that only the rich could afford them. The new “tin lizzie” sold for \$850. In 1916 the price dropped to \$360 when Ford perfected the technique of the assembly line. It was a triumph of the engineering mind: rather than hire or train skilled mechanics and artisans to take parts to an immobile chassis, why not take unskilled workers, teach them to do one task, and move the work past them—let them put one piece onto a vehicle as it came by. The concept revolutionized industry and as much as anything else, perhaps, created our economy of abundance (although today, with the old battle of scarcity won, some industries are experimenting with the artisan’s method of manufacturing to improve worker morale and increase his satisfaction with his job).

Ford became a billionaire, even though he kept lowering his prices rather than raising them. That was another social invention. “Every time I lower the price a dollar, we gain a thousand new buyers,” he said. If it were not for the fact that Ford had no use for reading and the search for knowledge (“Books muss up my mind,” he said), he might have learned the low-price, high-volume lesson from the example of Frank Munsey and the dime magazines.

But Ford was not finished with his social engineering. In 1914 he more than doubled the wages of his workers to \$5 a day and reduced the nine-hour shift to eight hours; he also speeded up the assembly line and hired efficiency experts to stand behind workers with stop watches. It worked: Ford company profits doubled within two years. Moreover, more money went into the

pockets of Ford workers—and by example into the pockets of other workers—that enabled them to buy Fords.

Specialization was beginning to prove itself in the most meaningful way: it paid off.

The United States emerged from World War I with new industrial capacity and an advantage in world trade. After the economic crisis of 1920-21, manufacturing began to rise rapidly; by 1929 it had increased more than 80 percent over 1913. In 1925 President Coolidge said, “The business of America is business.”

Wall Street’s optimism spread across the nation. Fortunes were being made in the stock market as prices rocketed. The warnings of a few prophets of doom such as Roger Babson were ignored. Installment purchases—another social invention—multiplied during the decade of the twenties; “buying on time” conquered the old Puritan fear of debt.

Prohibition, the “noble experiment,” began in 1920 and helped create an atmosphere of widespread disrespect for the law and may have created organized crime: were racketeers and rumrunners and hijackers any worse than the ordinary citizen who went to his speakeasy for a drink of bathtub gin or smuggled Scotch? Even President Harding’s cronies succumbed to the lawless, grafting, get-your-share spirit of the times.

A new industry of entertainment was developing out of Tom Edison’s invention: the experimental nickelodeons of the first two decades were changing into great new palaces of entertainment. Going to a movie became an experience in opulence, and motion-picture stars, ten times larger than life, were being created to fill the giant screens.

Radio, which had been in the air since Marconi invented the radio telegraph in 1895, became a practical method of communication in the twenties; KDKA, Pittsburgh, announced the returns of the Harding-Cox presidential elections in 1920 and went on to become the first

regularly scheduled broadcaster of news, church services, and music. By the end of the decade 618 stations were in business, and networks were regularly broadcasting across the nation. (And if any aliens were watching from afar, the process began the perceptible brightening of the Earth's "radio image" which would signal the birth of another technological civilization in the galaxy.)

During the twenties newspapers discovered the selling power of scandal and sensation, sex and violence: the New York *Daily News* became the nation's first tabloid in 1919; five years later it had the nation's largest circulation, 750,000. Five years later it was joined by the *Daily Mirror* and the *Evening Graphic*, which soon became known as the "Pornographic."

Magazines were specializing, too. The old mass-market giants—*The Saturday Evening Post*, *Collier's*, *The Literary Digest*—were still growing. But new magazines were being created to please more discriminating tastes or satisfy more peculiar desires: in *American Mercury* editors Henry L. Mencken and George Jean Nathan were criticizing the nation's bourgeois tastes and traditions; *Time* was offering the first weekly news summary; *The New Yorker* was appealing to the sophisticate in purchases and entertainment; and Bernarr Macfadden's *True Story Magazine* was paying writers good rates for their "true confessions" that tantalized nearly 2 million readers.

The Expanding Universe

The Thirties began with the United States doubting itself, even questioning its own survival, and ended with an optimistic look at a future of increasing technological miracles. It began in the Depression, so aptly named, and ended in hope and renewed vigor, even though that

hope was shadowed by the beginnings of war in Europe.

With the Thirties, the center of science fiction clearly was in the United States, and the focus of American science fiction was on progress and the instrument of progress was science and technology. The Clayton chain of magazines added a science-fiction magazine to compete with Hugo Gernsback's former magazine *Amazing Stories* and his new magazine *Wonder Stories*. In the first issue of *Astounding Stories* an editorial by Harry Bates described the kind of stories that would be included in future issues:

Tomorrow, more astounding things are going to happen. Your children—or their children—are going to take a trip to the moon. They will be able to render themselves invisible. They will be able to disintegrate their bodies in New York and reintegrate them in China—and in a matter of seconds.

Astounding? Indeed, yes.

Impossible? Well television would have been impossible, almost unthinkable, ten years ago. . . .

But the primary fact of the thirties, for science fiction as well as the nation and the world, was the state of the economy. World War I, with its inhumanity, its prolonged trench warfare, its indiscriminate bombings and shellings, and its poison gas, had destroyed a naive faith that man had outgrown all that, that he was destined to improve himself and his society for the foreseeable future. America's exposure to the ugly facts of modern warfare was mercifully brief; the nation itself was virtually untouched by it. But now the economy of the nation had gone awry. Social and economic theories had been developed to explain how society and the economy were supposed to operate, but suddenly they no longer explained what was happening. Natural forces were out of control and nobody could do anything about it.

The individual citizen felt as if the Earth itself were disappearing beneath his feet (as in fact it was for the Dust Bowl farmer), as if nature had turned against him, as if the gods had

forsaken him, as if he were a victim of life instead of its master. Technology was useless; science had no answers.

Incomes plummeted like brokers diving out of skyscrapers, and so did prices. Between late October and mid-November of 1929, stocks lost more than 40 percent of their total valuation, a drop of \$30 billion; General Electric stock dropped from \$1600 to \$600 by the end of 1930; Union Cigar went from \$113.50 to \$4.00. In 1932 a coal miner earned \$723 a year; a steelworker, \$422.87 a year; a public-school teacher, \$1,227; and a college teacher, \$3,111. At the University of Kansas, faculty salaries were reduced 10 percent for 1932-33, and the following year salaries stood at 15 to 25 percent below what they had been two years before.

Prices were low, too, of course. Sirloin steak cost twenty-nine cents a pound; pork chops, twenty cents; butter, twenty-eight cents; and bread, five cents a loaf. A modern six-room house in Detroit was advertised for \$2,800; an English cottage in Seattle, with eight rooms, three baths, and a ballroom for \$4,250. A washing machine cost \$47.95; a gas stove, \$23.95; a woman's wool dress, \$1.95; a man's suit, \$10.50; and a Pontiac coupe, \$585.00.

The President was Herbert Hoover, and he worked hard at measures to ease the economic slump. But he believed that "economic depression cannot be cured by legislative action or executive pronouncement."

The election of Franklin Delano Roosevelt brought the New Deal, the distribution of relief funds, and the beginnings of "recovery" and make-work programs, which may not have solved the economic problems but which alleviated misery and helped provide a reassurance that something was being done about the Depression.

Even the pace of invention seemed to slow during the thirties. The twenties ended with a flurry: in 1928 the invention of the television-image pickup tube, the differential analyzer

computer, and the electric shaver; in 1929 the perfecting of the rocket engine by R. H. Goddard and the discovery of penicillin; and in 1930 the invention of the cyclotron. Two significant gaps occurred in the steady progress of technological development; nothing important was invented until nylon and synthetic rubber in 1935, xerography in 1938, and the betatron, FM broadcasting, and the electron microscope in 1939.

It seemed as if economic and political events had drained the intellectual and scientific vitality of the nation. But perhaps the rapid pace of invention during the previous two centuries had solved the easy problems; and the subtle things that men were now beginning to do with molecules, atoms, subatomic particles, and electronics required a return to basic research.

But if technology was coasting, basic science was not. Atoms, which Isaac Newton had described as “solid, massy, hard, impenetrable, moveable particles” and nineteenth-century physicists still regarded as small, solid objects, became small, massive nuclei surrounded by shells of electrons, through the research of Lord Rutherford and others. They used X rays and magnetic fields at first, and these probes gradually developed into increasingly sophisticated and powerful atom smashers, which produced a bewildering profusion of sub-atomic particles from what was once considered indivisible. Particle physics became one of the glamour sciences as it produced new results, new insights, and even new applications such as atomic energy; but it also became more abstruse, with its antiparticles and antimatter.

Meanwhile Max Planck's quantum theory presented a picture of energy in packets (1900) which Einstein applied to photoelectric effect and the specific heat of solids. Einstein went on to add to his 1905 special theory of relativity a 1911 paper on the equivalence of gravitation and inertia and his general theory in 1916; he won the Nobel Prize in physics in 1921. In 1924 Louis Victor de Broglie expanded Einstein's wave-particle duality to a dualism between energy and

matter. No longer were energy and matter to be considered separate and inviolable. The old physics was rapidly breaking apart, and mechanical causality in the old Newtonian sense, which visualized the universe wound up and working like a clock, received a blow from which it might never recover when Werner Heisenberg in 1927 announced his uncertainty principle; it theorized that one cannot know simultaneously the position and velocity of a particle; and thus, as physicist P. W. Bridgman would speculate later, nature had placed limits to man's knowledge.

While knowledge at the subatomic level was becoming smaller, fuzzier, and less certain, the universe was becoming larger, older, and more profusely populated with possibly habitable planets. The origin of the Earth, the sun, the other planets, and ultimately the universe itself, once the province of myth and religion, became permanently a matter for science when Galileo and Copernicus began substituting observation for faith. Newton established in his monumental 1687 work, *Principia*, the laws of gravitation and of motion, which provided theory and method for calculating the positions of stars and planets.

In 1755 Kant speculated about an infinite system of galaxies in the universe, with suns and planets condensing out of rotating gaseous disks. A different origin for the planets had been suggested ten years earlier by a French naturalist named Buffon: a collision between the sun and a comet knocked off bits of the sun which became the planets. The distance between stars is such that if Buffon's theory is correct, planets are accidental and few in the universe; if Kant's is right, planets would be the rule and innumerable. These opposing views, modified through the generations, vied for the allegiance of astronomers and cosmologists for two centuries. Kant's theory of cloud condensation, as modified by Laplace, was popular until James Clerk Maxwell pointed out in the nineteenth century the impossibility of the planets having sufficient matter to be drawn together by gravitational attraction in the face of the sun's immense pulls; there was, as

well, a problem of angular momentum. So Buffon, as modified by Chamberlin and Moulton and then Jeans and Jeffries, returned to favor, and the uniqueness of Earth made man once more seem alone in the universe. In the forties the pendulum swung back toward a view of the planets being formed when cold bits of matter like meteorites came together with dust and gas and water; they stuck together because the mixture itself was sticky, later being heated by internal radioactivity and the lighter gases being driven off by the solar wind.

The incredible size of the universe and even of our own galaxy, the Milky Way, was unsuspected even by those who, like Galileo, Kant, Wright, and Herschel, could see the myriad stars and the nebulae which might, some thought, be distant galaxies. The discovery and analysis of Cepheid variables—stars that brighten and darken regularly—led to a 1918 announcement by Harlow Shapley of a galaxy 30,000 light-years thick and 300,000 light-years wide, ten times bigger than previous estimates; later the size was reduced to about 25,000 by 100,000. Our sun, meanwhile, was demoted from a central position in our galaxy to a peripheral spot in one of the spiral arms, just as in past centuries the Earth had been demoted from its position in the center of the solar system. In 1924 at Mount Wilson, Edwin P. Hubble finally proved the existence of other galaxies and demonstrated that our own was no more central in the universe than was our sun in the galaxy or our Earth in the solar system. The existence of billions of galaxies like our own was suspected, and some of them were a billion light-years away. Moreover they were getting farther away.

Einstein's model universe was static, but his equations required a situation without equilibrium—an expanding universe. Hubble noted in 1929 that the stars—and galaxies—farthest from Earth were receding from Earth faster and with a speed that could be estimated from the extent to which their spectrums were shifted toward the red. The universe was not only

bigger and more populated with stars, and perhaps with planets, than anyone had ever supposed, but it was getting bigger all the time.

Close at hand were the political activities which were dicing with man's immediate future: totalitarianism was growing in Europe, with the Nazi takeover of Germany in 1933 and the beginning of a series of aggressive actions to redress World War I losses, which would culminate in 1939 with the start of World War II. But science fiction writers had their eyes fixed on more-distant vistas. They were reading Sir James Jean's *The Universe Around Us* (1929) and *The Mysterious Universe* (1930), and their vision had turned cosmic. The letter columns of *Amazing Stories* referred frequently to Einstein, with the editor confessing that he didn't understand everything that he would like to know about Einstein's theories; those were the days when it was popular to repeat that only half a dozen people in the world understood Einstein.

In fact a limerick of the time, included appraisals of writer Gertrude Stein and English sculptor Sir Jacob Epstein:

There's a wonderful family named Ein.
There's Gert and there's Ep and there's Ein.
Gert's novels are bunk,
Ep's statues are junk,
And nobody understands Ein.