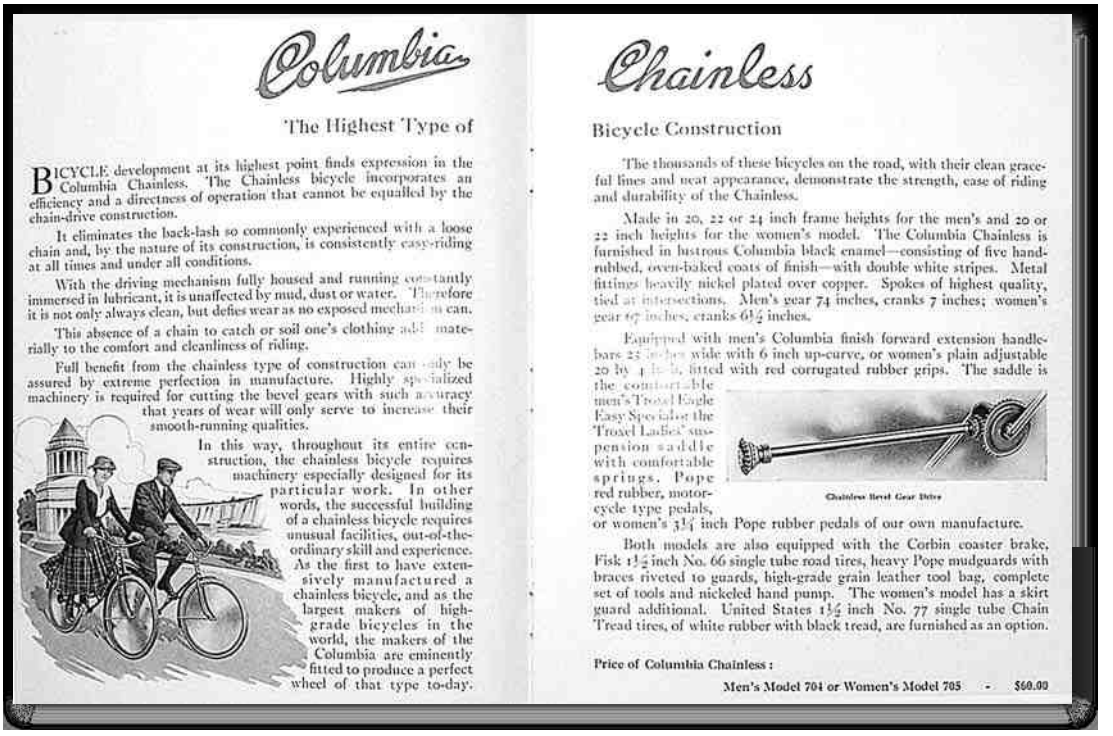

Columbia

The Highest Type of

BICYCLE development at its highest point finds expression in the Columbia Chainless. The Chainless bicycle incorporates an efficiency and a directness of operation that cannot be equalled by the chain-drive construction.

It eliminates the back-lash so commonly experienced with a loose chain and, by the nature of its construction, is consistently easy-riding at all times and under all conditions.

With the driving mechanism fully housed and running constantly immersed in lubricant, it is unaffected by mud, dust or water. Therefore it is not only always clean, but defies wear as no exposed mechanism can.

This absence of a chain to catch or soil one's clothing adds materially to the comfort and cleanliness of riding.

Full benefit from the chainless type of construction can only be assured by extreme perfection in manufacture. Highly specialized machinery is required for cutting the bevel gears with such accuracy that years of wear will only serve to increase their smooth-running qualities.

In this way, throughout its entire construction, the chainless bicycle requires machinery especially designed for its particular work. In other words, the successful building of a chainless bicycle requires unusual facilities, out-of-the-ordinary skill and experience. As the first to have extensively manufactured a chainless bicycle, and as the largest makers of high-grade bicycles in the world, the makers of the Columbia are eminently fitted to produce a perfect wheel of that type to-day.

Chainless

Bicycle Construction

The thousands of these bicycles on the road, with their clean graceful lines and neat appearance, demonstrate the strength, ease of riding and durability of the Chainless.

Made in 20, 22 or 24 inch frame heights for the men's and 20 or 22 inch heights for the women's model. The Columbia Chainless is furnished in lustrous Columbia black enamel—consisting of five hand-rubbed, oven-baked coats of finish—with double white stripes. Metal fittings heavily nickel plated over copper. Spokes of highest quality, tied at intersections. Men's gear 74 inches, cranks 7 inches; women's gear 67 inches, cranks 6¼ inches.

Equipped with men's Columbia finish forward extension handlebars 23 inches wide with 6 inch up-curve, or women's plain adjustable 20 by 4 inch, fitted with red corrugated rubber grips. The saddle is the comfortable men's Troxel Eagle Easy Spectator the Troxel Ladies' suspension saddle with comfortable springs. Pope red rubber, motorcycle type pedals, or women's 3¼ inch Pope rubber pedals of our own manufacture.

Chainless Bevel Gear Drive

Both models are also equipped with the Corbin coaster brake, Fisk 1¾ inch No. 66 single tube road tires, heavy Pope mudguards with braces riveted to guards, high-grade grain leather tool bag, complete set of tools and nickeled hand pump. The women's model has a skirt guard additional. United States 1¾ inch No. 77 single tube Chain Tread tires, of white rubber with black tread, are furnished as an option.

Price of Columbia Chainless:

Men's Model 704 or Women's Model 705 - $60.00

Nickel: The Stuff of Legends

by Frank J. Verderber*
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Columbia Manufacturing Inc.
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A legend is defined by Merriam Webster as: "a story coming down from the past." Nickel is a legend, and one that hails from the origins of the universe. It drives the engines of exploding stars and is the primary reason for the existence of iron. In retrospect, this story of nickel will not reiterate the fine articles completed by academics and engineers, who for so many years have kept vigil over finishing apparatus and tanks of green solutions. They paid their dues and embraced the world of finishing - men such as George Dupernell, who wrote a fine piece in 1959, which has since been reprinted in the 2006 volume of *Plating & Surface Finishing*. Oh, I wince to recount the story of Adams and Watts and all the celebrated champions of the plating industry. What I have to report is of serious but differing merit, and will deal with the element of nickel, and its use within and outside of plating.

This story is from the perspective of an outsider who has, by fate, been given the keys to the artful engine of nickel plating, a different sort of game than that of the high technology industries where I cut my teeth. Pragmatism and ingenuity are the watchwords now, not R&D budgets and new engineering toys.

After many years of high tech employ, and a few stops at other peripheral enterprises, my skills found place in the world of consumer goods, specifically the manufacture of "chrome-bright" metal furniture. My employer, a durable and all-American corporation, Columbia Manufacturing, Inc, of Westfield, Massachusetts, took me in, and from there began an odyssey of intrigue and discovery, much different than my mind could have ever imagined. Our wares, covered in nickel and chromium, give scholarly impetus to our end-users, by virtue of holding the posterior of students and academics. Columbia is the second largest manufacturer of metal chairs and tables, for universities, public and private schools.

Nickel and chromium were not the part of the intended design, from Columbia's inception. Those finishing materials found advantage by virtue of competition, quality and customer wants. Columbia Manufacturing was started by Colonel Albert Pope, in 1877.[1] He was one of many philanthropic and engineering dreamers, who marked the second half of the 19th century. His dream brought a new mode of transportation to the U.S. industrial age: bicycles. His first was called the "Velocipede." (Odd name for a

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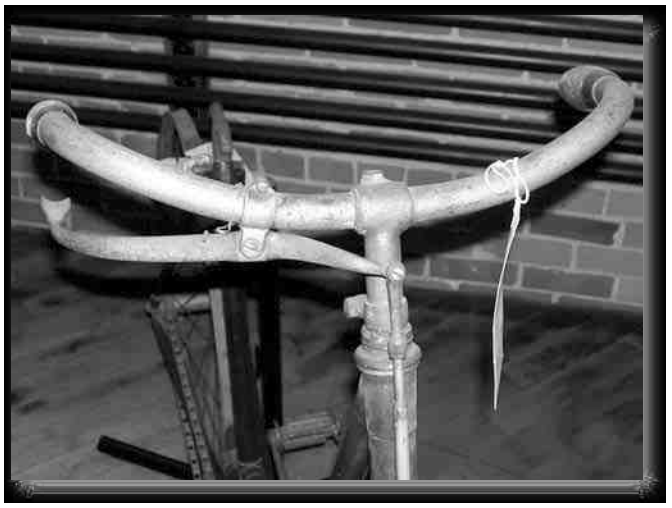
Circa 1880 Painted Bike



Circa 1900 Heavy Nickel over Copper Finish

recreational contraption. It sounds more useful for naming reptilian birds, long extinct.) His original bicycle, as well as his large tricycle were painted to protect from weather, however the change over to nickel came very quickly, as quality and mass production found harmony at the peaking of the U.S. Industrial Age. The plated parts were limited and used a copper strike and a dull nickel finish. By 1917, his brochures claimed bright nickel finishes on wheel rims, spokes, sprockets, handlebars and other periphery parts needing artistic aesthetics and pragmatic anti-rust capabilities.

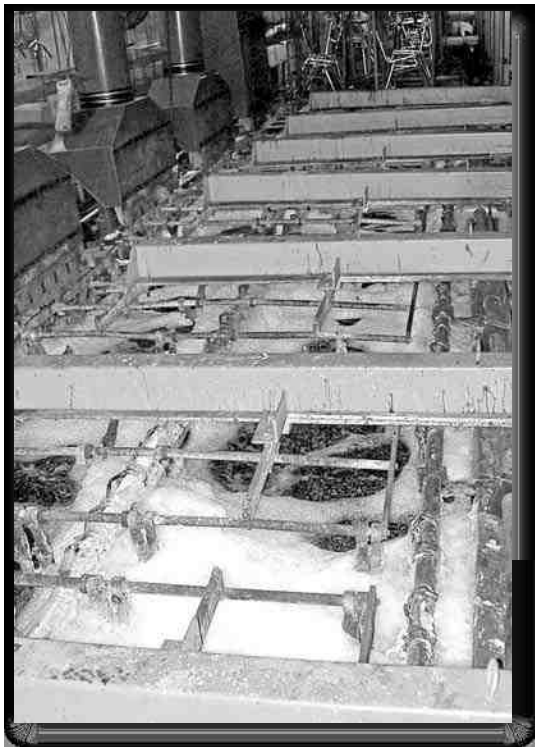
The original facility of Pope's bicycle factory is still in use at Westfield, Massachusetts, composed chiefly of 19th century red brick buildings. The whole of the Columbia (Pope) manufacturing plant reminds one of a Hollywood filming set. Their classic architecture transports one back to the traditions of horse drawn carriages, handle bar mustaches, striped shirts and suspended trousers. Once, when inspecting a closed portion of the facility's monolithic coal clinker, used for heating the facility to plating tanks, my eye briefly caught sight of a man with a bowler hat, while passing from view to a darker portion of the storage building. I swear that his shirt was pinstriped linen with arm garters, accented by a velvet cotton vest. The buildings do that sort of thing to you, and so what happened next should not surprise the reader.

It was when I passed by Columbia's very large nickel tank, a boiling cauldron of science and alchemy, that I noticed the redolence of sweet bakery cakes. I knew the green solution was for industrial purposes only, but just for a brief moment, I was standing in Willy Wonka's candy factory. The bubbling of green took hold ever so cleverly, reminding me of that DC comic character "The Joker," with his green nickel complexion, and all that purple, which is probably a shade shy of a chromic acid tint. I believe the movie version had him accidentally fall into a vat of nickel solution, making him the rudimentary sinister villain that he is.

Placing my excess imaginations aside, let us discuss this most useful and pragmatic element number 28 that resides between copper and cobalt, and leads palladium and platinum in the column ten noble metal family. It was hidden within the copper/nickel ore, niccolite (nickeline), a material well known during the Renaissance. At that time, chemists dabbled in the ancient art of alchemy, while wearing their four-cornered hats as they examined maps of the known and unknown world. They surrounded themselves with experiments of heating sulfur, saltpeter and throwing the occasional "eye of newt" into their pots of inquiry.

The sons of these ancient chemical pioneers are still with us today, as chemical suppliers. Each has their own secret recipe for the nickel solutions, as if they carry the mantle of a French chef. The sweet odor may come from saccharin, but there could be a small addition of rum cake essence, or some bat wing within their potions of plating. Only their coworkers know for sure.

Fortunately, the age of reason developed around the 1700s, and men of refined scientific methods entered the arena to ascertain the makeup of the world. And so, nickel's founder became Baron Axel Fredrik Cronstedt, a Swedish chemist who in 1751 realized that his sample of copper ore contained a hitchhiker (By the way, who names their child Axel, anyway?). Nickel was named after its copper ore, kupfernickel (niccolite). The name nickel strangely



Columbia Nickel Tanks

means "Satan" or "Old Nick."[2,3] Perhaps the venerable chemist was intrigued as to how no one found this element, since copper ore was processed as long ago as 4,200 BC (BCE).[4] "Old Nick" was there all the time just waiting to come and "demon-strate" its arcane uses.

So what of this special metal? It has 28 protons, but it also has brother and sister isotopes of varying neutron counts. The natural and stable isotopes (a) are in ascending order: 58 (66%), 60 (26%), 61 (1.7%), 62 (3.6%) and 64 (.9%). The other two isotopes are the progeny of nuclear reactors, 59 and 63. Their half-lives (b) are 75,000 years and 96 years respectively, and can be a cause for environmental concern.[5]

Nickel is predominantly found in the ores (c) garnierite, millerite, niccolite, pentlandite and pyrrhotite. The last two are the predominant ores. Mining is done within the countries of Canada, Cuba, Russia, China and Australia.[5] Although there are clusters of nickel ore close to the surface of the Earth, the predominate mass is to be found farther down in the center of our planet. Nickel affects our daily routines and helps save us from the effects of the solar wind (d), with its ionizing gamma radiation (e).

Digging out more facts about this trusty companion to iron is not so easy, by way of shovel. However, geophysicists have prepared a great deal of information, with which to whet our appetites and concerning the effects of nickel on the geomagnetism of Earth. To put some spin on it, let's take a journey the center of the Earth. We can take the journey by observation and measurement of secondary force affects, much as Isaac Newton did with his gravitational studies, or via modern studies of seismic S and P waves and their interaction when passing through the Earth's crust and through its center. The data would suggest that the Earth's average density is greater than the rock formations on the surface of the Earth. Composite minerals representing anticipated chemical signatures within the deep Earth are prepared in laboratories. The samples are then tested for density, temperature stability and response to lab-induced seismic waves to verify type of rock structures inherent within the Earth. This indicates that either the Earth's center is very dense, or for those skeptics, that the gravitational constant of the universe (f) is not invariable at the center of the Earth.

For purposes of efficiency, we will suspend the idea of a warped universe that would contain fluctuating gravitational non-constants, and travel in my matter transporter that has been adapted from a previous Star Trek episode. The first 40 kilometers (25 miles) we pass through is the surface or crust of the Earth. We then pass through the Mohorovicic Discontinuity (the boundary between the mantle and the crust) and find ourselves in a mass of hot viscous material made chiefly of iron, calcium, aluminum, magnesium, manganese, titanium and zirconium that combine with silicon oxide (silica) to form gemstone type rocks with some pockets of radio-active elements helping to generate heat. This region, the upper mantle and the source for volcanic lava, is 720 km (450 miles) thick. Afterwards, we pass through a 2,171-km (1,346-mile) region called the lower mantle, composed chiefly of magnesium and silicon oxides. However, in either case of mantle composition, we find no abundance of nickel.

Further down, we break through the 2,259-km (1,446-mile) outer core of the earth, and find the material dense yet viscous, as well as hot, under intense pressure, with large concentrations of iron, and that wonderful element we have been looking for, "Ole Nick" (nickel). It shares with several elements the unique characteristic of forming dipoles (a) of magnetic moments (b). Nickel holds this illustrious fame of magnetism with iron and cobalt. However, nickel follows as number three in the triad for ferromagnetism. Notably these elements are the most stable in the universe. Only sulfur and oxygen are the other elements in abundance within this hot dynamo region of the outer core of the earth.[6,7]

Magnetism and its relationship to gravity is a bit complicated for our adventure, since it would deal with electron energy shells, electron pairs and spins, as well as quantum numbers and other things men of logic ferret out in esoteric labs throughout the world. Personally, I'm still reeling from my chemistry professor's explanation of quantum mechanics, and that was multiple years ago. However, one must understand that to effectively explain this relationship, the scientist will have won, hands down, the ultimate Nobel Prize for physics, having mastered the knowledge that only the Divine has, the "Unifying Theory."

Moving on, we eventually come upon a 2,416-km (1,498-mile) diameter sphere,[6] a ball of iron and nickel that is oscillating every 3.7 hours. The inner core spins about 2/3 of a second faster that the rotation of the Earth's surface, taking 400 years to complete a complete rotation. Apparently, this is more than enough momentum to generate the Earth's magnetic field, and shield us from the radio ionizing effects of the solar wind (d). As a matter of fact, if the Earth's magnetic field were not so strong, the atmosphere of nitrogen and oxygen would be stripped by solar flares. How an abundance of nickel found itself trapped in the core is not a total mystery, but we can trace this element to places outside of our world, and ascertain the relation between nickel and iron.

Beam us up Scotty!

Here on the surface we find nickel in reasonable abundance, however in ores and in meteoric material. It is not by chance that iron-rich meteors have a significant amount of nickel within them. Our star, the Sun, was once thought not to be able to produce elements such as iron and those heavier. However, spectral analysis of red giant stars, and data from fission-fusion bombs, as well as type two supernovae, have led to a better understanding of the birth of heavy elements, and in particular nickel. The explanation for this resides in astrophysics, but we will keep to a clean finishing concept. To approach this type of physics cleverly, we will search for nickel with a hyperbolic warp speed transit to the gaseous Tarantula Nebula,** found within the Large Magellanic Cloud; a leftover of a disintegrating galaxy.

Tarantula Nebula from Hubble Space Telescope.**

** *This photo is in the public domain, created by NASA and the European Space Agency. The material was created for NASA by STScI under Contract NAS5-26555.*

As we arrive you will notice the Blue Giant star, Sanduleak. It was recorded as better than 20 solar masses, when in 1987 it became a supernova. It blew off its outer atmosphere, but not before it produced a quantity of heavy metals, to include about .08 solar masses of radioactive nickel. That nickel decayed quickly to cobalt, which then decayed into iron. The core engine of this monster rose to billions of degrees before blowing off massive amounts of ejecta that now circle the newly formed star as glowing embers.[8]

Though Super Giants will produce heavy elements astrophysicists have determined there are several methods that cause heavy elements to form, even within 0.8 solar mass or greater stars. The fusion engines can form nickel isotope (Iso) 56, by helium nuclei capture (alpha process), which starts from the element silicon. Helium nuclei are progressively captured by a silicon Iso 28 until the process produces nickel Iso 56, which decays to cobalt Iso 56, and finally to iron Iso 56 - a most stable element that represents 92% of natural iron.

According to astrophysicists, the brightness of a supernova comes from the process called electron capture within nickel Iso 56. The unstable nickel neutron captures an electron, and is converted into a proton to make cobalt Iso 56.[10]

Another device within stellar element factories is the process of neutron (N) capture. Iron Iso 56 can capture a neutron to become iron Iso 57 that accepts a neutron to become iron Iso 58 that accepts a neutron to become iron Iso 59. Iron Iso 59 decays to cobalt Iso 59 that accepts a neutron to become cobalt Iso 60 that decays into nickel Iso 60.[9,11] What is so interesting here is that iron is decaying to produce nickel whereas before the nickel decayed down to iron.

Regardless of the stars size or the process, it is nickel in the thick of stellar engines. Nickel is the element of choice to get the heavy element process past stable iron to produce the likes of uranium.

Taking the nearest wormhole at warp speed we come back to Earth and our legendary tank of nickel sulfate, nickel chloride and boric acid. The odor is sweet, not just to our olfactory sensors, but to our aesthetic sight, as well as our understanding of the universe past the element iron.

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Definitions

Sources: *Hack's Chemical Dictionary 4th Edition*, and others noted below.

(a) Isotopes: Atomic species differing in atomic weight, but having the same atomic number [Atomic weight: a number indicating the relative weight of an element as compared with hydrogen. Atomic number: The number of protons in an atom's nucleus, also called Z.].

(b) Half-life: The period in which the activity of a radioactive substance falls to half its initial value or the time required to convert one-half of a reactant to product. The term is commonly applied to radioactive decay, where the reactant is the parent isotope and the product is a daughter isotope.

(c) Ore: A natural mineral from which useful substances are obtained; found with matter (matrix or gangue).

(d) Solar Wind: P = the momentum of flux (under the conservation of momentum) [NOAA], or continual flux of particles emitted by the Sun into interplanetary space; plasma continuously ejected from the Sun's surface into and through interplanetary space [Merriam Webster]; or stream of ionized hydrogen - protons and electrons - with an 8% component of helium ions and trace amounts of heavier ions, that radiates outward from the Sun at high speeds [general scientific interdisciplinary].

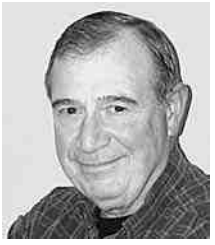
(e) Gamma rays: Radiation similar to x-rays, but having shorter wavelengths, emitted by radioactive substances as secondary radiation caused by *B*-rays striking matter

(f) Gravitational Constant of the Universe: particle physics ... for two point masses, a distance r apart, the strength of the force F is given by

$$F = G\frac{m_1 m_2}{r^2} .$$

G is called the constant of gravitation and is equal to $6.67 \cdot 10^{-11}$ $N\mu m^2 \mu kg^{-2}$. [Encyclopedia Britannica]

About the Author



Frank J. Verderber is professionally employed at Columbia Manufacturing Co., Inc., of Westfield, MA, as Staff Chemist. Prior to coming to Columbia, Mr. Verderber held several technical and engineering positions with Combustion Engineering Inc, (Windsor CT) as a Nuclear Fuels Technician, at Galileo Electro-Optics Corp (Sturbridge MA), as an Engineering Specialist, and at VMV Optics Corporation (Chicopee, MA).

He holds a B.S. degree in General Science from Westfield State College, Westfield, MA, where he graduated Magna Cum Laude. He was also granted a teaching certification for General Science and Chemistry, and taught Physics and Biology at Chicopee Comprehensive High School, Chicopee, MA. He also holds an Associate of Science degree in Chemical Technology from Holyoke Community College, Holyoke MA, where he graduated Cum Laude.

Mr. Verderber also holds the distinction of having locally published three literary fictions and has numerous published articles to his credit in the types: Scientific field reports (Crossed Chestnuts- Forestry), Government Proposal (invasive species warfare- Botany) and Nature Studies. Currently, Mr. Verderber is working on three books, a philosophic literary fiction, a nature book and a historical fiction.