

A Fascination with Fasteners

by Peter Standing

Whilst sitting in a traffic jam and trying to be constructive, a fascinating thought about fasteners crossed my mind and it basically began as a question, "What do we know?"

Well, we think we know there was a Big Bang which started the universe! Before that and outside it we might imagine a collection of soap bubbles? Everything inside our universe has expanded and since we know nothing can exceed the speed of light, the assumption is that will define the boundary? Atoms are the smallest elemental particle and their shape is impossible to define. Yet if we increase our scale of measurement from an atom by adding zeros, there would be more zeros going down to sub atomic particle sizes than moving out to the edge of the universe.

Using the constancy of the speed of light it seems the Big Bang occurred 13.8 billion years ago. Our Sun is 5 billion years old and the Earth 4.6 billion.

One billion years ago life on Earth began and through the whole of this time the experimental programme has continued in its countless forms until, four million years ago it produced us.

Of course, we can't know if we are alone in this huge universe (or a tiny soap bubble) but looking through the big end of our telescope at the incredibly limited things we can see, it would appear that humans are the most intelligent form of life yet spawned?

So, what differentiates human kind from all other life? In short what can we do that they can't? Discounting the use of fire, I mused, 'what does mankind do that is so different to every other form of life?'

The conclusion was, the initial invention of taking two entirely disparate objects and using a third to combine them to make an implement. I don't mean tying a rock to a stick to make a club using animal sinew or the tendrils of creepers. Or weaving branches or leaves to make shelters or clothing; birds make nests. What I mean is using something to fasten two other items to each other by making a third. Namely, a **fastener**.

Just imagine the significance of that giant leap for mankind. To our certain knowledge, never, in the one billion years of life on Earth and perhaps even in the whole universe, possibly the most important invention ever to be made is the fastener. Without it, technological progress could not have taken place. And the time required to invent the fastener? In terms of distance travelled by light, that would be around 1.3×10^{22} km. It makes you think?

Of course, thoughts must be the fastest thing in the universe in how they fly unencumbered instantaneously and to anywhere. But we know the process of thought is electronically stimulated and therefore obeys the laws of physics. However, the thought which crossed this Author's mind was not why the fastener has become so ubiquitous and necessary, rather how would it fare in the digital age of Additive Manufacturing where a major goal is to make a product in one piece?

Game Changers

Blessed with the benefit of hind-sight, it is possible to identify periods of the past when the direction of human travel has been altered. In parts of Africa and other remote places of the world, herds of migrating animals can be found and with these, small groups of people who still follow the nomadic lifestyle once practised by all of our hunter/gatherer ancestors. Farming changed this and somewhere, living in 'permanent' dwellings, the fastener was created? The smelting of base metal and the development of alloys have provided turning points in history but only when fashioned into a weapon, an implement, a device held together by one or more fasteners. Telecommunications, internal combustion engines, heavier than air flight and today's massive container ships have all shrunk our world from a few seconds delay in a satellite communications link to a few hours/days for goods ordered on-line and delivered.

As shown in Figure One, by far the biggest game changer to influence the direction of all human travel has been in the field of electronics. The rate of progress, the degree of miniaturisation, the capacity for good and bad in equal measure means the 'comfort zone' of delayed communications and hence decision making has gone. 24/7 emails, social media, breaking news give the everyday recipient a sense of being at the centre of their life environment while the tanks of the corporate empires park unnoticed on their front lawns collecting the data which will be used to impact their lives. Recently in England, financial globalisation of the football Premier League caused the national coach to bemoan the fact that his players in the top six teams could only get to play in 21% of the games. A trivial matter, yes but along with corporate influence on employment, health, education and welfare, it is one small part of an inexorable trend which naturally includes manufacture.

Digitalisation

In the same way lexicographers study the derivation of words, mathematicians muse over the origin of numbers. The use by the ancient Sumerians of the base sixty is still with us today when we divide a circle into 360 degrees etc.. The adoption of the base ten as a common system is probably due to the fact that we have eight fingers and two thumbs on which all humans learn to count. The use of 'digit' for both numbers and the things we learn to count them with is perhaps, self evident. However, the use of numbers in manufacture and particularly for automation goes back millennia.

As mentioned in a previous article for Fastener World ('Following the Thread' – Published in Fastener World Issue 168, Jan/Feb 2018 pp 326 – 330) the Greek Antikythera machine for calculating solar motions used highly sophisticated gearing to replicate the numerical data from the observation of heavenly bodies. Jacquard Cards to control the process of making patterned textiles on power looms at the beginning of the 1800's were also used to programme early computers. The application of gearing and cams allowed the 3D curvature of large propeller blades to be machined and to control single/multi spindle automatic lathes and other machine tools.

The introduction of stepper motor drives linked with microprocessor control created machines having computer numerical control (CNC). Parallel developments in computer aided draughting/design/ manufacture (CAD/ M) have made it possible for a CAD part to be manufactured directly from its downloaded data file instantaneously anywhere around the world. Numerical simulation and the use of neutral file formats, e.g. STEP ensure a part can be designed and manufactured right first time globally 24/7. Marketing data linked with logistics and supply chain fundamentals mean that international OEM's now represent the dinosaurs which fear only the natural disasters of economic collapse or other predatory big beasts.

Today, digitalisation controls virtually everything which moves in the modern world. Consider how long our society would survive if a solar flare of destructive magnitude were to hit the earth. Communications, transport, power, finance and food all disrupted for more than a few days. Could social cohesion be maintained and if that broke down, what then?

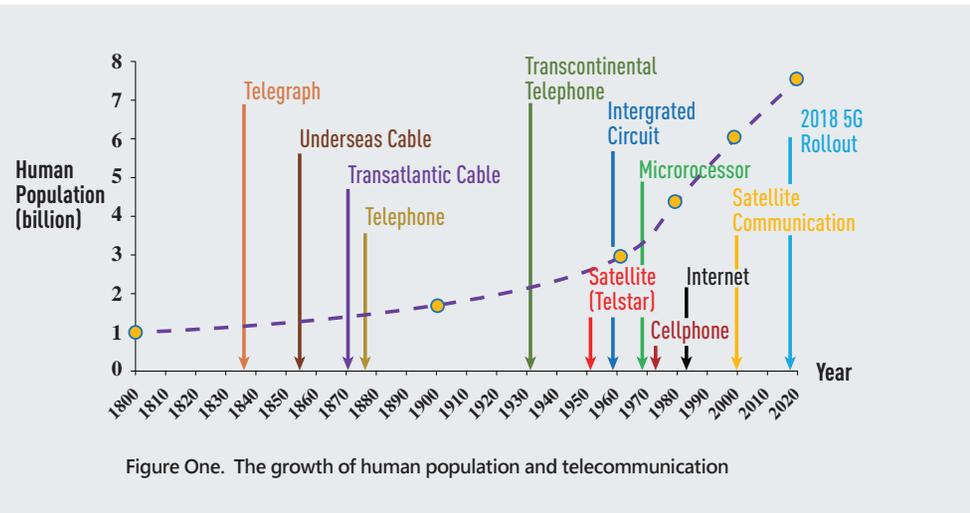
Putting aside any doom laden portents and assuming progress continues at its accelerating pace, what might tomorrow bring for the fastener industry?

Artificial Intelligence (AI)

Imagine you are travelling on public transport, a bus, a train, a flight and you turn to the stranger next to you remarking on something you see from the window. Then, almost instantaneously and it may seem like coincidental magic, on to the screen of your electronic device pops an advertisement for the same or similar product.

Such an increasingly regular occurrence is neither mystical or intuitive but simply the clever combination of data harvested from different sources. In the same way a hunter gatherer might be mystified by how a magnifying lens can focus the sun's rays to get things to burn, many people don't recognise the use of digital advertising for the marketing tool it is.

Like speech, the internet is a communication tool and like speech, our words can be recorded and used in ways they were never intended to be. We recognise this as we grow up and choose our words according to the circumstances. Data collection and storage on human activity is ubiquitous and on a scale never dreamt of before. Certainly, if the rate of progress of the previous 25 years continues, few people being born now will escape the cradle to grave surveillance as evidenced in China by the Social Credit System Programme due for rollout in 2020. As yet, those who obtain and manipulate human data do so 'mechanically' using algorithms to obtain the results they desire. However, if computers are ever able to be programmed to 'think' for themselves, the definition of 'life on earth' as we know it will need to be changed.



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Like us, computers operate electronically at the speed of light. But, unlike humans, at present they do not have 'intuitive' abilities to cut across so many boundaries and, like the fastener, link disparate things. Instead, computers operate as nature itself does by coded instructions which either stop or change when an error in transmission occurs.

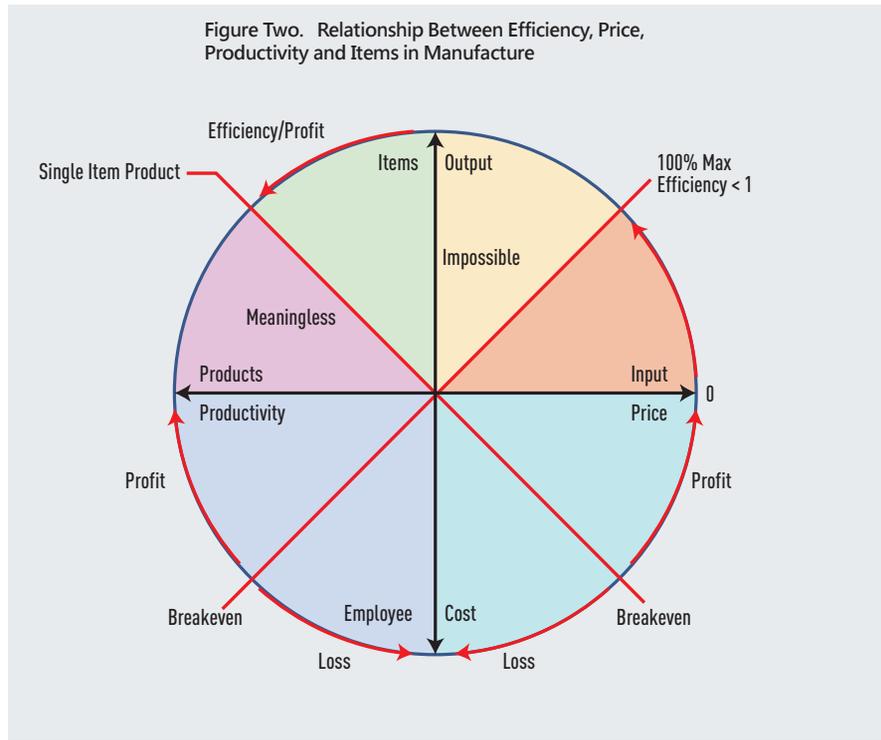
In some way, yet to be discovered, humans escaped the tyranny of the code when their thoughts became meaningful. As described above, perhaps the most important thought was in realising we could join things together? And what have we done with this ability? We have used it in every way to do everything more efficiently.

Key Drivers

It is efficiency which is key to everything the human direction of travel is taking. Sure, civilisation is stuffed full of ancient statues, paintings, great accomplishments of human culture and endeavour which occasionally reach the news headlines when they are sold or destroyed. But in an electronic era of 24/7 'wanabes' who seem lost without their phones, working on line, listening and watching whatever is in vogue, surviving between one mega event and the next; who gives a damn!

It is the efficiency of life (output over input) which drives modern culture and it's the scale of a market which determines the efficiency - always less than one. Consider industrial and other acquisitions and mergers. Yes, the market share increases but the important factor is the sharing of common back office activities which always result in cost cutting.

Figure Two. Relationship Between Efficiency, Price, Productivity and Items in Manufacture





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So too in product design, eliminate one item from an assembly and the value of its removal from the inventory can be dramatic. As all vehicle OEM's have found, introducing sub assembly modules improves line speed and reduces cost (efficiency). For over twenty years, wheel hub assemblies of hub, bearing, ABS etc., have been produced by forming the hollow hub spindle over the assembled bearings.

This simple 'riveting' operation provides OEM's with a tamper proof, sealed for life and accurately preloaded unit which can be mounted directly to the vehicle. For a bearing manufacturer, instead of just selling a bearing (for the price of a hamburger) they sell a finished multipiece unit where the assembly of its safety critical rolling elements are preloaded by the supplier.

As can be seen in Figure Two, the inexorable trend toward manufacturing 'efficiency', does not serve the fastener industry well. For example, fewer items in assemblies, fewer assemblies, single piece products and the chemical bonding of often quite dissimilar materials in safety critical applications. However, even in the present situation of drive down prices, it is difficult to envisage 'security' as being included in the efficiency cost down. More people means more manufactured goods. Products which have value will require protection from the more people who would like to deprive their owners of them. Also, in an increasingly liturgical society, the safety of both public and private spaces will demand ever closer attention to the safety and security of those who enjoy them. Perhaps in a high volume and 'efficient' disposable/recyclable world, high value fasteners will be required where high value goods are found? For the rest, design for dumping and disposal in an environmental manner!

And If?

In my few decades on this jewel in the blackness of space, I have seen things which, a few years ago, were prized and common place; fur coats and smoking are two of many examples. Today, for obvious reasons both are considered unethical and unhealthy. So, in both cases, people who indulge in enjoying such things are often shunned by others who don't. The same trends can be found in manufacturing where products which are deemed harmful or toxic to humans are banned or their use severely restricted. Likewise, products which have been rendered 'inefficient' in today's world, candles and slide rules come to mind, have completely disappeared or are primarily used to celebrate birthdays.

But what might happen if Artificial Intelligence became a reality and we humans were then to share our world with inanimate objects which could think? Chips do not require fasteners only thin strips of silicon with holes in them! And if you were a machine designing another machine, wouldn't you prioritise 'simplicity' simply to be more efficient? And if the machines you designed were to work only for your benefit and survival wouldn't that mirror the natural progression of current life on earth toward evolutionary 'perfection.' For example colonies of insects which have remained largely unchanged for over 300 million years and of course don't use fasteners!

These musings may indeed be reflective but I can recommend their use if you ever get stuck in a traffic jam. It's far better than any playlist in helping to pass the time.

Of course, if you are efficient in time management and naturally well informed, you could spend the delay reading Fastener World – or perhaps should we call it Fastener Universe? ■

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