

The Business of Barbed Wire

Barbed Wire has an interesting history. With hundreds of patents for various types of wire and machines to build them, barbed wire is undeniably an invention that has changed property and ranching, prisons and concentration camps, and defense and snares. Barbed wire has gone from inexpensive fences for the west to being developed for military operations.

To begin, we must look at barbed wire's origins. There are over 400 varieties patented, and in the United States these go back to William D. Hunt's Patent 67117 (Warren 3).ⁱ Hunt's patent was to put spurs on the wire. A second idea and patent for barbed wire was developed by Alphonso Dabb. Dabb patented a type of fence with protruding point at the top of it (Warren 3), Henry Rose offered a type of "wooden post with metallic points" (Warren 4). Yet another man, Charles Kennedy, offered a type of removable barb that fits onto the wire (Warren 4). The most significant invention however was Michael Kelly's patent. Kelley's Patent 74379 was to affix two-pointed flat barbs to the wire and offer a better, inexpensive, material-abundant fence for the west (Warren 4). Following Kelly's famous patent were two inventors who figured out how to keep the barbs in place: Jacob Haish and Joseph Glidden. Haish patented a special type of wire that utilizes barbs s-shaped to hold themselves between helical twisted pairs of wire (Warren 4). Glidden on the other hand had the barbs spun around a wire and utilized the helical twisting of the wire to hold the coils in place (Warren 4). To this day, Joseph Glidden's barbed wire is the most recognized form of barbed wire in use (Warren 7).

Fig. 2.



Jacob Haish's S-shaped wire

Image taken from

<http://www.google.com/patents/USRE9036?printsec=abstract&dq=jacob+haish&ei=h5kkUdOk>

MrPE0AHXtICoAg#v=onepage&q=jacob%20haish&f=false

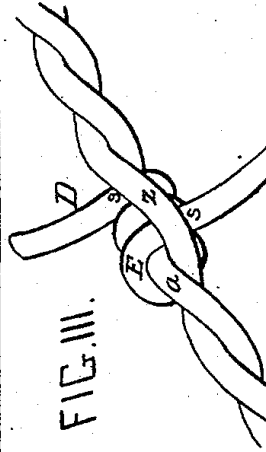
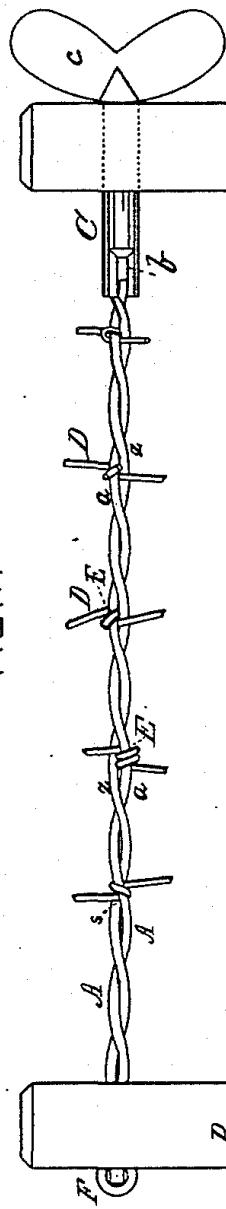


FIG. I.

FIG. II.

FIG. III.

Witnesses:

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Glidden's Original Design

Image Taken from

<http://www.google.com/patents/US157124?printsec=abstract#v=onepage&q&f=false>

Part of the success of Glidden's patent can be attributed to Worcester's Ichabod Washburn. Prior to producing barbed wire, Washburn was creating an empire of wire production. Washburn's success over competitors came from two major sources. First was that he found a way to make card wire more cheaply with different materials and second was that he employed the drawing block, a machine used to pull wire instead of doing the work by hand (Smith).ⁱⁱ

The traditional process of forming wire is as follows: a 4500 lb. ingot is taken, heated and divided into 5"x5" pieces called blooms. These blooms are then subdivided into 2"x2" pieces known as billets, and then drawn out into 30 foot lengths and divided into wire rod. This wire rod then becomes wire by one of two methods; either cold drawing or cold rolling (Warren, Wire Industry 6).ⁱⁱⁱ

These two things (cheaper wire and the drawing block) allowed Washburn not only the ability to produce more wire with less cost on materials, but also to produce more of it in a single day. This allowed his company to out-produce his competitors. A major use for the wire produced for Washburn & Moen was cloth covered wire, or hoop skirts (contemporary women's fashion) (Worcester Telegram).^{iv}

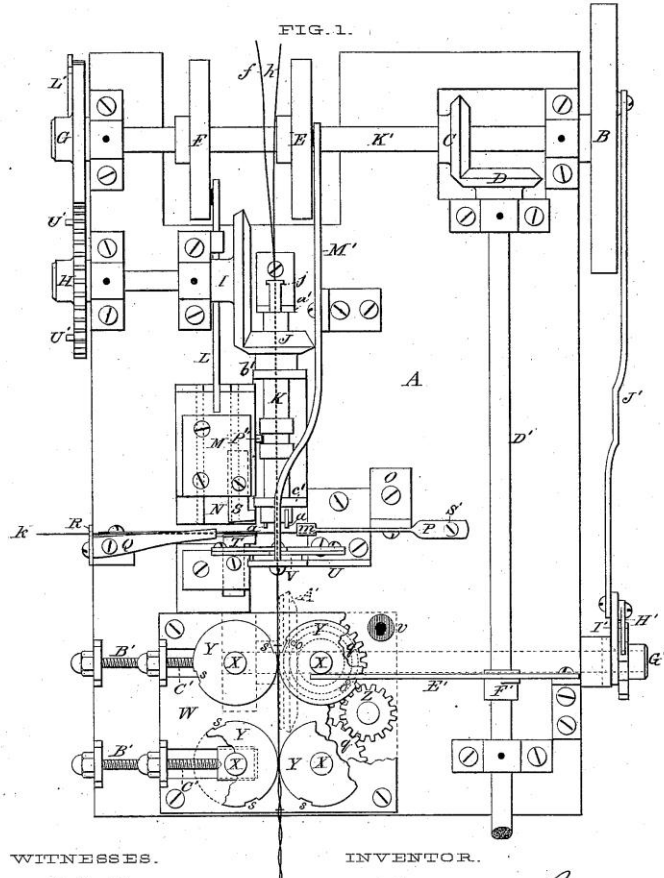
Washburn then considered the upsides to producing barbed wire at his mill, so he approached the two major inventors at the time, Jacob Haish and Joseph Glidden. Washburn first approached Haish and offered to buy his patent for the s-shaped barbed wire. Haish asked for \$200000 which Washburn declined (Warren 6). Washburn then turned to Joseph Glidden and offered to buy his patent for the coiled barbs. Glidden asked for \$100000 which Washburn accepted (Warren 6).

Washburn proceeded to collect patents relating to barbed wire. Henry Putnam gave a couple of patents to Washburn. One was a patent (in the original document it is listed as patent 187172 by smith, but this is an error; this one was an improvement on Glidden's type of barbed wire), which was for a machine that could easily produce barbed wire; it was sold to Washburn in May 1878 (Smith). The actual patent for the barbed wire machine is Patent 253824 (Patent 253824)^v Washburn & Moen owned 90 patents relating to barbed wire in 1881 and by 1884 this number had grown to 220 patents (Warren 7).

H. W. PUTNAM.
FENCE WIRE BARBING MACHINE.

No. 253,824.

Patented Feb. 14, 1882.



WITNESSES.

INVENTOR.

G. D. Pinckney
Chas. H. Smith

H. W. Putnam

S. PETERS, Photo-Lithographer, Washington, D. C.

Putnam's Wire Barbings Machine

Image from: <http://www.google.com/patents/US253824>

More Modern Developments

Modern Barbed Wire follows sets of standards set by the American Society for Testing and Material (ASTM). For basic double stranded barbed wire, the ASTM outlines specifics in production. This is the basic form of barbed wire and is not specialized for anything in particular. The ASTM states that the wire's strands must be made of high carbon steel (strong), with the barbs being a high carbon steel/aluminum alloy, and coated with either Aluminum, zinc, or a .05 zinc and aluminum alloy (ASTM 121).^{vi} The diameter of the wire must be within the range of 0.067-0.099 \pm 0.005 inches and must be able to sustain a tension greater than 4320 Newtons (ASTM 121).

A second type of barbed wire, one more suited for military applications and prisons, is high security wire. The standard for double stranded barbed wire for high security purposes is similar to the basic version, but has different constraints due to usage. This barbed wire is, of course, for more eminent areas, such as prison yards or heavily guarded areas. Similar to the basic form of barbed wire, the strands must be high carbon steel, the barbs are steel/aluminum alloy, and are coated with either aluminum, zinc, or .05 zinc and aluminum alloy (ASTM 121). The standard dimensions for high security, double stranded wire are stricter than the basic form. The wire itself must be 12.5 gauge and 0.099 inches in diameter, while the barbs themselves must be 14 gauge, and 0.030 inches in diameter (ASTM F1712 – 06).^{vii} These measurements are to be at the maximum allowable due to the intention of the wire.

Yet another type of wire, ribbon wire/barbed tape/razor wire, deviates from the previous two specifications. According to ASTM specification, "Barbed tape shall be manufactured from stainless and galvanized steel in accordance with ASTM AISA or UNS

designations to ensure correct chemistry.” (ASTM F1910-98)^{viii} The materials remain the same, but for the dimensions and configuration, the razor wire’s shape (not double stranded) must be taken into consideration. For razor wire, the maximum barb point radius is 0.005 inches, the maximum barb length (how far the barb can extend from the central wire) is 1.2 inches and the maximum amount of space between barbs on the wire is 4 inches. In addition to standards for the wire not being double-stranded, they are arranged in a concertina formation. The definition for concertina formation as defined by the ASTM is, “A pattern formed by attaching adjacent loops of helical coils to one another at specified points on the circumference, resulting in an accordion-like configuration.” (ASTM F1379 – 95).^{ix} Due to razor wire’s flat shape, a concertina configuration must be used to accommodate the storing of it.

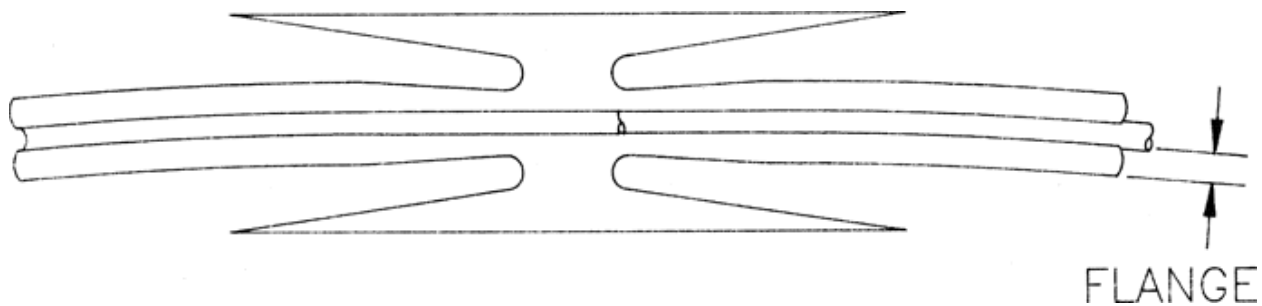


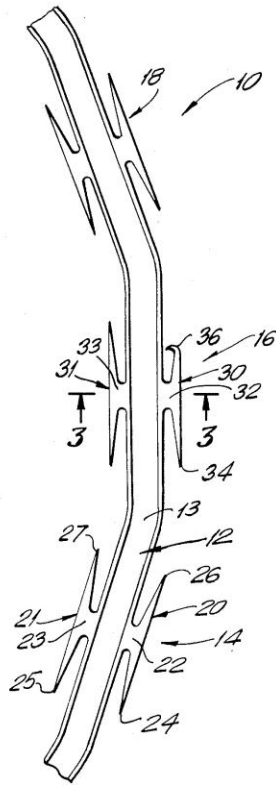
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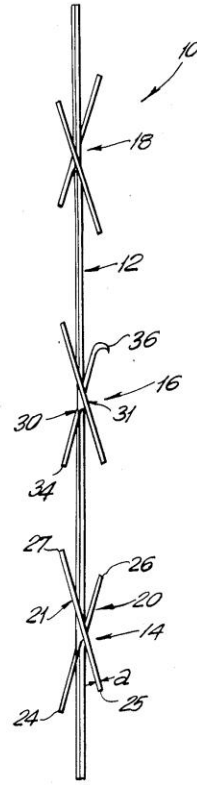
Razor wire, until fairly recently, was not considered too seriously for military applications. The key issue is that razor wire had been easier to cut than double-stranded wire, and thus was not considered. However in the 1980s, razor wire began being produced with a steel core center, meaning it was more difficult to cut through (Razor Wire Use).^x Now, because of increased durability, the military has become interested in its use for defense and high-security applications. The military now trains soldiers to crawl through concertina razor

wire (Razor Wire Use). Razor wire is also usually not used by itself; it is usually used in conjunction with curved walls (Razor Wire Use).

Some patents for razor wire take advantage of its weak strength. US patent 4818972, which was filed on November 25, 1987 and issued on April 4, 1989, addresses the issue with barbed tape's necessity to have a required thickness to be effective (Patent 4818972).^{xi} This patent requires that the wire actually be thinner than recommended, and the patent requires that the razor wire have an electrical sensor as part of the design. The barbs on the tape are placed so that touching or moving the wire will cause the barbs to bend toward the point of intrusion; thinner barbed tape allows the barbs to bend in this way (patent 4818972).



(PRIOR ART)
FIG. 1



(PRIOR ART)
FIG. 2

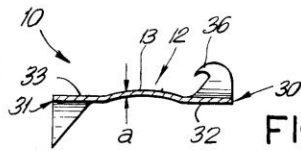


FIG. 3 (PRIOR ART)

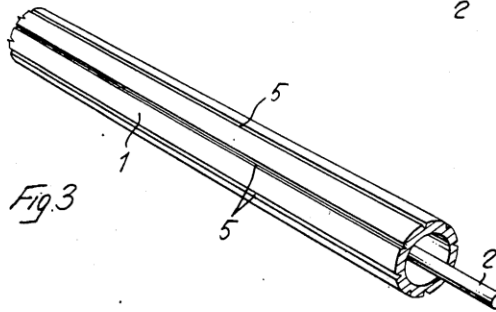
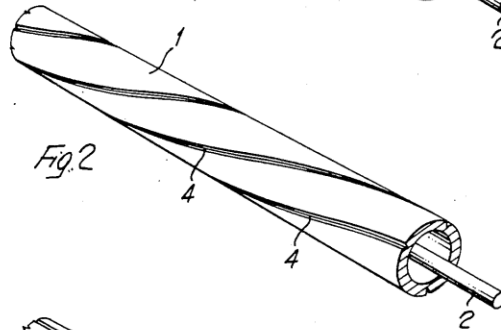
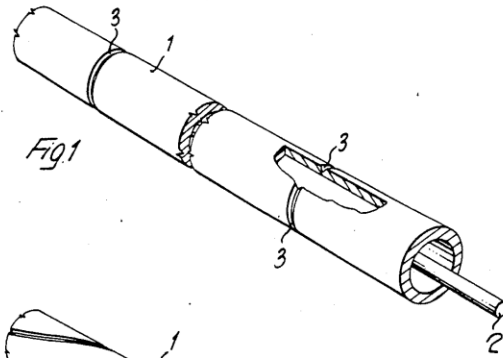
Barbs that turn in toward the intruder

Image taken from

<http://www.google.com/patents/US4818972?printsec=abstract#v=onepage&q&f=false>

Other developments in barbed wire include using electrical currents. US patent 2909360 is for electrical barbed wire. Filed March 8, 1954 and issued October 20, 1954, this patent for barbed wire describes the method for preparing a type of barbed wire that runs an electrical current through it. Primarily it calls for the barbs to coil tightly around a single wire (patent 2909360).^{xii} Unlike the standard that Glidden and Washburn had set previously, electrical barbed wire does not set the barbs between two wires, but rather around a single one with a charge running through it. Due to the electrical current running through the wire, a layer of insulation must be wrapped around the stakes of the wire fence (patent 2909360).

Another barbed wire patent that is to be noted is alarm wire, or US patent 4680573. Filed on October 22, 1985 and issued on July 14, 1987, this wire is similar to the aforementioned electrical barbed wire. This single-wire concertina is to be in the shape of a tube with metal, plastic, or fiber glass as its material (Patent 4680573).^{xiii} Around this tube will be the barbs, but within the tube will be the main mechanism. Inside the tube is an electrical or (preferred) optical conductor which connects to the warning system; any breaks in this inner wire will disrupt the electrical current running through it and set off the warning system (Patent 4680573). Furthermore, the tubular wire is to be weakened by notches and grooves in it, making the trigger wire more sensitive (Patent 4680573). This is interesting because both this patent and patent 2909360 (improvement to barbed tape) take weakness in the wire to be utilized for functionality rather than to be ignored or protected.



Grooves in the outer tube of the wire.

Image Taken from

<http://www.google.com/patents/US4680573?printsec=abstract#v=onepage&q&f=false>

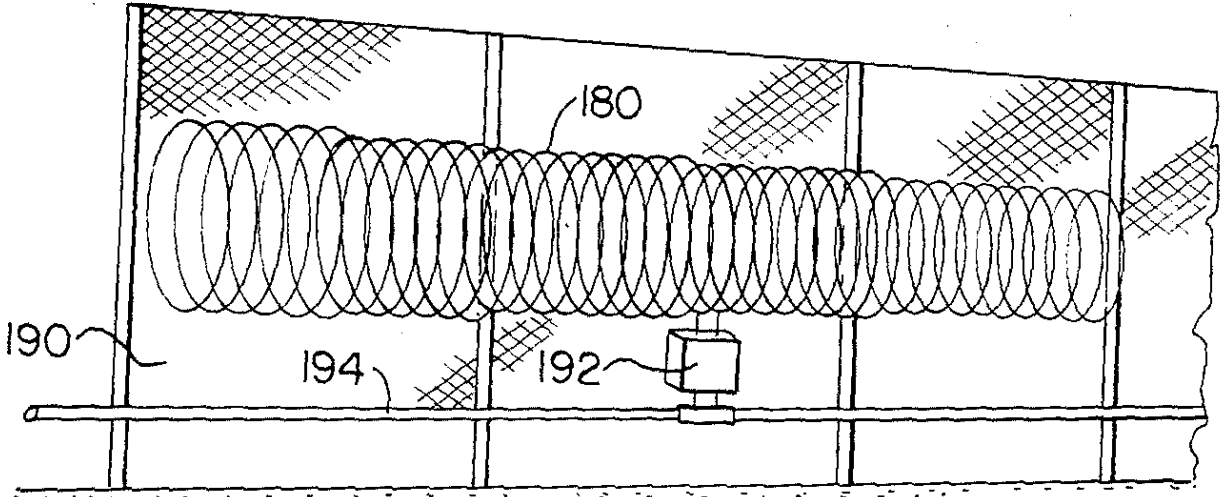


FIG. 15

The barbed wire and the alarm device.

Image Taken from

<http://www.google.com/patents/US4680573?printsec=abstract#v=onepage&q&f=false>

Barbed Wire Iconography

The tensile strength of barbed wire seems to be a key aspect that reinforces the image of barbed wire. Already the idea of a metal rope probably brings to mind a feeling of being trapped. With the addition of the barb, the wire gives a tangible image to oppression. Its use in concentration camps reinforces this image. In his book, *The Devil's Rope: A Cultural History of Barbed Wire*, author Alan Krell discusses many such images of barbed wire. While the idea of bare hands working to break barbed wire seems incredulous, it sends a message of liberation and the nature of the human spirit in the face of atrocities (Krell 9).^{xiv} Another symbolic analogy to be made is that between barbed wire and the crown of thorns. Jesus' crown of thorns was weaved as an insult and cruel parody of the laurel crown (Krell 18). What makes the image really stand out is that the barbs protrude from the wire in such a way that is eerily similar to the thorn bush used to craft the crown of thorns.

Barbed wire is also part of the symbol of Amnesty International. There are two parts to Amnesty International's logo. There is barbed wire forming a concertina coil around a candle. The barbed wire represents oppression while the candle represents hope ("Amnesty International Logo Design").^{xv}





Images taken from: <http://www.logodesignlove.com/amnesty-international-logo-design>

One could even draw a comparison between this logo and the image of Jesus' resurrection breaking the chains of death. The logo brings to mind that even if one isn't free now, there is hope that someday they will be free.

Barbed Wire's Pre-World War Usage

In warfare, wire traps were used prior to the advent of barbed wire. Wire traps date back to the American Civil War. During the attack on Drewrey's Bluff, General Butler ordered his troops to gather nearby telegraph wire and tie it between nearby tree trunks (Johnson 208).^{xvi} In warfare there are two vital pieces to the equipment: the technology and the doctrine. Technology, is the application of science or the physical equipment. Doctrine is how to use the equipment. Here we see telegraph wire (technology), strung between fixed points for defensive purposes (doctrine). The results of this tactic are evident. General Weitzel remarked about the battle, "The other seven regiments of my line didn't move until, after they have twice repulsed the enemy with terrible slaughter,-- he being piled in heaps over the telegraph wire,-- they were ordered to fall back." (Johnson 212). Even without barbs, wire defenses and traps provide an effective (and deadly) barrier.

The first use of **barbed** wire for warfare was in 1898 during the Spanish American War. This is just thirty one years since the first patents in 1867 (or 24 years since Glidden's famous invention). One of the most notable examples during the Spanish American War is the defense provided by the Moron-Jucardo Trocha. The trocha (or trench) stretched for fifty miles between the cities of Moron and Jucardo. Within this trench, and in addition to fallen trees, barbed wire barbed wire was used. The barbed wire was arranged in a cat's cradle formation that for every 12 yards of barbed fence built, 420 yards of barbed wire was strung (or 35 yards of wire per yard of fence) (O'Tool 74).^{xvii}

Barbed wire was also used in the Russo-Japanese War, during which several battle strategies would be developed and carried over to World War I. One particularly relevant battle to note is the Battle of Sha Ho in October of 1904. During this battle, a new type of combat was being fought: trench warfare. Trenches were employed in the battle, and used in conjunction with them was barbed wire (Russo-Japanese War).^{xviii} This battle would set the new standard for warfare with trenches and barbed wire obstacles to stand between the two sides.

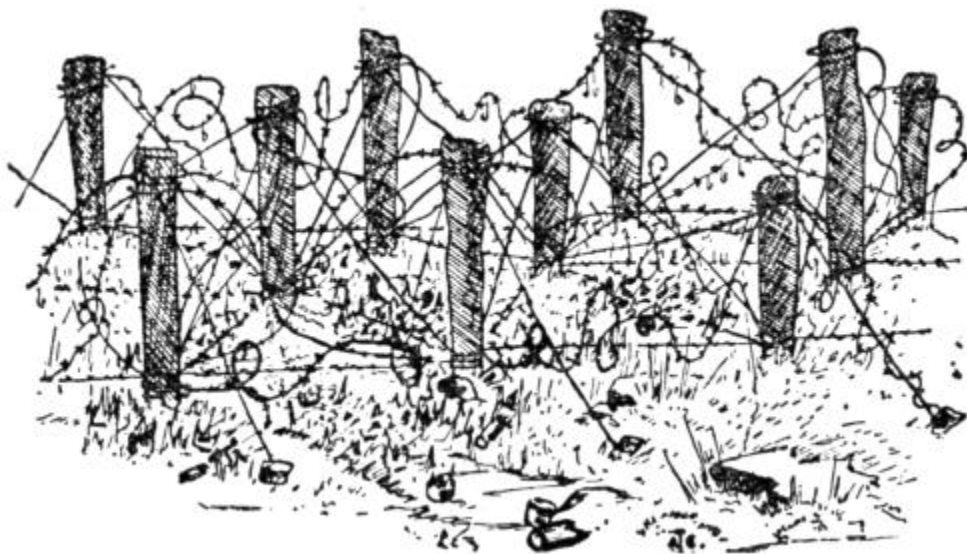
In addition to trenches and barbed wire obstacles, the Battle of Sha Ho and the Russo-Japanese War overall had another invention revolving around barbed wire: the Bangalore Torpedo. Developed in 1912, the Bangalore Torpedo is a simple elongated bomb. Soldiers would make these bombs in the field by attaching a series of 400g TNT blocks to a wooden pole or placing them inside a metal tube (Kraft).^{xix} For the most part, Bangalore Torpedoes are used for demolition and removal of traps, especially those left behind from the Russo-Japanese War, and especially for barbed wire entanglements. This device is interesting because the other methods of breaching a defense of barbed wire are either trying to navigate around/through it (risking injury and ensnarement), or to attempt to cut the double-stranded barbed wire (taking time and risking getting caught in gunfire). With the Bangalore Torpedo, soldiers could place the explosive, retreat to a safer distance, and have it detonate, clearing the area of barbed wire.

Barbed Wire used by World War I and World War II Soldiers

Following the Russo-Japanese War, barbed wire was used in World War I. In addition to rations and tools and ammunition, barbed wire was assigned to United States soldiers as part of their supplies, with small units being assigned 100 rolls of barbed wire to use (Small Units 41).^{xx} For trench warfare the purpose is not to stop enemy advancement, but to slow them down and make them easier to hit (Cole).^{xxi} Here we see how barbed wire is being used in combat. The object is not to repel, but rather allow to be caught. In general, barbed wire was to be set up 50-100 yards away from the trenches so as to keep it intact from artillery fire. The fences were to be set up as a three row fence with alternating stakes placed in the ground and the furthest being constructed first (Cole). There were three major forms of entanglement. The first was high entanglement which would be on 4' camouflaged wooden posts (Cole). Low entanglements, which would be hidden in vegetation, would be half the height of high entanglements. Loose wire obstacles are loops of wire that would be fastened to stakes or thrown on the ground. The purposes of these configurations is to hide the wire so that it is a trap for enemy troops, and configurations such as low and loose were either completely invisible or difficult to locate (Cole).

In addition to the entanglements mentioned in Captain Cole's *Military Instructor's Manual*, Colonel James A. Moss' *Manual of Military Training* describes more ways barbed wire can be used in entanglements. All obstacles are to be set up at most 100 yards from the defending trench and should be located out of reach of enemy artillery fire (Moss 402). *The Plattsburg Manual* (1918) also supports this set up for obstacles. For an effective defense, the

area up to artillery range should be kept cleared (Ellis)^{xxii}. All obstacles are to be at a range such that it is at a distance away from the defender to be both protective and outside of artillery. The first thing to note with general barbed wire fences is that the fences should be formed by having horizontal or diagonal wire and then adding irregularities to the fencing later (Moss 404).^{xxiii} High wire entanglements are those tied to four foot stakes while low wire entanglements are those tied horizontally to 18 inch stakes (Moss 405). These two entanglements were considered the most prominent because these were the two easiest and fastest to assemble obstacles. According to Moss, "One man can make 10 sq. yds. of low and 3 sq. yds. of high entanglement per hour (Moss 405)." The speed at which the high and low entanglements can be assembled allowed for rather effective obstacles during a battle. This ease was noted in *Lectures on Land Warfare* (1922). Barbed wire was mentioned as an effective obstacle under the section of new inventions, and to paraphrase, barbed wire was used to quickly set up defensive points and not only prevented advances by the enemy, but also drew them into areas guarded by machine gun fire (LOLW 76).^{xxiv}



High Wire Entanglement

Image taken from www.gutenberg.org/files/26706/26706-h/26706-h.htm

The first major non-fence obstacle relating to barbed wire is the abatis, from the French word *abattre*, meaning “to strike down, slaughter” (Merriam-Webster Dictionary).^{xxv} In the words of Moss, “Abatis consisting of trees lying parallel to each other with the branches pointing in the general direction of approach and interlaced... Barbed wire may be interlaced among the branches” (Moss 402). With an abatis obstacle, barbed wire is used in conjunction with the environment’s recently felled trees, offering an augmentative roll to the wire.

Additionally, Moss describes a *fraise*, which is a palisade, or fence, projecting horizontally from the scarp or counterscarp, and has the fence posts connected by barbed wire, forming a horizontal, barbed wire fence (Moss 403). While fairly similar to the abatis, a *fraise* is more regular in shape than barbed wire in tree branches and takes advantage more of the land’s shape than the abatis.

Finally, Moss describes a barbed wire fence. Barbed wire fences used for combat are arranged in a way such that is an ordinary barbed wire fence with additional aprons on one or both sides (Moss 405). Aprons are additional fences tied at an angle to the main fence. These fences are 300 to 600 yards in length and are connected to block houses, similar to how the fences were used in South Africa (Moss 405). Alluding to barbed wire fences’ use in the Boer War shows how well this configuration has been carried over to World War I. These types of fences also can be built so that a mechanical or electrical alarm can sound (via counterweight) if the wire is cut (Moss 405).

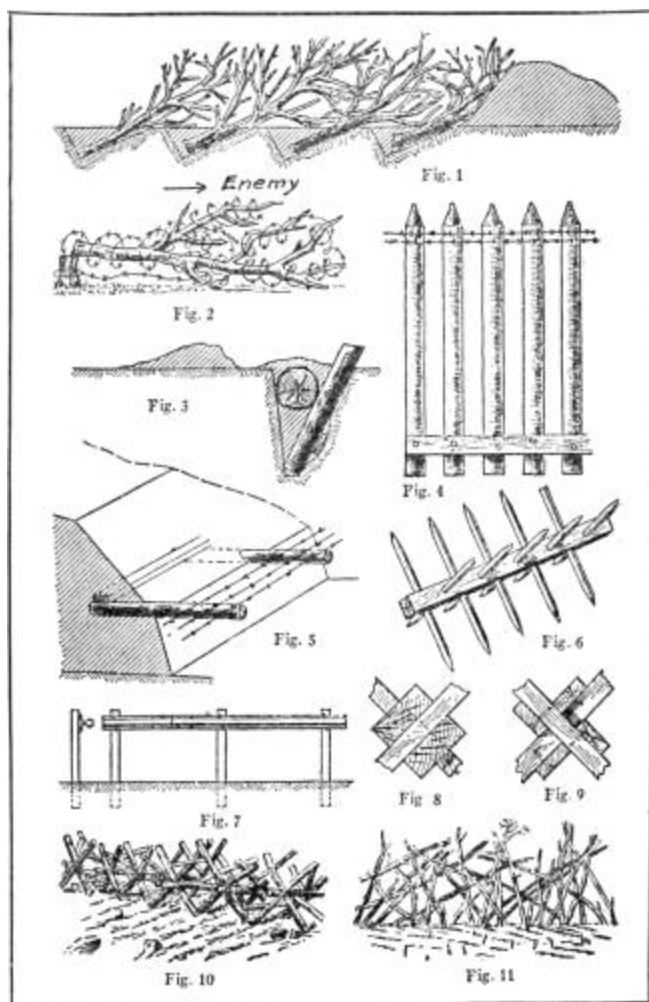


Fig.1 & Fig. 2: Abatis

Fig. 4: Palisades

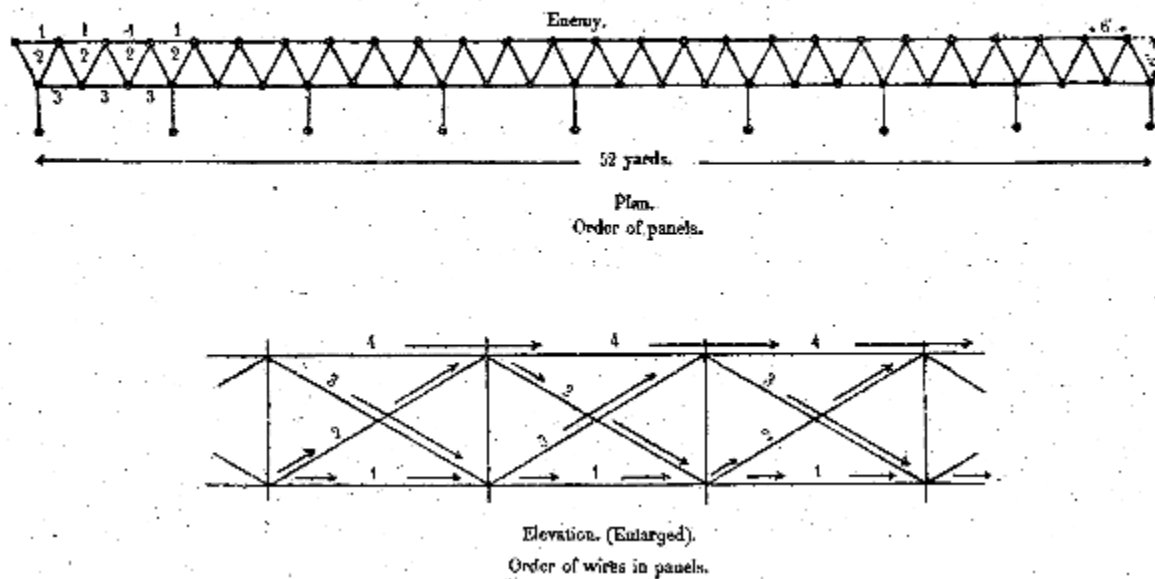
Fig. 5: Fraise

Image taken from <http://www.gutenberg.org/files/26706/26706-h/26706-h.htm>

There were a couple of wire entanglements the United States Army borrowed from the French. One of these was variation of the high entanglement obstacle is the French high wire entanglement. Simply put, the French high wire entanglement is two rows of pickets and three rows of fences (Wire Entanglements 20).^{xxvi} Two of the fences are set up as normal fences along the pickets while a third fence is strung zigzag between the two rows of fences (Wire

Entanglements 20). What also made this entanglement effective was the efficiency of time. The design of the entanglement made it so set up such that soldiers wouldn't stumble over each other and could assemble the entanglement quickly (Wire Entanglements 20).

50 YDS STANDARD FRENCH HIGH WIRE ENTANGLEMENT



French High Wire Entanglement

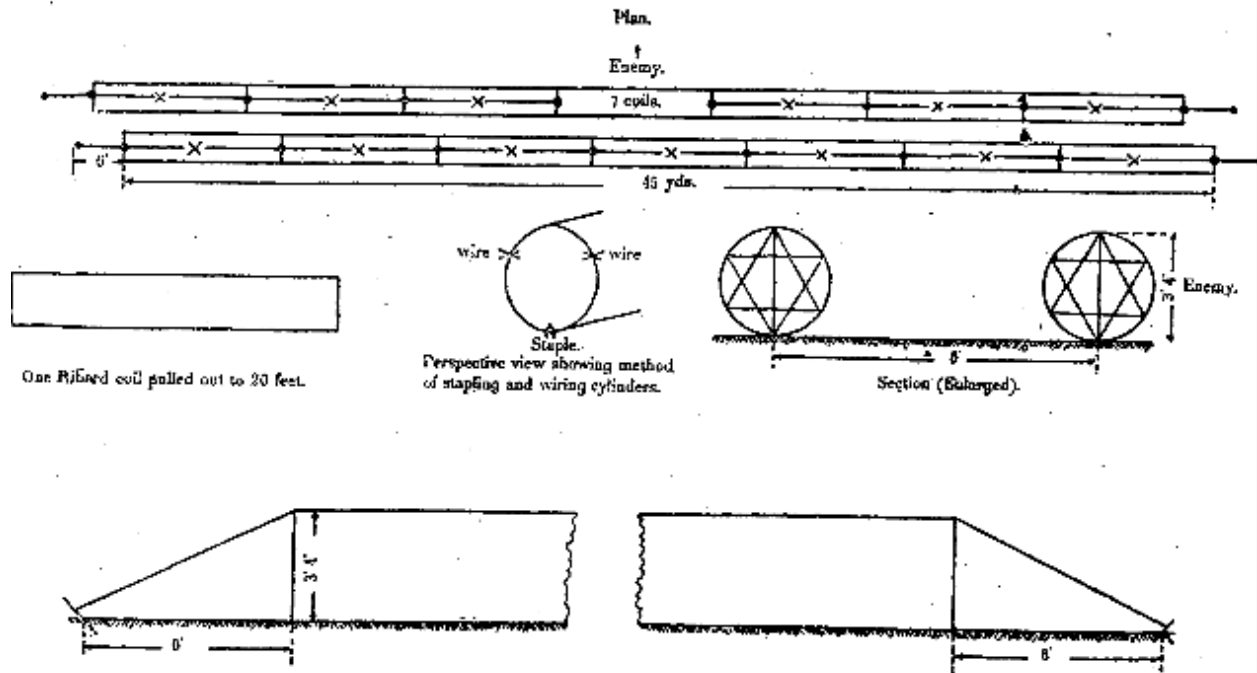
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Another entanglement borrowed from the French was ribard wire. Ribard wire is a series of heavy steel rings strung together by barbed wire (Wire Entanglements 8). The key advantages to ribard wire are visibility and resilience. Ribard wire is said to have low visibility, be made and carried into place, and be able to resist being destroyed by artillery fire (Wire Entanglements 8).

50 YDS DOUBLE BELT OF RIBARD WIRE



Ribard Wire

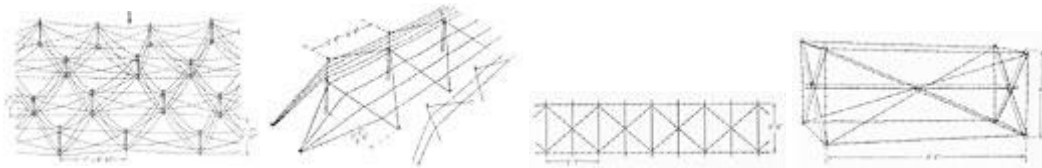
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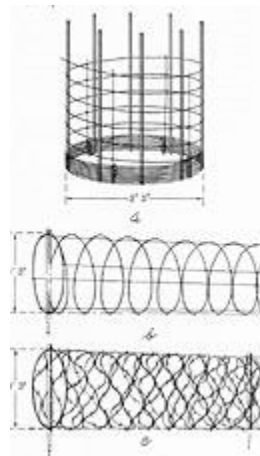
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Barbed wire use continued past World War I and continued into World War II. On the Japanese Theatre, barbed wire was used by the Japanese and had different configurations due to the coastal location of conflict. The basic wire entanglement was of a triangular net design. The double apron design was 6 rows of wire forming a blanket over an area of 2.5'-3' high and 10' wide (Japanese Military Forces 153).^{xxvii} The low entanglements remained from World War I and were placed on beaches. In addition to normal fences, the Japanese employed movable barriers that were not as effective but were useful in a hurry (Japanese Military Manual 154).

These Barriers include movable fences, the Cheval-de-frise (a box of barbed wire), and concertina wire.



Left to right: Basic Entanglement, double apron, movable fence, Cheval-de-frise, and concertina



Images Taken From: <http://ibiblio.org/hyperwar/Japan/IJA/HB/HB-7.html#X>

Germany had a remarkable use of barbed wire in World War in The Netherlands, Belgium, and France. The first to note are the instructions for the aforementioned cheval-de-frise/knife rests. Located on the coast above high tide, they are four trestles strung with barbed wire into a box (German Coastal Defense).^{xxviii} The first major entanglements on the beaches were the trip fences. These were diagonal/diamond shaped entanglements that would be set up just before major defensive positions (German Coastal Defense). Germany used alarm barbed wire and pioneered the use of electrified barbed wire. Alarm wires would be set up so that grenades, explosive charges, or a bell would go off if any part of the wire was cut or otherwise tampered with (German Coastal Defense). Electrified barbed wire has also been

employed, but was considered rare (German Coastal Defense). In addition to using barbed wire obstacles as is, Germany has also been noted to have combined barbed wire obstacles. A German combined fence would be a combination of trip wire, knife rest, and apron fence, in that order (German Coastal Defense). This is interesting in that, as opposed to other variations where just the types are listed, here we have how the different types of entanglements are arranged in order to complement one another.

On the United States side there is the *Basic Field Manual of Coastal Defense* (1944). According to the manual, barbed wire is to be set above the high tide line and covered by machine gun fire (fm31-10 18).^{xxix} While barbed wire in coastal defense does not need to take into consideration artillery fire, it does need to be placed in such a way that the tides do not damage the entanglements. The manual goes on to describe the usefulness of barbed wire and other entanglements under the water. “Underwater Obstacles and entanglements are placed to stop or damage landing boats approaching the shore, to block the advance of amphibious tanks and tractors, and to delay, while under fire, troops which attempt to debark and to wade ashore.” (fm31-10 19). Thus far, there is barbed wire that is placed both above and below the water. Below the water, barbed wire must be underneath at least six feet of water and for areas that have a large variation in tide heights, multiple times the barbed wire dropped must be employed to ensure that there are adequate obstacles to deter approaching enemies (fm31-10 19).

Barbed Wire in Post World War II Warfare

Even after World War II, barbed wire has and will continue to be used for warfare.

During the Vietnam War, combat had become more indirect as chemicals such as Agent Orange and napalm began being employed. During this time the usage of barbed wire entanglements had also changed. According to military manual instructions at the time, barbed wire entanglements were primarily meant to impede movement and should be a viable defense due to barbed wire being lightweight and inexpensive (FM 5-15).^{xxx} During the Vietnam War, barbed wire obstacles were set up somewhat differently than during the Great Wars. Similar to World War I and World War II, barbed wire was meant to be covered by gunfire, partially concealed from the enemy, and used with other objects to complement a defense; however, the key differences are that in the Vietnam War, barbed wire should adopt an irregular, non-geometric pattern, and the barbed wire was classified by purpose rather than by set up (Manual Vietnam). While World War II could have allowed for more geometric patterns, the Vietnam War required that barbed wire entanglements be irregular and more bizarrely set up.

In Vietnam, barbed wire was set up to be tactical, protective, or supplementary.

Tactical barbed wire was set up in a way to hold the enemy in the most intense areas of fire. Protective barbed wire (set up 40-100 meters away) was used to provide defense nearby or overhead and used to prevent surprise assaults. Supplementary wire would be used in conjunction with tactical wire to conceal the exact line of tactical wire (Manual Vietnam 73). These entanglements were also made up of base parts. These base parts are belts (single

fences), bands (multiple, connected belts), and zones (multiple intermittent bands) and it was recommended that the latter two be employed whenever possible (Manual Vietnam 74). During the Vietnam War, the portable types of barbed wire (knife rests, wire in water, loose wire, tripwires, etc.) were employed as well as fences. Portable barbed wire entanglements were employed to cover gaps and the rear, as well as closing up lanes and gaps when not in use (Manual Vietnam 74). Common areas where barbed wire would be employed were outposts, battle sites, with artillery, in antipersonnel obstacles, roadblocks, and to strengthen the natural obstacles of the area.

Barbed wire has continued into the Iraq and Afghanistan wars. Currently the most common type of fence is the triple concertina fence. While this new variation on the concertina is prominent, there are still several older variations. Tanglefoot barbed wire is still used in areas where it can be concealed by shallow water or tall grass. The double apron, while still used, is considered manpower and material intensive and is generally set up for truly defensive obstacles; whereas there is now general purpose barbed tape that is deployed from a moving vehicle (FM 90-7 3-10).^{xxxi}

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