

Living in the Past

Historical perspective



A beautiful mind

Once named [the most beautiful woman in the world](#), **Hedy Lamarr** was more than just a pretty face. Born [Hedwig Kiesler](#) in 1914 Vienna, Hedy won a beauty contest at age 12, then began her career as an actress at age 16. Her father, however, had recognized Hedy's quick intellect early on, and freely shared mechanical details of things "from printing presses to street cars," which she later confessed that other girls never had the luxury of hearing about (not that they wanted to.)



At 19, Hedy married Fritz Mandl, an arms dealer whom she later discovered had ties to Nazi leaders.

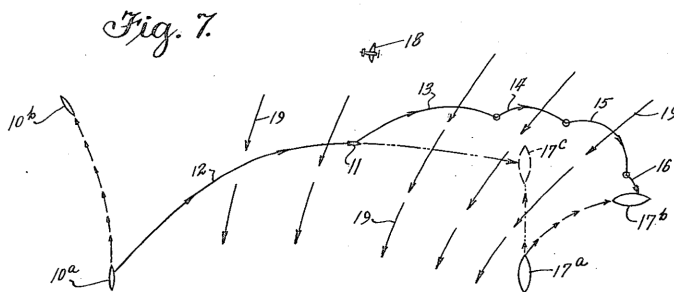
Mandl loved to show off his trophy wife to business associates, while discussing wired remote-controlled torpedoes, submarine innovations, and other weaponry, not knowing all the while that Hedy was not only paying attention to the details, but understanding it all too.

Eventually, Hedy escaped her marriage and left for London, where Louis B. Mayer of [MGM](#) offered the young beauty a contract for \$125 a week. She turned down the contract, and booked a fare [on the same ocean liner](#) that Mayer took for New York City, on which she accepted his new offer for \$500 a week. On the advice of Mayer's wife, Hedy changed her last name in honor of silent film star Barbara La Marr. She went on to appear in 30 films in her 28-year career.

In between films, Hedy attempted to improve the world around her by inventing things, inspired by her technology-minded father. Soon, World War II took center stage, and Hedy decided to apply her inventive mind to the war effort. Remembering the discussions on remote-controlled torpedoes, she thought of taking the project a step farther, and invested some time into radio-controlled torpedoes. But she also realized that radio signals could be jammed, so Hedy put some thought into a way of producing a radio signal that was resistant to not only jamming, but interference, something that also plagued radio signals of the day.

At that time, the best way to avoid a jamming signal was to change frequency, hoping that the enemy could not figure out the new frequency in time to do much damage. So, the thought occurred to Hedy, to have both the transmitter and receiver change frequencies periodically, in

a pattern known only to the radios. This way, if the signal was spread over several frequencies, chances are, the jamming would only interfere with one of them, leaving the others intact. She called the scheme [frequency hopping](#). Figure 7 to the left is a drawing from the patent on frequency hopping, that Hedy shared with George Antheil, her composer friend.



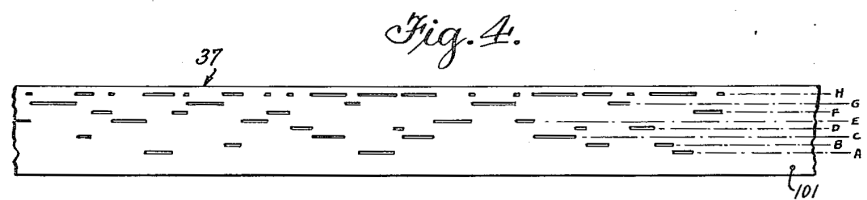
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Hedy and George filed the patent under the name of [Secret Communication System](#) in June 1941, which they presented to the US Navy. The patent was approved, but six months later came the attack on Pearl Harbor, and the Navy made good use of Hedy's frequency hopping, which found its way into numerous military radio designs. While many thought the scheme was attributable to some genius engineer, little did they know it was the brainchild of the most beautiful woman in the world!

(Unrelated, Lamarr helped make improvements to aircraft aerodynamics for Howard Hughes, while they dated during the War. In 1960, she was also awarded with a star on the Hollywood Walk of Fame.)



Player piano strip, on which Hedy and George tested their idea in a kind of proof-of-concept

Hedy's design was later enhanced and renamed to *frequency-hopping spread spectrum*, which has proven very useful against many kinds of radio interference and fading. Turns out that FHSS is capable of preserving communication where low-power or high-noise is key, and so became incorporated into many radio technologies. Hedy's very application of FHSS has found its way into today's WiFi, GPS, cellular phone, Bluetooth, and military radio. Even amateur radio uses a version of FHSS in its spread-spectrum modes, such as mesh networks.

In 2000, Hedy Lamarr passed away, and in 2014 along with George Antheil was posthumously inducted into the [National Inventors Hall of Fame](#).

