The woman behind your WiFi

Hedy Lamarr: Frequency Hopping in Hollywood

Anja Drephal (anja.drephal@informatik.hu-berlin.de)

Geschichtliche Entwicklung der Spread-Spectrum Technik

1942	*Markey* und *Antheil* patentieren das erste Spread-Spectrum System (U.S. Patent 2 292 387).
1948	*Shannon* publiziert die mathematische Theorie der Nachrichtenübertragung.
1949	*Pierce* schlägt ein asynchrones Mehrbenutzersystem nach dem Zeitsprungverfahren vor.
1950	*De Rosa* und *Rogoff* publizieren die ersten Ideen über Direct-Sequence Spread-Spectrum Multiplexübertragung. Die Unterscheidung der Teilnehmer erfolgte durch aufgenommene Rauschsignale. Sie stellen die erste Gleichung für den Prozeßgewinn auf.
1952	Am MIT wird das NOMAC System entwickelt.
1954	Die ersten Feldversuche der F9C Direct-Sequence Spread-Spectrum Übertragung finden statt.
1956	*Price* und *Green* reichen das erste Patent eines RAKE-Empfängers ein.
1961	Das erste mit Halbleitern ausgestattete Direct-Sequence System (ARC-50) geht in Produktion.
1962	Das erste Frequenzsprung-Spread-Spectrum System (BLADES) wird getestet.
1973	Das Global Positioning System wird entwickelt.
1980	Das erste kabellose Inhaus Funksystem wird von HP vorgestellt.
1985	Die rechtliche Grundlage (FCC Part 15) zu Spread-Spectrum Experimenten wurde geschaffen.
1993	Für zellulare Spread-Spectrum Systeme wird der Standard IS-95 geschaffen.
1994	Die erste Basistation einer zellularen Spread-Spectrum Versuchszelle wird in Betrieb genommen.

Source: Goiser 1998

Hedwig Kiesler

Vienna

November 9, 1914


1138 X 92
MGM

Atelier Förster, Wien phot.

Hedy Kiesler

„Ross" Verlag

Sascha Film Studios Vienna

Max Reinhardt

“Das schwache Geschlecht (The Weaker Sex)”

“Sissi”

“Die Koffer des Herrn O.F.

(The Trunks of Mr. O.F.)”

“Man braucht kein Geld (We Don’t Need Money)”

“Hedy Kiesler is the most beautiful woman in the world!”

Max Reinhardt

Man braucht kein Geld


ECSTASY!

Fritz Mandl

Born 1900

Hirtenberger ammunitions factory

3rd richest man in Austria

Austro-Fascist

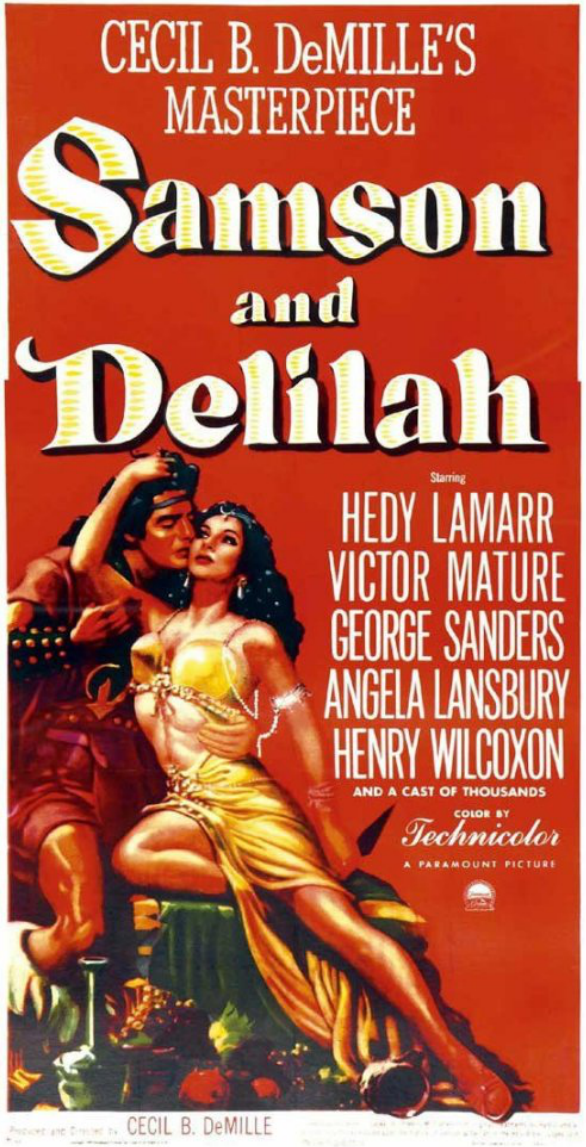
Supplied weapons to Spanish Fascists, Mussolini, Austrian right-wing militia Heimwehr


STRANGE LOVES
HIDING IN THE CASBAH
CITY OF SECRETS!
CHARLES BOYER
as "PEPE LE MOKO"
HEDY LAMARR
as "GABY"
WALTER WANGER presents
CHARLES BOYER ★ HEDY LAMARR in
ALGIERS
with SIGRID GURIE
Re-released thru United Artists

“She should have been at MIT rather than MGM.”

Peter Antheil, George’s son


gatabella


CECIL B. DeMILLE'S
MASTERPIECE
Samson
and
Delilah
Starring
HEDY LAMARR
VICTOR MATURE
GEORGE SANDERS
ANGELA LANSBURY
HENRY WILCOXON
AND A CAST OF THOUSANDS
COLOR BY
Technicolor
A PARAMOUNT PICTURE
CECIL B. DeMILLE

The Nitrate Diva @NitrateDiva · Apr 3

TFW you're 3000% done with glam photo shoots and are inwardly planning a new radio frequency system for torpedoes:

84 4.5K 6.7K •••

SS Benares

Carrying 90 children from England to Canada

Torpedoed by German U-Boat in September 1940

77 children died

Idea:

German glide bombs were radio controlled, torpedoes weren’t. Radio control of US torpedoes to increase their chances of hitting targets

Idea:

“split-second” radio signals between ship, torpedo, and plane overhead in between intervals of radio silence

Idea:

Changing the frequency of the split-second signals, making it harder to intercept and jam


Frequency Hopping!

George Antheil

Trenton, NJ

July 8, 1900

Konzertdirektion Otto Bauer, Wurzer Straße 16

Bayerischer Hof

Donnerstag, den 8. März 1923, abends 7½ Uhr

II. KLAVIERABEND

George Antheil

Pianist-Futurist

Programm

1. Fuge E-Moll	J. S. Bach
Brillanter Walzer, op. 34 Nr. 1	Fr. Chopin
Nocturne, op. 15 Nr. 2	Fr. Chopin
Malaguena	Issac Albeniz
	A. Borodine

Pause

2. Kinderblätter (für K. u. B.)

Introduction, Kanon, Valse Rapide, Valse Lente, Kindergesang, Schulmädchenwalzer, Galanter Galopp, Espana, Dummkopf, Gavotte, Rondino, Troika, Chinoiserie.

Pause

3. Mechanismen, Erste Gruppe in 4 Dimensionen

1. Mechanism interrhythmic
2. „ cubistic
3. „ elipticinterrhythmic
4. „ „
5. „ psychoeliptic
6. „ sensurorhythmic
7. „ planetary

Pause

4. Drei futuristische Sonaten:

Abstracte Sonate „Aeroplane" (Sonate Nr. 2)

Der Tod der Maschine (Sonate Nr. 3)

mechanismus nocturne, Aeroplan, nächtliche Volksmenge

5. Jazz Sonata (Sonate Nr. 4)

Konzertflügel: STEINWAY AND SONS

Während der Vorträge bleiben die Saaltüren geschlossen


Ballet Mécanique
1924
Player pianos, airplane propellers, sirens

Method of secret communication

88 frequencies

Random signals on 3 extra frequencies to enhance enemy confusion

Aug. 11, 1942. H. K. MARKEY ET AL. 2,292,387

SECRET COMMUNICATION SYSTEM

Filed June 10, 1941 2 Sheets-Sheet 1

Fig. 1.

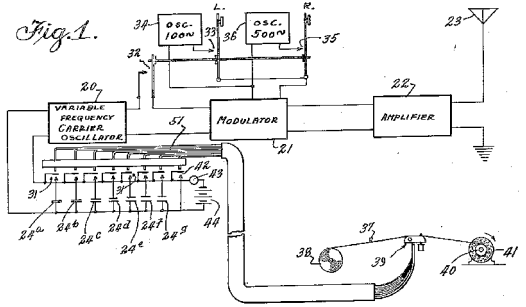


Fig. 2.

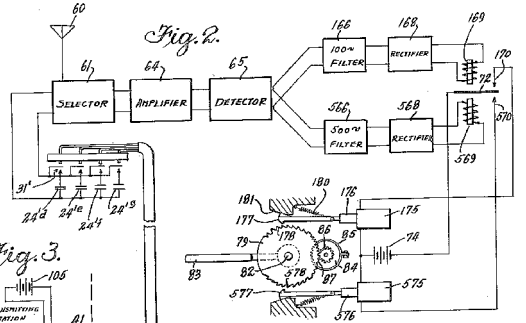
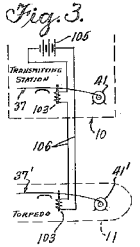


Fig. 3.



Inventors
Hedy Kiesler Markey
George Antheil
By Lyon & Lyon
Attorneys

Aug. 11, 1942. H. K. MARKEY ET AL 2,292,387

SECRET COMMUNICATION SYSTEM

Filed June 10, 1941 2 Sheets-Sheet 2

Fig. 7.

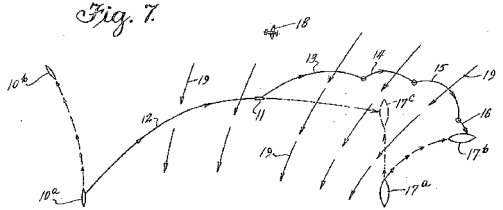
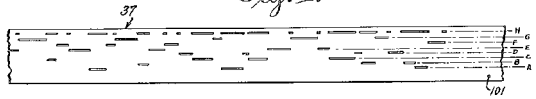


Fig. 4.



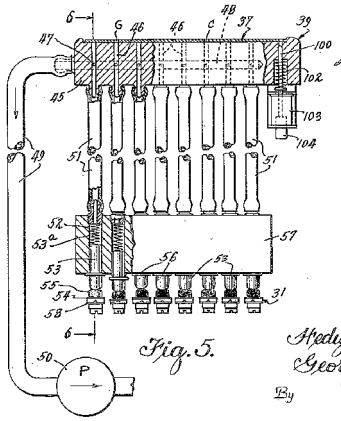


Fig. 5.

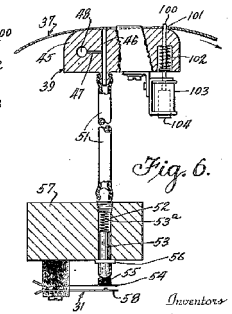


Fig. 6.

Inventors

Hedy Kiesler Markey

George Antheil

By Lyon & Lyon

Attorneys

Fig. 7.

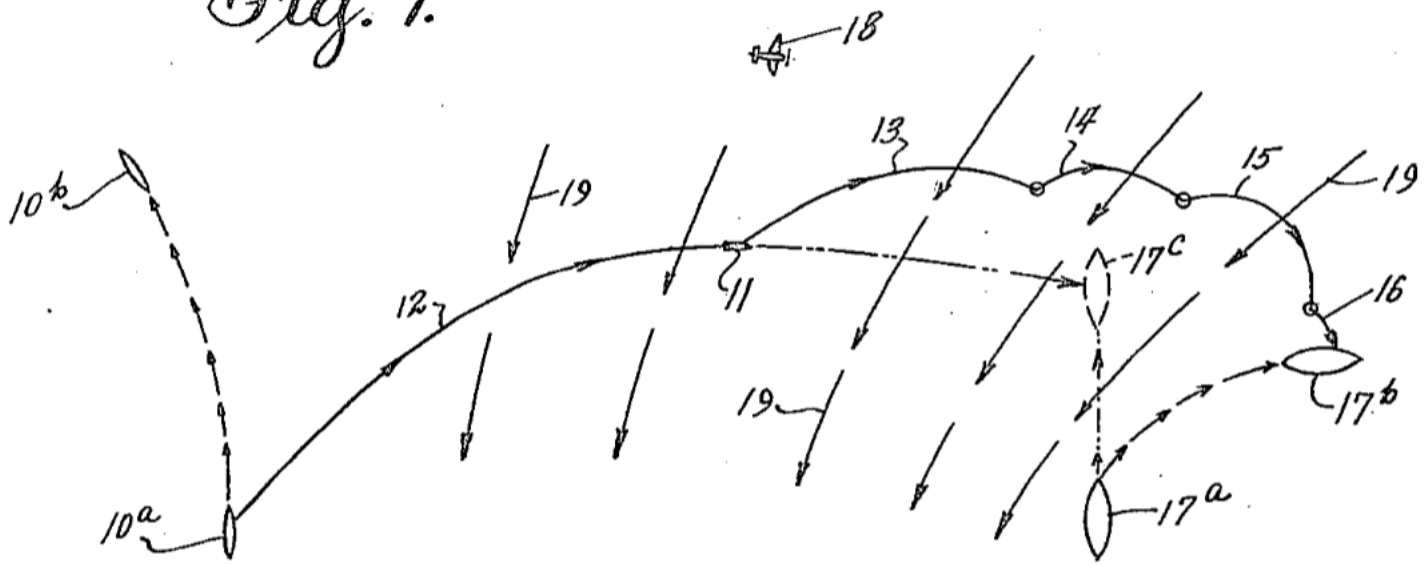
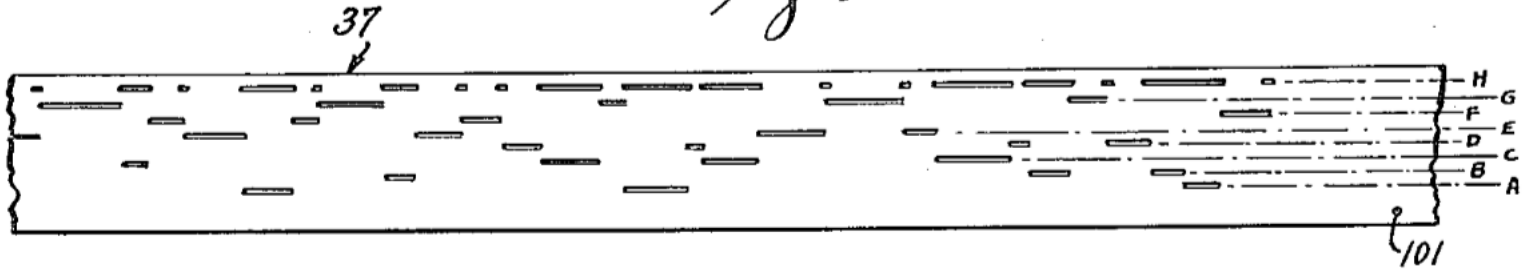
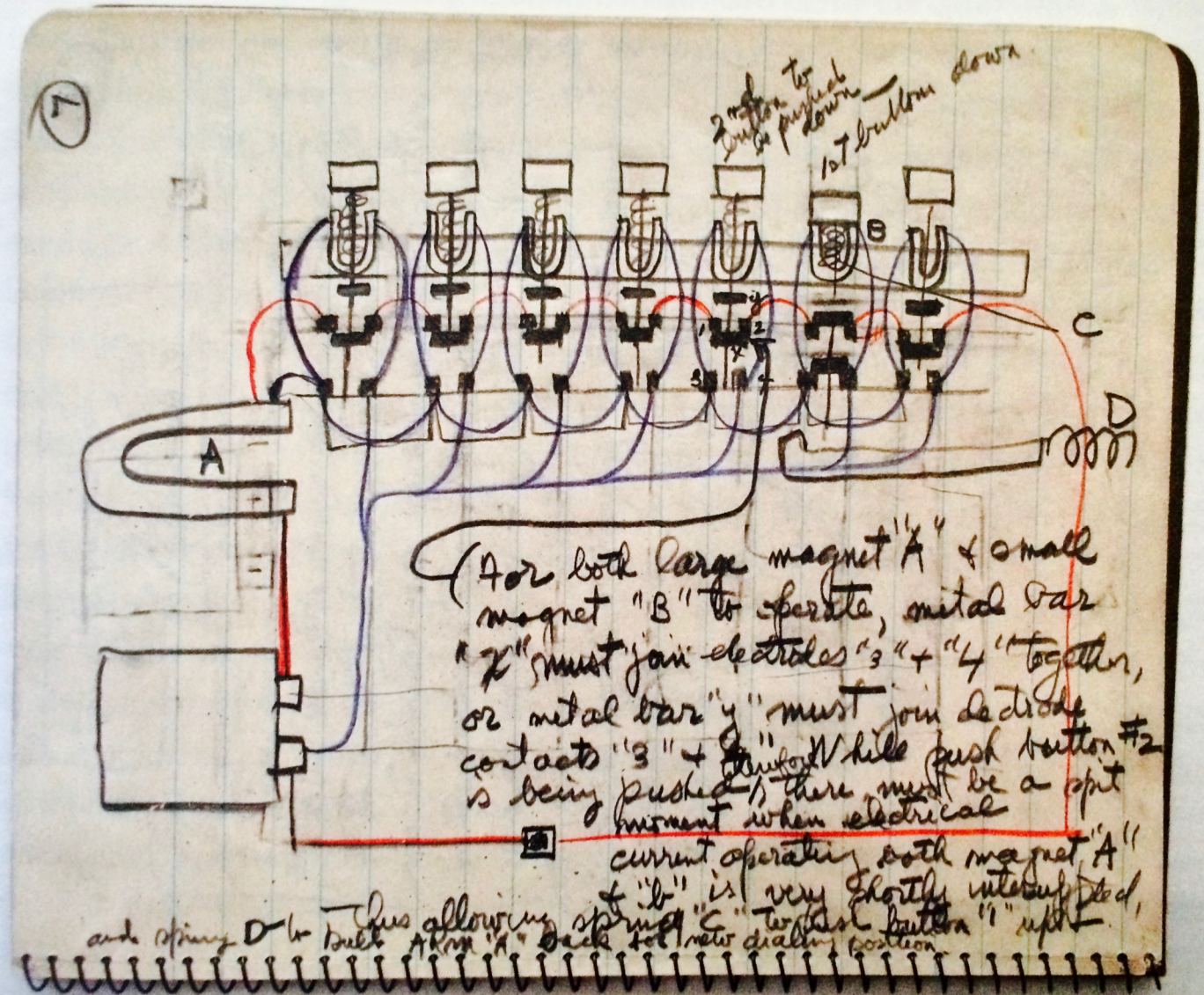


Fig. 4.




1
2nd button to be pushed down
1st button down
A
B
C
D
E
1
2
3
4
x
y
For both large magnet "A" & small magnet "B" to operate, metal bar "x" must join electrodes "3" + "4" together, or metal bar "y" must join electrode contacts "3" + "2" while push button #2 is being pushed & there must be a split moment when electrical current operating both magnet "A" & "B" is very shortly interrupted, and spring D to push Arm "A" back to new dialing position. Thus allowing spring "C" to restore button "1" up

HEDY LAMARR INVENTOR

Actress Devises 'Red-Hot' Apparatus for Use in Defense

Special to THE NEW YORK TIMES.

HOLLYWOOD, Calif., Sept. 30—Hedy Lamarr, screen actress, was revealed today in a new role, that of an inventor. So vital is her discovery to national defense that government officials will not allow publication of its details.

Colonel L. B. Lent, chief engineer of the National Inventors Council, classed Miss Lamarr's invention as in the "red hot" category. The only inkling of what it might be was the announcement that it was related to remote control of apparatus employed in warfare.

The New York Times
Published: October 1, 1941


Navy rejects proposal – Why?

Put a player piano in a torpedo?

A Hollywood star and a composer inventing a weapons system?

Pearl Harbor – fix existing torpedo system first!

Hedy Lamarr, an enemy alien …?


LOYEES OF
hit the bull's eye!
PAYROLL SAVINGS PLAN
SCORE
AT LEAST
10%
EVERYBODY
EVERY PAYDAY
SHOOT STRAIGHT
WITH OUR BOYS
Buy U.S. WAR BONDS


crimsie|tumblr
oliviasdehavilland|tumblr

Secret military research on spread spectrum from 1940s – 1970s

BLADES

Cuban Missile Crisis 1962

FCC (Federal Communications Commission)

Controlled assignment and use of frequencies

Deregulation in the 1970s/1980s

Civil use of spread spectrum in mobile phones, microwaves, bluetooth, WiFi, etc.

Dave Hughes, internet pioneer

Researched Hedy’s work, lobbied for her recognition as an inventor

Electronic Frontier Foundation (EFF)
Pioneer Award 1997

Hommage à Hedy Lamarr exhibition

Hedy-Lamarr-Award for achievements by women in information technology since 2006

Hedy-Lamarr-Weg in 1120 Vienna

November 9: Inventors Day

National Inventors Hall of Fame 2014

Sources:

Antheil, Peter. “My father was a wishful thinker.” Mauro Piccinini Website. https://piccininimusic.wordpress.com/my-father-was-a-wishful-thinker/ (accessed 20 December, 2016)

Barton, Ruth. Hedy Lamarr: The Most Beautiful Woman in Film. Lexington, Ky.: University Press of Kentucky, 2010.

Förster, Jochen, and Anthony Loder. Hedy Darling: das filmreife Leben der Hedy Lamarr. Hollenstedt: Ankerherz Verlag, 2012.

Goiser, Alois. Handbuch der Spread-Spectrum-Technik. Wien u.a.: Springer, 1998.

Lamarr, Hedy. Ecstasy and Me: My Life as a Woman. New York: Bartholomew House, 1967.

Miessner, Benjamin Franklin. Radiodynamics: The wireless control of torpedoes and other mechanisms. London: Crosby, Lockwood & Son, 1917.

Sources:

Price, Robert. “Further Notes and Anecdotes on Spread-Spectrum Origins.” IEEE Transactions on Communications, Vol. 31, No. 1, January 1983, pp. 85–97.

Rhodes, Richard. Hedy's Folly: The Life and Breakthrough Inventions of Hedy Lamarr, the Most Beautiful Woman in the World. New York: Doubleday, 2011.

Robbins, Trina. Hedy Lamarr And a Secret Communication System. Mankato, Minn.: Capstone Press, 2007. [graphic novel aimed at middle school students]

Scholtz, Robert. “The Origins of Spread-Spectrum Technology.” IEEE Transactions on Communications, Vol. 30, No. 5, May 1982, pp. 822–854.

Shearer, Stephen Michael. Beautiful: The Life of Hedy Lamarr. New York: Thomas Dunne Books/St. Martin's Press, 2010.

Simons, Marvin K., et. al. Spread Spectrum Communications Handbook. New York: McGraw-Hill, 2002.

Patents and other links:

Nikola Tesla's "boat" patent, 1898

https://www.google.com/patents/US613809

Nikola Tesla's "Method of Signaling", 1903

https://www.google.com/patents/US723188

Markey and Antheil's "Secret Communication System", 1942

http://www.google.com/patents/US2292387

Google Doodle celebrating Hedy Lamarr's 101st birthday on November 9, 2015

https://youtu.be/Z0gu2QhV1dc