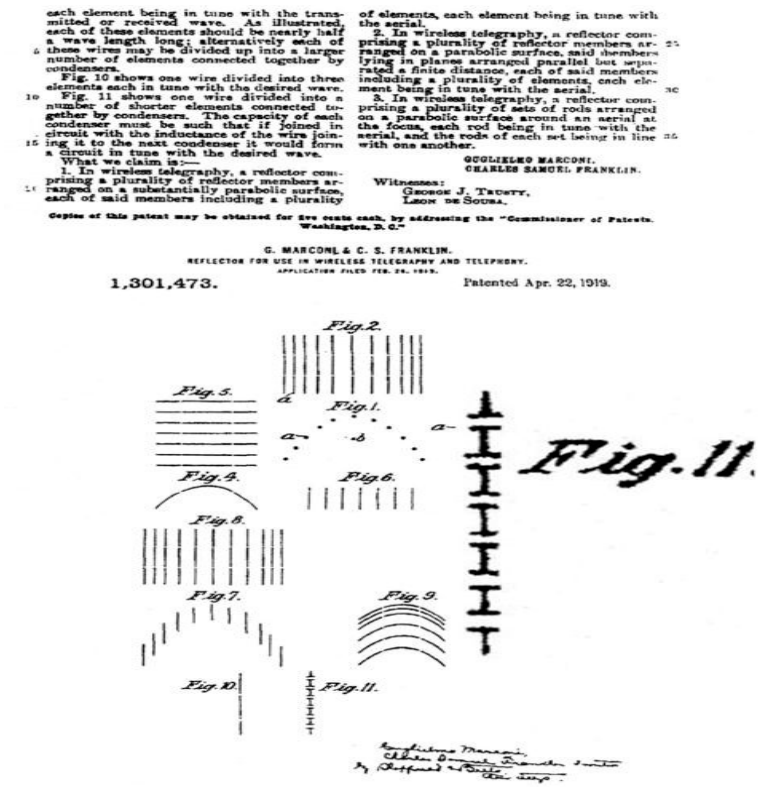


each element being in tune with the transmitted or received wave. As illustrated, each of these elements should be nearly half a wave length long; alternatively each of these wires may be divided up into a larger number of elements connected together by condensers.

Fig. 10 shows one wire divided into three elements each in tune with the desired wave.

Fig. 11 shows one wire divided into a number of shorter elements connected together by condensers. The capacity of each condenser must be such that if joined in circuit with the inductance of the wire joining it to the next condenser it would form a circuit in tune with the desired wave.

What we claim is:—

1. In wireless telegraphy, a reflector comprising a plurality of reflector members arranged on a substantially parabolic surface, each of said members including a plurality of elements, each element being in tune with the aerial.

2. In wireless telegraphy, a reflector comprising a plurality of reflector members arranged on a parabolic surface, said members lying in planes arranged parallel but separated a finite distance, each of said members including a plurality of elements, each element being in tune with the aerial.

3. In wireless telegraphy, a reflector comprising a plurality of sets of rods arranged on a parabolic surface around an aerial at the focus, each rod being in tune with the aerial, and the rods of each set being in line with one another.

GUGLIELMO MARCONI.
CHARLES SAMUEL FRANKLIN.

Witnesses:
GEORGE J. TRUSTY,
LEON DE SOUSA.

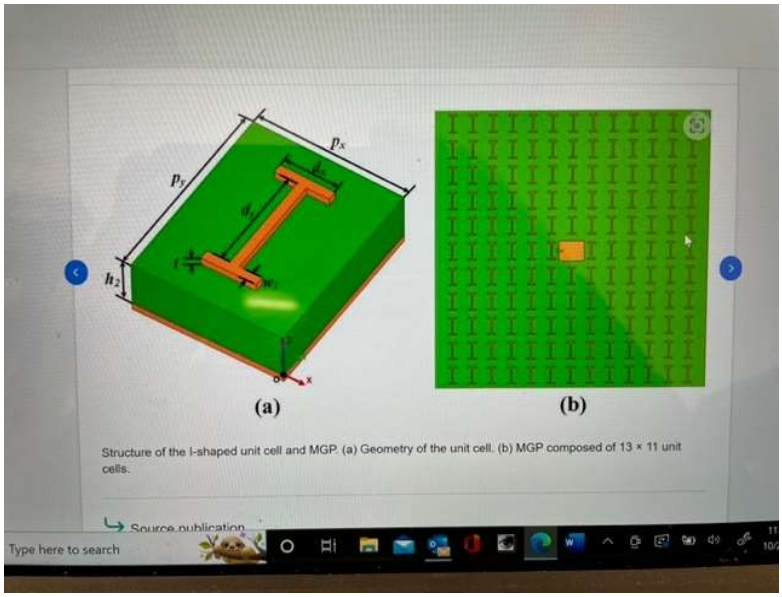
Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

G. MARCONI & C. S. FRANKLIN.
REFLECTOR FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY.
APPLICATION FILED FEB. 24, 1919.

1,301,473. Patented Apr. 22, 1919.

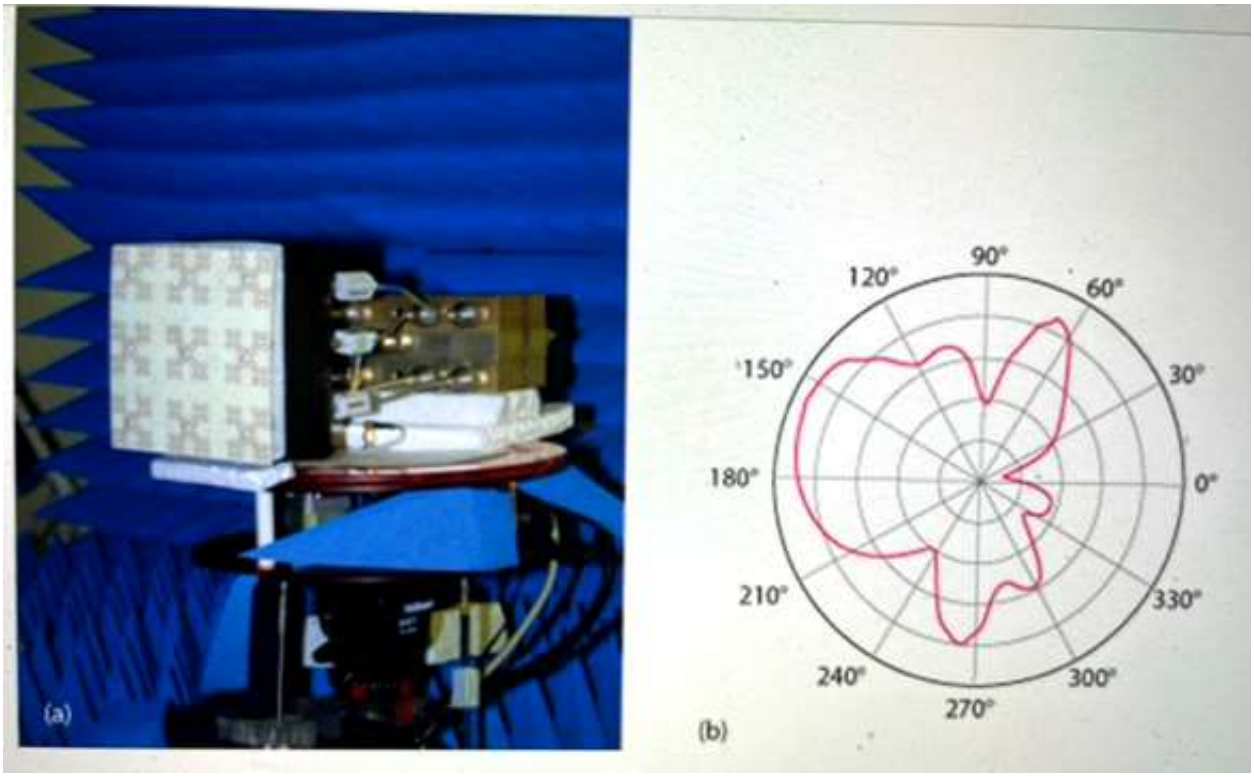
Fig. 2. Fig. 5. Fig. 1. Fig. 4. Fig. 6. Fig. 8. Fig. 7. Fig. 9. Fig. 10. Fig. 11.

Fig. 11.



Metamaterials—artificial materials of close-spaced resonators with properties not found in nature—were first **invented by Marconi and Franklin in 1919**. Note the page from their patent 1,301,473 (with blow up of Fig .11). Also, a contemporary use as an ***'I-shaped metasurface'***, for example, in the paper by Zhang et al (IEEE Transactions on Antennas and Propagation,65,7, July 2017 Fig 4)

COHEN---FIGURE 1

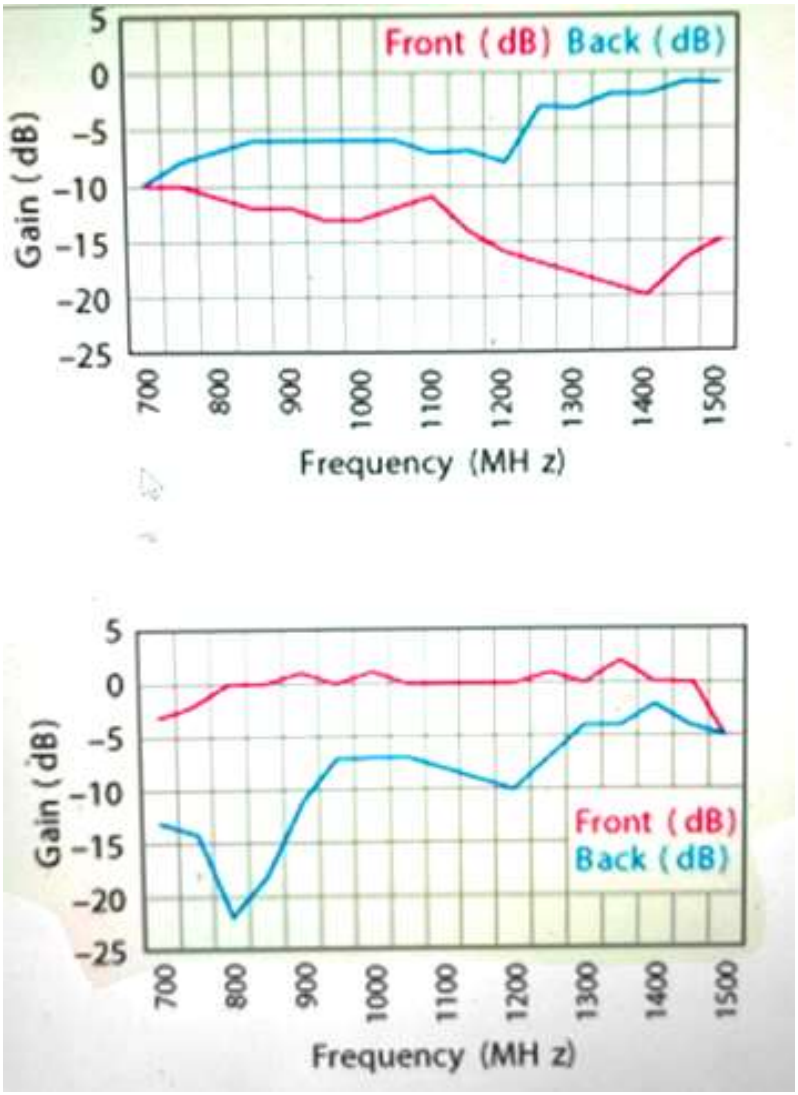


From 2002/2003—a **fractal metasurface (a thin metamaterial layer) with backplane**, being used for a supergain array under DARPA funded study "Close-Packed Fractal Antenna Array"(not classified) by Cohen et al. Note the strong lobes which radiated at the metasurface edges, the result of evanescent excitation of a surface wave. After the DARPA study, in December 2003, Cohen shaped a fractal metasurface around a copper cylinder and saw strong front scatter, as the surface wave wrapped round the cylinder, despite the obstruction caused by the copper cylinder itself. Strong front scatter is the heart of an 'invisibility cloak' as one can 'see' the other side of an obstruction, despite being blocked by it.

COHEN--FIGURE 2

A public demonstration re-creating the Dec 2003 discovery of 'invisibility cloak' front scatter. Scaled up for 'cloaking' part of a person, the copper sleeve obstructs the microwave intensity by more than 20 dB(left) Adding a single fractal metasurface on the copper sleeve causes an intense surface wave(s) that propagate to the opposite side, and restores the line of sight unobstructed intensity, over a 20+ percent bandwidth (right).

COHEN—FIGURE 3



A two-layer fractal metasurface has considerable bandwidth for the front scatter ('front') and considerable reduction of back scatter('back'). The copper sleeve itself is shown on the top graph acting as an obstruction, while addition of the two layered metasurface gives results shown at bottom graph. From the Jan 2015 MWJ article. Later invisibility cloaks were built with -20 to -30 dB RCS reduction and front scatter near parity compared to unobstructed, over > 5 :1 bandwidth.

COHEN—FIGURE 4

Still image from 2018 PRC TV show showing fractal metasurface being fabricated for retrofit of jet fighters for stealth, without the inventor's knowledge.

COHEN—FIGURE 5