Energy/Watts/BPS: Post to TCML by Bert Hickman

It depends on the desired energy per bang, and whether you're driving the system directly off AC or from a DC-resonant charging system. From a pure energy standpoint, the energy/bang (Ep) will be a function of the tank cap size (Cp), and the main spark gap breakdown voltage (Vg):

Ep = 0.5*Cp*(Vg^2) Joules (Watt-Seconds)

The power required to recharge the tank cap to Vg 800 times/second will be:

Wp = 800*Ep Watts

Plugging in Cp = 1.61e-7 Farad:

Wp = 6.44e-5*Vg^2

Vg	Wp (KW)	Bang Size (Joules)
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12,000	9.3	11.5
13,000	10.9	13.6
14,000	12.6	15.8
15,000	14.5	18.1
16,000	16.5	20.6
17,000	18.6	23.3
18,000	20.9	26.1

Now a break rate of 800 BPS means the gap must be fire about every 1.2 mSec. However, the allowable tank cap recharge time will be less than this, since recharging can only take place after the main gap quenches. If we assume the gap's "firing" time is about 100 uSec, the estimated recharge time must be 1.1 mSec or less.

Also, the time that the HV source voltage spends above |Vg| must represent a major portion of the incoming HV waveform. This means that that you will most likely need a higher voltage pig in order to achieve the desired bang size AND BPS rate. For the sake of argument, assume that we need to reach Vg in 1.1 mSec after the AC Mains zero crossing, and the absolute value of the pig's output voltage then stays above Vg until 1.1 mSec before the NEXT zero crossing. It can be shown that this implies that the pig's output RMS voltage must be as much as 1.75 times the desired main gap breakdown voltage(!). Another option might be to adjust the ballast inductance to resonate at 60 Hz with the "reflected" impedance of the tank cap. In either case, the tank cap must be very robust to withstand the severe over-volting effects of a main gap misfire.

Obtaining 800 BPS while using a large tank cap directly off the 60 Hz AC mains is not trivial!