Understanding patent claims
(e) Electrical power converter
The invention

An isolated power converter with a damping network to protect the main switch against high voltage peaks created at the blocking time.
How to patent this invention: claim it!

Patent Claim: "A flyback power converter which protects the switch."

Protection against peak voltages is a technical problem. Problems cannot be patented - only specific solutions. What is the technical feature that achieves the protection?

Patent Claim: "A flyback power converter with at least one capacitor in parallel with the primary winding."

You don’t want anyone circumventing the patent by using your primary damping arrangement with a different secondary circuit, for instance in a forward converter.

Patent Claim: "A switched mode power supply with at least one capacitor in parallel with the primary winding."

A prior art search will show whether the invention – as claimed – is actually new.
Result of the prior art search

The prior art search found DE 40 29 221, "Switched mode power supply", which discloses a similar invention.

"... said power supply having a series connection of a resistor and a capacitor in parallel with the primary winding ..."
### Comparison of the two inventions

<table>
<thead>
<tr>
<th>The invention as claimed</th>
<th>DE4029221</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A switched-mode power supply with at least one capacitor in parallel with the primary winding.&quot;</td>
<td>&quot;A switched mode power supply having a series connection of a resistor and a capacitor in parallel with the primary winding.&quot;</td>
</tr>
</tbody>
</table>

"... where the primary winding is subdivided into sub-windings with at least one tap, and that a capacitor is in each case connected in parallel with the two sub-windings."

- New
- Inventive step (the modification provides improved damping of high voltage peaks across the primary switch)
Claim to be filed:

"A switched-mode power supply with a storage capacitor, a transformer with a primary winding and a secondary winding, and with a switching transistor connected in series with the primary winding, characterised in that the primary winding is subdivided into sub-windings with at least one tap, that a capacitor is in each case connected in parallel with at least two sub-windings."
Use of dependent claims to improve protection

An independent (broader) claim helps prevent the patent from being circumvented.

Dependent (more specific) claims are tailored to fit exactly to potential infringing products.

Main claim

Specific claim A

Specific claim B
Claim 1:

"A switched-mode power supply ... with a subdivided primary with at least one tap, and a capacitor in each case in parallel with the two sub-windings."

Claim 2: "A device according to claim 1, characterised in that the capacitances and the numbers of windings are selected such that oscillations arising upon deactivation of the switch have different resonant frequencies."

Claim 3: "A device according to claim 1, characterised in that the capacitor which is connected to the switching transistor is smaller than the second capacitor."

The EPO will perform its own prior art search and then consider whether the invention AS CLAIMED is new and non-obvious.
Additional prior art found by the EPO

United States Patent [39]  
Igarashi et al.  
[45] Date of Patent:  May 9, 2000

"Soft switching power supply with reduced noise"

US6061253:  
"A switching power supply with an active snubber circuit comprising an auxiliary switch (Q2) to achieve zero-current and zero-voltage switching."
Opinion of the EPO

Applicant's claim:
"A switched-mode power supply with a storage capacitor, a transformer with a primary winding and a secondary winding, and with a switching transistor connected in series with the primary winding, characterised in that the primary winding is subdivided into sub-windings with at least one tap, that a capacitor is in each case connected in parallel with at least two sub-windings."

This is already shown in US6061253

EPO response:
Please amend your claims if you want your invention protected!
Further analysis

Did the EPO overlook any important features of the invention?

Applicant's reply:
Amendments to the patent application, explanation of the relationship between the invention and the prior art

How can the claims be amended to reflect the invention in such a way that it is new (considering all the prior art)?
## Comparison of the invention with the prior art

<table>
<thead>
<tr>
<th>Technical features of the invention</th>
<th>DE4029221</th>
<th>US6061253</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitor in parallel to primary</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Two sub-windings, two capacitors</td>
<td>No</td>
<td>✔️</td>
</tr>
<tr>
<td>Dimensioning to cancel oscillations</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Advantages/technical result**

<table>
<thead>
<tr>
<th></th>
<th>(passive damping)</th>
<th>(active damping)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damp each winding individually</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Effective damping/small capacitance</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Result of the analysis

Some of the individual elements of the invention are not known and do not seem obvious in light of the documents found, such that the combination of features is not known and it produces new, unique benefits.

Given knowledge of the prior art, it is not obvious to combine the elements to achieve these new effects → the inventive step requirement is fulfilled. The claim must be changed to distinguish it from US6061253:

"A switched-mode power supply with a storage capacitor, a transformer with a primary winding and a secondary winding, and with a switching transistor connected in series with the primary winding, where the primary winding is subdivided into sub-windings with at least one tap, that a capacitor is in each case connected in parallel with at least two sub-windings, characterised in that the capacitances and the numbers of windings are selected such that oscillations arising upon deactivation of the switch have different resonant frequencies and thereby at least partly cancel each other."
The original description filed with the EPO supports the amendments to the claims

For this purpose, it is known for a damping network, also referred to as a snubber network, to be provided, which at least partially suppresses these voltage peaks. A frequently used damping network of this type is, for example, known from DE4029221. A switched mode power supply according to the preamble of the claim 1 is disclosed in US6061253.

The objection of the invention is to indicate a damping network for a switched-mode power supply of the type mentioned at the beginning, which has only a few components and produces low losses in the switched-mode power supply.

The switched-mode power supply **according to the invention** … The primary winding is subdivided here into sub-windings with at least one tap, and, as the damping network, a capacitor is in each case disposed in parallel with a sub-winding. By means of this measure, the sub-windings of a primary winding are individually damped, and not the primary winding as such.

… the oscillations produced when the switching transistor is deactivated have different resonant frequencies and thereby at least partially cancel each other. This results in an effective damping of the deactivation voltage over the switching transistor.
The patent is finally granted

Response from EPO: granted!