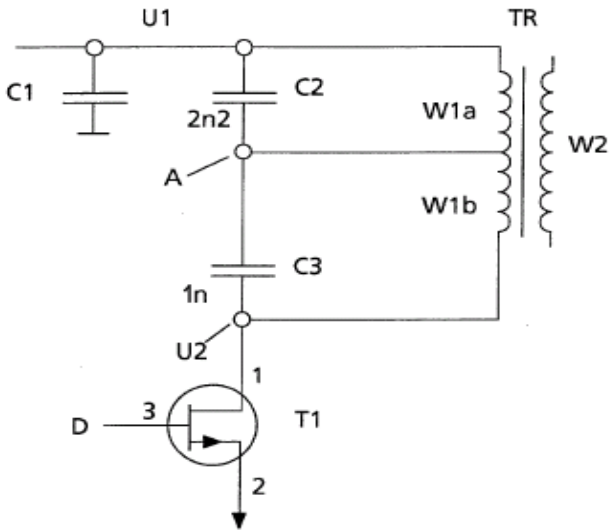
Understanding patent claims

(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."~~

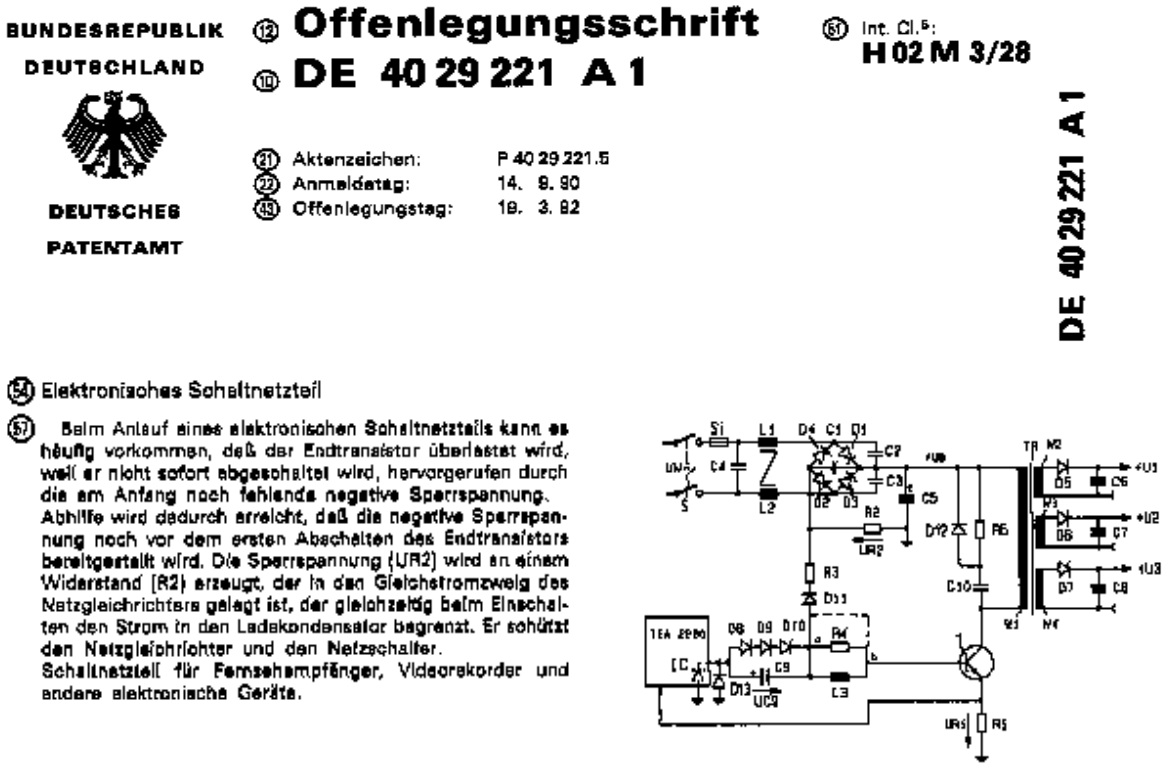
You don't want anyone circumventing the patent by using your primary damping arrangement with a different secondary circuit, for instance in a forward converter.

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.



BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(12) **Offenlegungsschrift**

(19) **DE 40 29 221 A 1**

(51) Int. Cl.5: H 02 M 3/28

(21) Aktenzeichen: P 40 29 221.5
(22) Anmeldetag: 14. 9. 90
(43) Offenlegungstag: 19. 3. 92

DE 40 29 221 A 1

(54) Elektronisches Schaltnetzteil

(57) Beim Anlauf eines elektronischen Schaltnetzteils kann es häufig vorkommen, daß der Endtransistor überlastet wird, weil er nicht sofort abgeschaltet wird, hervorgerufen durch die am Anfang noch fehlende negative Sperrspannung. Abhilfe wird dadurch erreicht, daß die negative Sperrspannung noch vor dem ersten Abschalten des Endtransistors bereitgestellt wird. Die Sperrspannung (UR2) wird an einem Widerstand (R2) erzeugt, der in den Gleichstromzweig des Netzgleichrichters gelegt ist, der gleichzeitig beim Einschalten den Strom in den Ladekondensator begrenzt. Er schützt den Netzgleichrichter und den Netzschalter.
Schaltnetzteil für Fernsehempfänger, Videorekorder und andere elektronische Geräte.

"… said power supply having a series connection of a resistor and a capacitor in parallel with the primary winding …"

Comparison of the two inventions

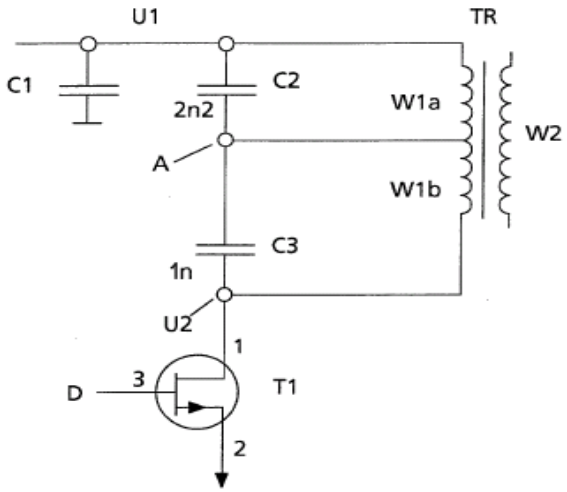
The invention as claimed	DE4029221
"A switched-mode power supply with at least one capacitor in parallel with the primary winding."	"A switched mode power supply having a series connection of a resistor and a capacitor in parallel with the primary winding."
"… where the primary winding is subdivided 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)

Not new

Claim to protect the invention

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.



Application filed with the EPO

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

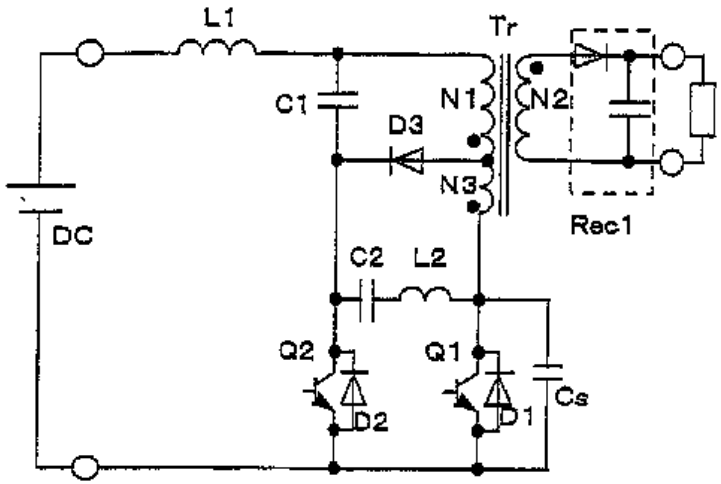
United States Patent [19]
Igarashi et al.

[11] **Patent Number: 6,061,253**
[45] **Date of Patent: May 9, 2000**

[54] **VARIABLE FREQUENCY SOFT SWITCHING POWER SUPPLY WITH REDUCED NOISE AND IMPROVED POWER FACTOR**

4,985,818 1/1991 Niederreiter 363/19

"Soft switching power supply with reduced noise"



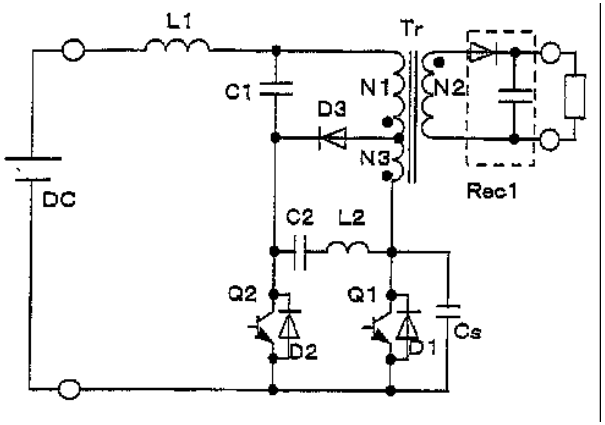
US6061253:
"A switching power supply with an active snubber circuit comprising an auxiliary switch (Q2) to achieve zero-current and zero-voltage switching."

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."

US6061253

C1 in parallel with N1,
C2 in parallel with N3



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

	DE4029221	US6061253
Technical features of the invention		
Capacitor in parallel to primary	✓	✓
Two sub-windings, two capacitors	No	✓
Dimensioning to cancel oscillations	No	No
Advantages/technical result	(passive damping)	(active damping)
Damp each winding individually	No	No
Effective damping/small capacitance	No	No

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.

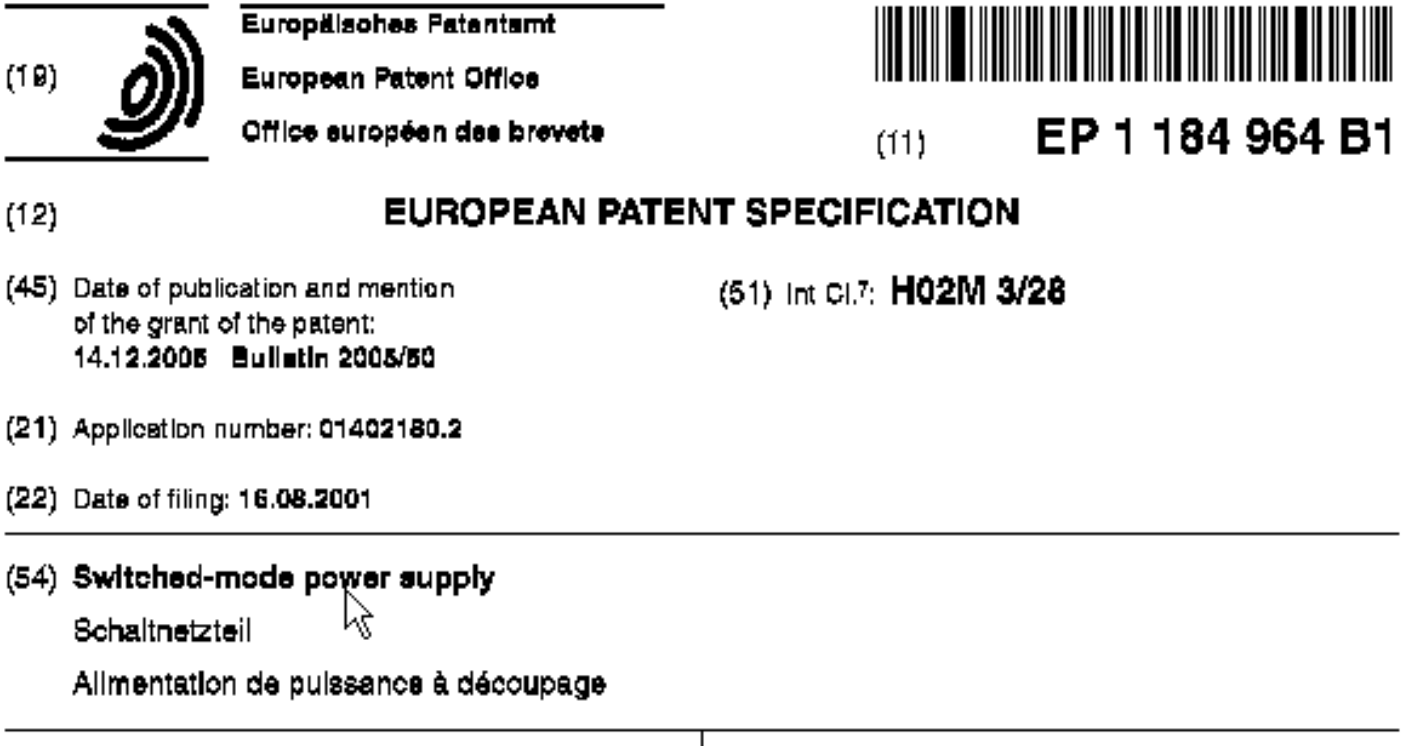
Supports inventive step: different technical result

Different to patent DE40…

Different to patent US60…

The patent is finally granted

Response from EPO: granted!



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 184 964 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
14.12.2005 Bulletin 2005/50

(51) Int Cl.[7]: H02M 3/28

(21) Application number: 01402180.2

(22) Date of filing: 16.08.2001

(54) Switched-mode power supply

Schaltnetzteil

Alimentation de puissance à découpage