

New DC-DC Converter

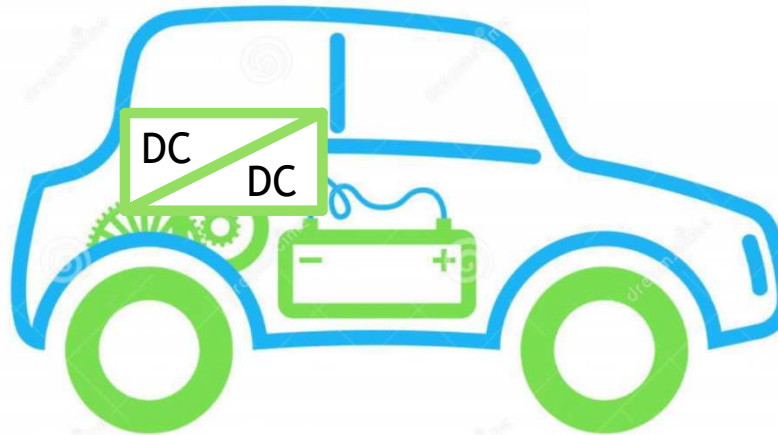
EP 2 448 099 Novel Topology

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Vít Kocur

Introduction of invention

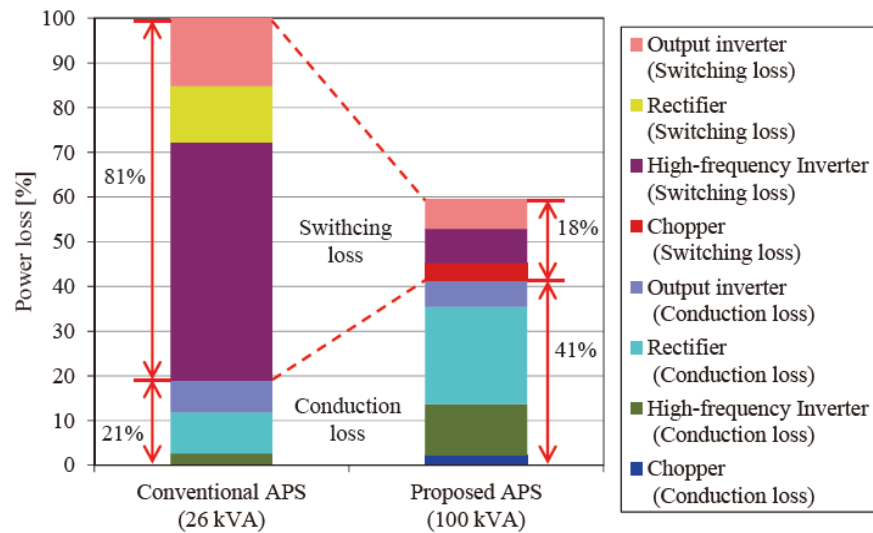
- ▶ Presented invention is today a **key component** in many electronic devices
- ▶ DC-DC converter converts DC voltage from one level to another and enables current control
- ▶ **Input** of such converter is **battery** e.g. of electric vehicle, **fuel- or solar- cells** and their combination
- ▶ Output is typically **DC-link** (e.g. for traction inverter in electric vehicle)



Business potential

- ▶ One of key-component of electronic device with **significant cost reduction**
- ▶ Spare potential in mass production in \$ milions
- ▶ Green solution due to **highest possible efficiency** and saved CO2
- ▶ **Market advantage** of complete end product

https://www.toyodenki.co.jp/technical-report/pdf/giho141/p17_23.pdf



Possible application

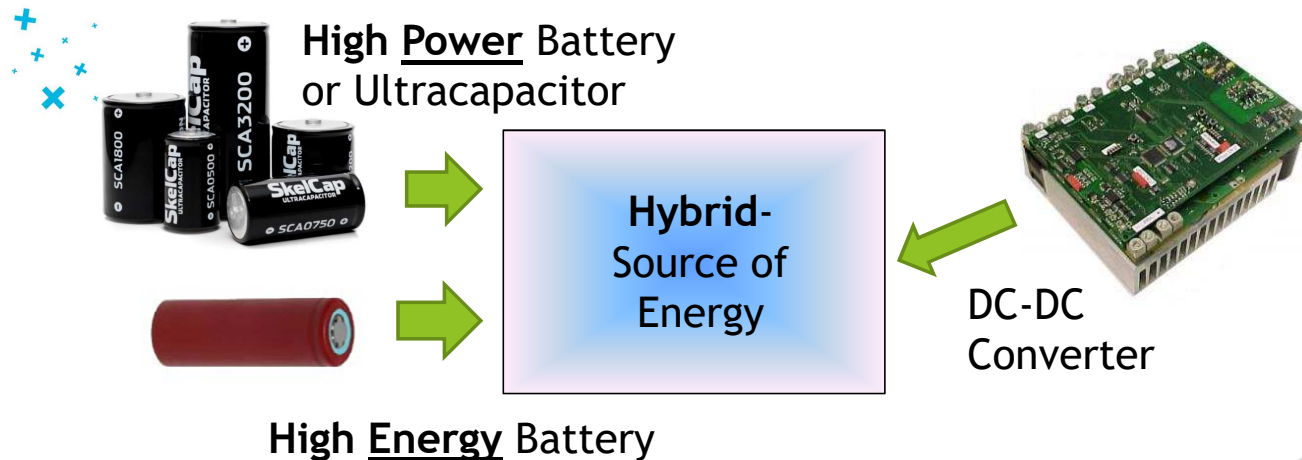
- ▶ **Railway industry** - part of power supply from catenary (see **Toyo Denki**)
- ▶ **Automotive** - converter for battery voltage boost for traction inverter (see **Honda**)
- ▶ **Consumer electronics** - mobile phone integrated **battery charger**, **LED light converter**
- ▶ **Renewables** - solar MPPT converter (see **SEW Eurodrive**)



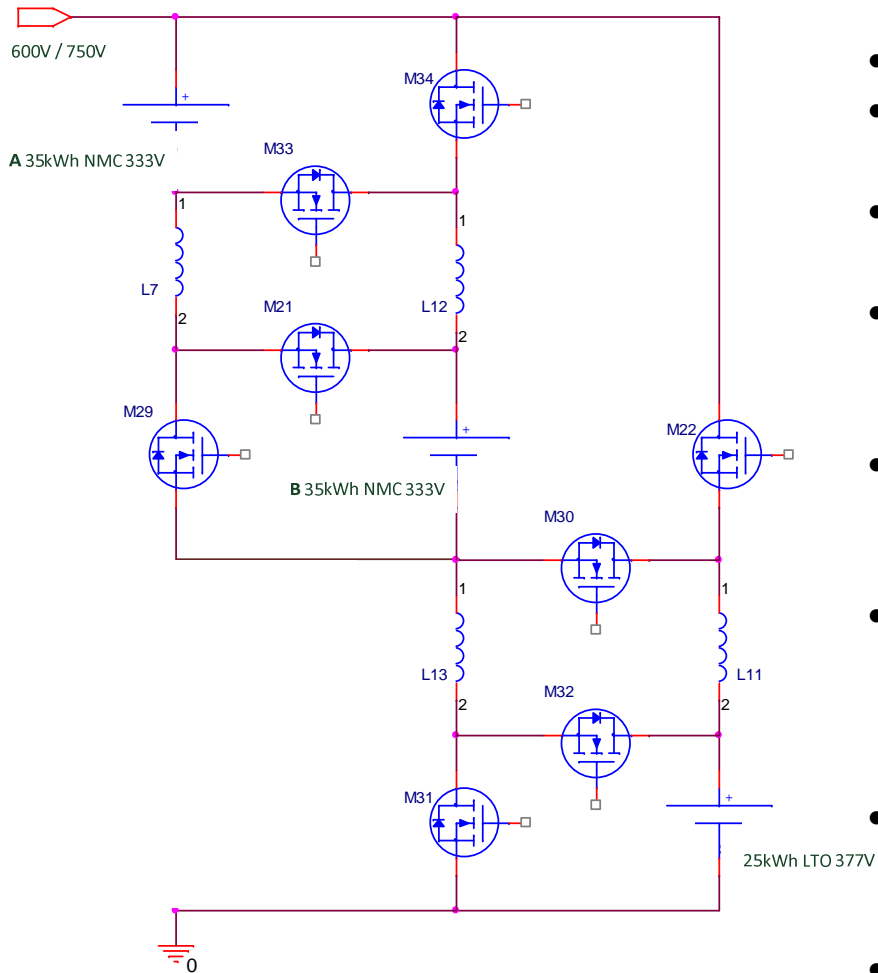
Converter characteristic

European Patent *EP 2 448 099* valid in *DE, F, GB, IE, CZ, SK* to *10/2030*

- ▶ Unrivalled efficiency and therefore lowest cost
- ▶ Power sources combination possibility - hybrid source of energy
- ▶ Bi-directional - it is possible to use stored energy or to store energy
- ▶ Suitable for voltages <1200V



Application example - hybrid energy storage system 95kWh



- Lowest U_{max} 817V
- Highest U_{min} 468V
- Max current e.g. 500A
- LTO primarily as supply for high power
- NMC primarily as energy storage
- Enables all directions of energy flow in each medium
- Instead of LTO Battery could be used **Fuel Cells**
- **Unrivalled efficiency**

References

from main part identical patents

Patent Kocur

Priority 28.10.2010

<https://worldwide.espacenet.com/patent/search/family/044114384/publication/EP2448099A1?q=ep2448099>

Valid in DE, FR, GB, IRL, CZ, SK

Patent SEW-Eurodrive

Priority 5.11.2010 (8 days later priority after patent of Kocur)

<https://register.epo.org/application?number=EP11008636&tab=main>

Patent Toyo Denki

Priority 2015

<https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015133118>

Toyo Denki technical papers

https://www.toyodenki.co.jp/technical-report/pdf/giho141/p17_23.pdf

<https://www.toyodenki.co.jp/technical-report/pdf/giho133/s133-13.pdf>

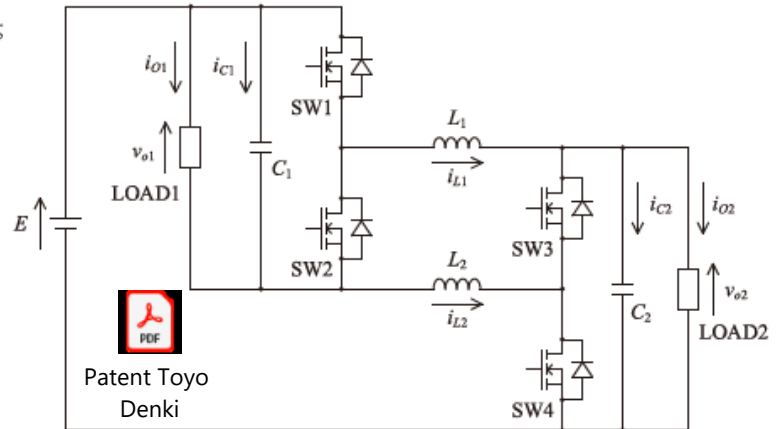
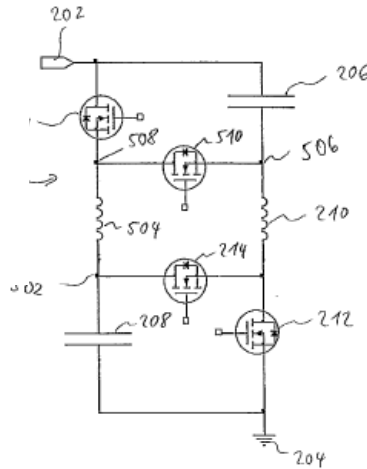
Patent Honda

Priority 2013

<https://patents.google.com/patent/US20140361617>



Patent Kocur



Patent Toyo Denki

Patent Toyo Denki

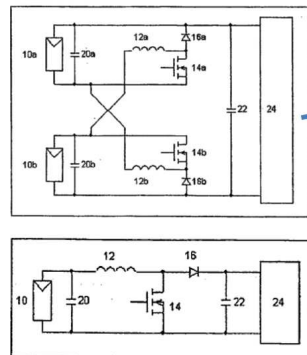
Priority 2015

<https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2015133118>

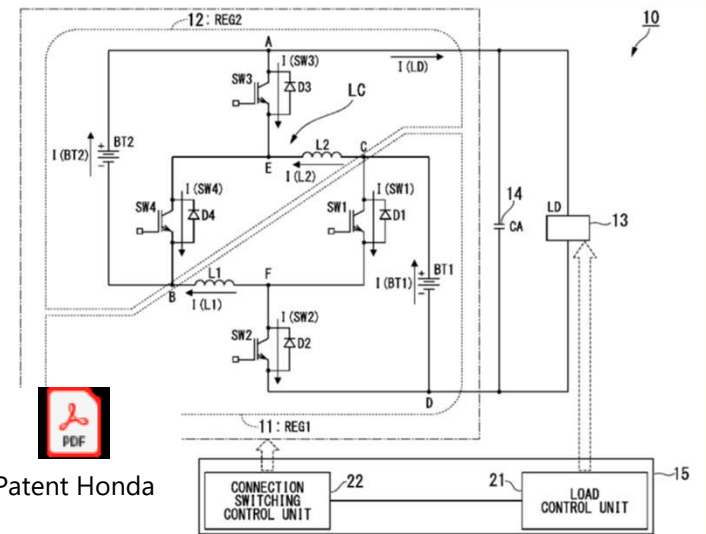
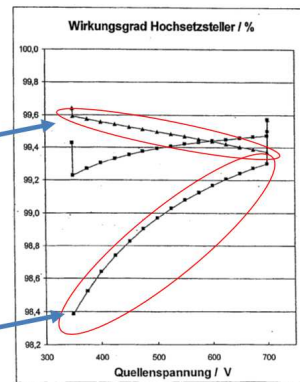
Toyo Denki technical papers

https://www.toyodenki.co.jp/technical-report/pdf/giho141/p17_23.pdf

<https://www.toyodenki.co.jp/technical-report/pdf/giho133/s133-13.pdf>



Patent SEW-Eurodrive



Patent Honda