H02M

APPARATUS FOR CONVERSION BETWEEN AC AND AC, BETWEEN AC AND DC, OR BETWEEN DC AND DC, AND FOR USE WITH MAINS OR SIMILAR POWER SUPPLY SYSTEMS; CONVERSION OF DC OR AC INPUT POWER INTO SURGE OUTPUT POWER; CONTROL OR REGULATION THEREOF (systems for regulating electric or magnetic variables in general, e.g. using transformers, reactors or choke coils, combination of such systems with static converters G05F; {digital function or clock generators} for digital computers G06F 1/00, {G06F 1/025, G06F 1/04}; transformers H01F; connection or control of one converter with regard to conjoint operation with a similar or other source of supply H02J; dynamo-electric converters H02K 47/00; controlling transformers, reactors or choke coils, control or regulation of electric motors, generators or dynamo-electric converters H02P; pulse generators H03K; {static converters specially adapted for igniting or operating discharge lamps H05B 41/28})

Definition statement

This place covers:

• Generic details relating to switch mode power (chopper-type) converters;
• Circuits performing DC to DC power conversion other than by linear regulation;
• Circuits performing AC to AC power conversion by direct conversion without a DC link;
• Circuits performing AC to AC power conversion by initial conversion of AC into DC, using a DC-link, and subsequent conversion from DC back to AC;
• Circuits performing AC to DC power conversion with actively switched or passively controlled rectification elements;
• Circuits performing DC to AC power conversion with static operation, i.e. without physical movement.
• Circuits performing power conversion with dynamic operation, i.e. involving physical movement.

Relationships with other classification places

This subclass covers only circuits or apparatus for the conversion of electric power, or arrangements for control or regulation of such circuits or apparatus. The electrotechnical elements employed are dealt within the appropriate subclasses, e.g. inductors, transformers H01F, capacitors, electrolytic rectifiers H01G, mercury rectifying or other discharge tubes H01J, semiconductor devices H01L, impedance networks or resonant circuit not primarily concerned with the transfer of electric power H03H.

Voltage and current regulation circuits operating according to the non-switched (linear) principle are classified in subclass G05F.

The subject matter of starting, regulating, electronically commutating, braking, or otherwise controlling electrical machines using power converters covered by this subclass is classified in subclass H02P.

Arrangements of power converters of this subclass in power distribution networks, not being concerned with the particular converter designs, are classified in subclass H02J.

Measuring of circuit parameters such as currents, voltages or magnetic flux in general and not particularly intended for power converters of this subclass, is classified in subclass G01R.

General mechanical arrangements of electronic components other than mechanical arrangements particularly intended for power converters of this subclass, are classified in subclass H05K.

Protection circuits in general, other than those forming an integral part of power converters of this subclass are classified in subclass H02H.
Enabling and disabling of power switches, other than particularly intended for power switches in power converters of this subclass, is classified in subclass H03K.

Use and generation of Pulse Width Modulation schemes, other than particularly intended for power converters of this subclass, are classified in subclass H03K.

General testing and monitoring of power converters of this subclass are classified in subclass G01R.

Power converters particularly adapted for charging batteries are classified in subclass H02J.

Uninterruptible Power Supplies are classified in subclass H02J.

Dynamically controlled power converters, that serve the purpose of signal amplification rather than energy supply as in this subclass, are classified in H03F.

Power supply circuits particularly intended for operating light sources are classified in subclass H05B.

Power supply circuits and arrangements particularly intended for computer type gear are classified in subclass G06F.

Power supply circuits and arrangements particularly intended for video type gear are classified in subclass H04N.

Switched capacitor power conversion circuits particularly intended for supply of semiconductor memory circuits are classified in subclass G11C.

Generation of pulsed high-voltages used to generate sparks is classified in H01T/F23Q/F02P.

Power converters being used in a particular application and characterised by their operation in that application, without focus on the design of power converter, are classified in the subclass relevant for the application.

References

Limiting references

This place does not cover:

| Linear voltage or current regulation | G05F 1/00 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Testing power supplies | G01R 31/40, G01R 31/42 |
| Emergency protective circuit arrangements...for static converters or rectifiers | H02H 7/12 |
| Electronic switching or gating | H03K 17/00 |
| Generation or supply of power specially adapted for television receivers | H04N 5/63 |

Special rules of classification

Switch Mode Power Converters are generally made up of generic, functional elements. Such generic elements are rectifiers (AC-DC-conversion), inverters (DC-AC-conversion), transformers (AC-AC-conversion), filters, regulation loops, resonance-circuits, drivers, snubbers etc. Of these generic elements only few may appear at first glance to be novel over the prior art and it serves no purpose repeatedly to classify all elements. Only those elements that appear novel should form basis for the classification.
The following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups:

- **H02M9/00** covered by H03K 3/53
- **H02M9/02** covered by H03K 3/53
- **H02M9/04** covered by H03K 3/53
- **H02M9/06** covered by H03K 3/53

**Glossary of terms**

*In this place, the following terms or expressions are used with the meaning indicated:*

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMPS</td>
<td>Switch Mode Power Supply. A general designation for the type of power converters where power is converted in small quantities at a very rapid pace. The energy entering into the conversion circuit or out of the conversion circuit is controlled by power switches. In an SMPS the power switches are typically operated either to be fully conducting or fully non-conducting, opposite to linear voltage regulators where the power switch is used as partly conductive.</td>
</tr>
<tr>
<td>Chopper</td>
<td>Chopper is another name for a switch mode circuit. Chopper refers to that the signal (energy flow) is cut-up into small amounts.</td>
</tr>
<tr>
<td>&quot;Conversion&quot;, in respect of an electric variable, e.g. voltage or current</td>
<td>change of one or more of the parameters of the variable, e.g. amplitude, frequency, phase, polarity</td>
</tr>
<tr>
<td>PFC</td>
<td>Power Factor Correction. PFC relates to AC power input. Power Factor Correction is the discipline of rendering the input current sine-wave-shaped, with little harmonics and in phase with the AC input voltage. The aim is to make the AC input power load appear purely resistive for efficient use of the AC distribution network.</td>
</tr>
<tr>
<td>Snubber</td>
<td>A circuit aiming at absorbing or redirecting inductive energy generated during switched power conversion when a power switch is turned off (rendered non-conductive).</td>
</tr>
</tbody>
</table>

**H02M 1/00**

**Details of apparatus for conversion**

**Definition statement**

*This place covers:*

- Details of power converters that are generic for different types of power converters.
- Power switch driving circuits particularly intended for switch mode power converters.
- Adaptation of power converters for operation from different kind of input sources.
- Means for reducing ripple or harmonics on inputs or outputs.
- Contact mechanisms of dynamic converters.
- Means for protecting power converters.
- Means for starting and stopping power converters.
- Means for preventing simultaneous conduction of switches.
- Means for preventing magnetic saturation.
- Circuits or arrangements for Power Factor Correction.
- Circuits or arrangements for compensating for electromagnetic interference.
References

Limiting references

This place does not cover:

- Protection circuits in general, other than those forming an integral part of power converters

| Protection circuits in general | H02H 7/10, H02H 7/12 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

- Protection circuits in general
  - H02H
- Electronic switching or gating
  - H03K 17/00

H02M 1/096

The power supply of the control circuit being connected in parallel to the main switching element (H02M 1/092 takes precedence)

References

Limiting references

This place does not cover:

- Control signals being transmitted optically

| Control signals being transmitted optically | H02M 1/092 |

H02M 1/32

Means for protecting converters other than automatic disconnection (emergency protective circuit arrangements specially adapted for converters with automatic disconnection H02H 7/10)

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

- Emergency protective circuit arrangements specially adapted for converters with automatic disconnection
  - H02H 7/10

H02M 3/00

Conversion of dc power input into dc power output {(converters specially adapted for use in combination with a battery H02J 7/0065)}

Definition statement

This place covers:

- Conversion of DC power input into DC power output without conversion into AC.
- Conversion of DC power input into DC power output with conversion into AC.
- Conversion of DC power input into DC power output using dynamic converters.
### References

#### Limiting references

This place does not cover:

| Converters specially adapted to charge batteries | H02J 7/0065 |
| Electric motor control with feedback of internal parameters of the motor | H02P |

#### Informative references

Attention is drawn to the following places, which may be of interest for search:

| Protection circuits in general | H02H |
| Electronic switching or gating | H03K 17/00 |
| Generation or supply of power specially adapted for television receivers | H04N 5/63 |

### H02M 3/07

using capacitors charged and discharged alternately by semiconductor devices with control electrode{}, e.g. charge pumps (for substrate bias voltage generators G05F 3/205; for static stores G11C 5/145, G11C 16/06; charge pumping structures for internal polarisation H01L 27/0222)

#### References

##### Informative references

Attention is drawn to the following places, which may be of interest for search:

| Charge pumps for substrate bias voltage generators | G05F 3/205 |
| Charge pumps for static stores | G11C 5/145, G11C 16/06 |
| Charge pumping structures for internal polarisation | H01L 27/0222 |

### H02M 3/10

using discharge tubes with control electrode or semiconductor devices with control electrode (H02M 3/07 takes precedence)

#### References

##### Limiting references

This place does not cover:

| Capacitors charged and discharged alternately by semiconductor devices with control electrode | H02M 3/07 |
**H02M 3/337**

in push-pull configuration {(**H02M 3/33576** takes precedence; with self-oscillating arrangements **H02M 3/3382** and **H02M 3/3385**)}

**References**

*Limiting references*

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiconductor devices having at least one active switching element at the secondary side of an isolation transformer</td>
<td>H02M 3/33576</td>
</tr>
<tr>
<td>With self-oscillating arrangements</td>
<td>H02M 3/3382, H02M 3/3385</td>
</tr>
</tbody>
</table>

**H02M 3/338**

in a self-oscillating arrangement (**H02M 3/337** takes precedence)

**References**

*Limiting references*

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semiconductor devices in push-pull configuration</td>
<td>H02M 3/337</td>
</tr>
</tbody>
</table>

**H02M 3/42**

with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general **H01H 51/34**)  

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-interrupters in general</td>
<td>H01H 51/34</td>
</tr>
</tbody>
</table>

**H02M 5/00**

Conversion of ac power input into ac power output, e.g. for change of voltage, for change of frequency, for change of number of phases

**Definition statement**

This place covers:

- Direct conversion of AC input power into different AC output power, e.g. by change of voltage, frequency or number of phases, without intermediate conversion into DC.
- Conversion of AC input power into AC output power with intermediate conversion onto DC (DC-link).
- Conversion of AC input power into AC output power using dynamic conversion means.
## References

### Limiting references

**This place does not cover:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninterruptible power supplies</td>
<td>H02J 9/00</td>
</tr>
<tr>
<td>Electric motor control with feedback of internal parameters of the motor</td>
<td>H02P</td>
</tr>
</tbody>
</table>

### Informative references

**Attention is drawn to the following places, which may be of interest for search:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection circuits in general</td>
<td>H02H</td>
</tr>
<tr>
<td>Electronic switching or gating</td>
<td>H03K 17/00</td>
</tr>
</tbody>
</table>

## H02M 5/04

by static converters (controlling transformers, reactors or choke coils, e.g. by tap changing [H02P 13/00](#))

### References

#### Informative references

**Attention is drawn to the following places, which may be of interest for search:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling transformers, reactors or choke coils, e.g. by tap changing</td>
<td>H02P 13/00</td>
</tr>
</tbody>
</table>

## H02M 5/25

using devices of a thyatron or thyristor type requiring extinguishing means ([(H02M 5/225), H02M 5/27](#) take precedence)

### References

#### Limiting references

**This place does not cover:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two stages of AC-AC conversion, e.g. having a high frequency intermediate link</td>
<td>H02M 5/225</td>
</tr>
<tr>
<td>Conversion of frequency</td>
<td>H02M 5/27</td>
</tr>
</tbody>
</table>

## H02M 5/275

using devices of a triode or transistor type requiring continuous application of a control signal ([(H02M 5/225), H02M 5/297](#) take precedence)

### References

#### Limiting references

**This place does not cover:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two stages of AC-AC conversion, e.g. having a high frequency intermediate link</td>
<td>H02M 5/225</td>
</tr>
</tbody>
</table>
Conversion of frequency

H02M 7/00
Conversion of ac power input into dc power output; Conversion of dc power input into ac power output

Definition statement
This place covers:
• Constructional details of power converters.
• Conversion of AC power input into DC power output without reversal.
• Conversion of DC power input into AC power output without reversal.
• Conversion of AC power input into DC power output or DC power input into AC power output with possibility of reversal.
• Conversion of AC power input into DC power output or DC power input into AC power output using dynamic converter means.

References
Limiting references
This place does not cover:

| Electric motor control with feedback of internal parameters of the motor | H02P |
| Switched power amplifiers (class D) | H03F |

Informative references
Attention is drawn to the following places, which may be of interest for search:

| Semiconductor device modules | H01L |

H02M 7/23
arranged for operation in parallel {((H02M 7/2176 takes precedence))

References
Limiting references
This place does not cover:

| Semiconductor devices comprising a passive stage to generate a rectified sinusoidal voltage and a controlled switching element in series between such stage and the output | H02M 7/2176 |
H02M 7/36
with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Self-interrupters in general | H01H 51/34 |

H02M 7/505
using devices of a thyatron or thyristor type requiring extinguishing means ((H02M 7/4807, H02M 7/483, H02M 7/493 and H02M 7/4826 take precedence))

References
Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>High frequency intermediate AC stage</th>
<th>H02M 7/4807</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge tubes with control electrode or semiconductor devices with control electrode operating from a resonant DC source, i.e. the DC input voltage varies periodically, e.g. resonant DC-link inverters</td>
<td>H02M 7/4826</td>
</tr>
</tbody>
</table>

H02M 7/519
in a push-pull configuration (H02M 7/517 takes precedence)

References
Limiting references
This place does not cover:

| Special starting equipment | H02M 7/517 |

H02M 7/53
using devices of a triode or transistor type requiring continuous application of a control signal ((H02M 7/4807, H02M 7/493 and H02M 7/4826 take precedence))

References
Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>High frequency intermediate AC stage</th>
<th>H02M 7/4807</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge tubes with control electrode or semiconductor devices with control electrode operating from a resonant DC source, i.e. the DC input voltage varies periodically, e.g. resonant DC-link inverters</td>
<td>H02M 7/4826</td>
</tr>
</tbody>
</table>
H02M 7/5383
in a self-oscillating arrangement (H02M 7/538 takes precedence)

References
Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>CPC Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a push-pull configuration</td>
<td>H02M 7/538</td>
</tr>
</tbody>
</table>

H02M 7/539
with automatic control of output wave form or frequency
(H02M 7/5375 - H02M 7/5387 take precedence)

References
Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>CPC Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special starting equipment</td>
<td>H02M 7/5375</td>
</tr>
<tr>
<td>Push-pull configuration</td>
<td>H02M 7/538</td>
</tr>
<tr>
<td>Self-oscillating arrangement</td>
<td>H02M 7/5383</td>
</tr>
<tr>
<td>Bridge configuration</td>
<td>H02M 7/5387</td>
</tr>
</tbody>
</table>

H02M 7/62
with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Self-interrupters in general</th>
<th>CPC Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H01H 51/34</td>
</tr>
</tbody>
</table>

H02M 7/75
using devices of a thyatron or thyristor type requiring extinguishing means
(H02M 7/77 takes precedence)

References
Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>Devices of a thyatron or thyristor type arranged for operation in parallel</th>
<th>CPC Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H02M 7/77</td>
</tr>
</tbody>
</table>
H02M 7/79
using devices of a triode or transistor type requiring continuous application of a control signal (H02M 7/81 takes precedence)

References
Limiting references
This place does not cover:

| Devices of a triode or transistor type arranged for operation in parallel | H02M 7/81 |

H02M 7/95
with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Self-interrupters in general | H01H 51/34 |

H02M 11/00
Power conversion systems not covered by the preceding groups

Definition statement
This place covers:
• Switch mode power converters not falling under any of the groups described previously.
• Power converters with pulsed power output.
• Power converters including piezo-electric elements performing power conversion.

References
Limiting references
This place does not cover:

| Generation of pulsed high-voltages used to generate sparks | H01T 15/00, F23Q, F02P/00 |

Informative references
Attention is drawn to the following places, which may be of interest for search:

| Piezo-electric devices | H01L 41/00 |