A SEMIBRIDGETHYRISTOR INVERTER FOR A WIDE RANGE OF LOADINGS

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The new scheme of a semibridgethyristor inverter operating in a wide range of voltages is presented.

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Nowadays semibridge inverters a widely applied in various secondary power supplies ranging from 3 up to hundreds kw, for example in electrowelding devices for arc welding, plasmotrones and other devices requiring stabilization of capacity in loading.

To provide a steady operation at small loadings an additional switching choke is included into an inverter circuit.

The lacks of this circuits are parameters of a switching choke and a limited range of loadings of which the inverter is efficient. To minimize them two switching capacitors with free outputs connected with the direct current diagonal of inverter 1 are included into the circuit. It has allowed to make a switching choke saturate quickly and operate only at switching currents. As a result the volume of employed materials (copper, iron) and the choke parameters as a whole have been reduced sharply and the working capacity of a semibridgethyristor inverter has been provided in all the loadings range (from the idle mode up to maximal loads).

The operation of a semibridgethyristor inverter is illustrated by Fig. 1, where the scheme of a modernized inverter is presented and by Fig. 2 (the voltage diagrams).

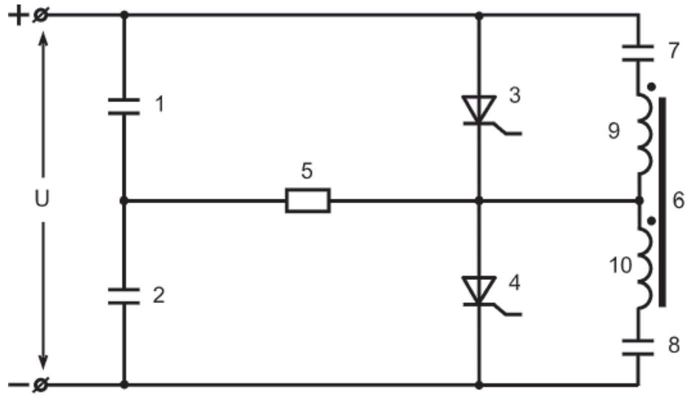

Fig. 1. The scheme of a modernized inverter

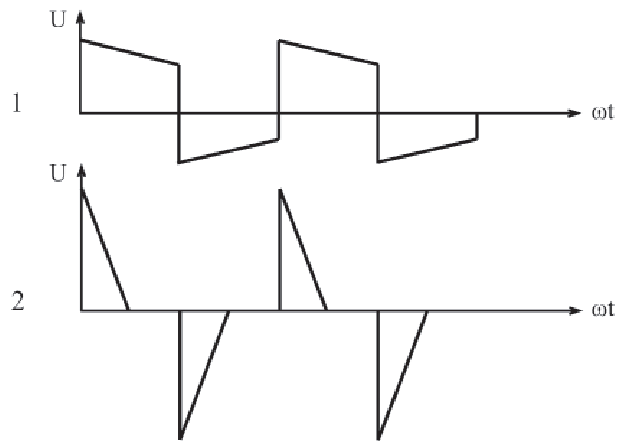

Fig. 2. The voltage diagram

The inverter functions as follows . When the supply voltage is on switching capacitors 7, 8 are charged (each up to half of supply voltage U). Let the unlocking impulse from a typical control system arrives at thyristor 3. Thyristor 3 is unlocked and capacitor 1 charges into loading 5 and a simultaneous discharge of switching capacitor 7 via unlocked thyristor 3 and semiwinding 9 of switching choke 6. Capacities of switching capacitors 7 and 8 are chosen according to the locking time of thyristors 3 and 4. These capacities are less than capacities of capacitors 1 and 2, therefore the discharge occurs quickly. After the discharge of switching capacitor 7 switching capacitor 8 is charged up to the charge U of the power supply. If the loading current is small, capacitor 1 discharges slowly (Fig. 2, diagram 1) and the voltage at thyristor 4 has no time to decrease up to zero before the next impulse. When thyristor 4 is unlocked the discharge of switching capacitor 8 occurs via half winding 10 of switching choke 6 and thyristor 4 and in the process the voltage equals to the halfwinding 10 voltage (U) is induced in halfwinding 9 of switching choke 6. This voltage has the sign of plus at the thyristor 3 cathode and thyristor 3 is locked. Then the process of switching repeats. When the loading current is increased up to a certain value, which, depending on the inverter parameters makes usually (0,4-0,5) of the rated loading current capacitors 1 or 2 have time 2 to discharge completely during a half cycle of the inverter voltage (Fig. 2, diagram 2) and the current via thyristor 3, 4 falls down up to zero in a natural way. Switching elements (switching choke 6 and switching capacitors 7, 8) do not influence the switching process in this mode.

As halfwindings 9 and 10 in switching choke 6 pass only short-term current impulses, dimensions of switching choke 6 are ensignificant in comparison with the dimensions of the analogues known.

The positive beature of the scheme is that compulsory switching is necessary only at small loadings and it reduces the locking time of thyristor 3, 4 and the dimensions of the switching unit considerably.

A semibridgethyristor inverter can be used in a wide power range especially if the power supply is a three-phase rectifier.

References

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