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Increasing slot fill more than 20%
Nittoku Engineering developed new method of winding

Nittoku Engineering Co., Ltd (Nobushige Kondo, president), developed new method of winding magnetic pole of inner stator. With this new method of winding (patent applied) the slot fill increases more than 20% comparing to a nozzle or hook winding. "We do expect that the winding machine with this new method of winding will be the mainstream of solid stator "said Nobushige Kondo, the president of Nittoku Engineering.

Nowadays, when dealing with problems concerning the environment and material high-cost become a major issue for the global economy, one of the significant points is a matter of motor efficiency in electronic devices, automotive electric-components and etc. Putting it into practice "All depends on the efficiency (perfect-layering) of wire winding", the technical development department said.

The figure shows the new winding method comparing with the conventional nozzle/hook winding and perfect-layering winding of segmented core. Until now, a nozzle was inserted into a slot between magnetic poles and when there was no more space for the nozzle; a wire was hanged on a hook and inserted into the slot. However, there were still problems. Particularly, the slot fill does not improve in the parts which nozzle could not reach as well as the efficiency and wire utilization was poorly performed.

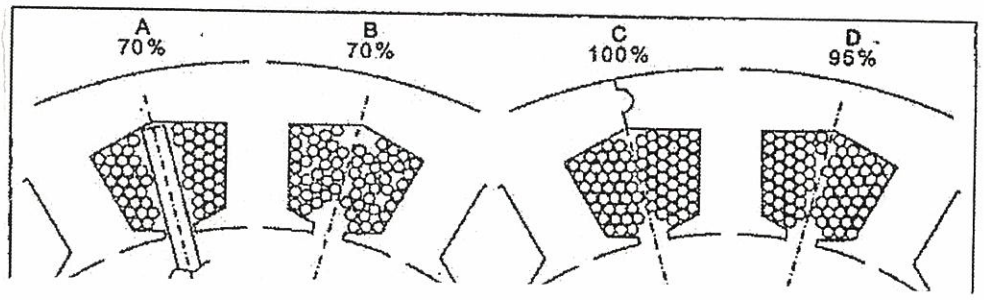
In case of a segmented core winding, where every single pole is wound separately and then integrated together, the slot fill itself is high. However, because some further processes for accurate integration of core, fixation and wire connection are necessary, which requires additional equipments, the cost performance is very high.

The new winding method was realized through "accumulation of winding technology expertise and conversion of the way of thinking" said the president Nobushige Kondo. The wire which should be wound to the parts where nozzle could not get is fixed and nipped by moving guide. This new method becomes possible, since a nozzle is controlled from the outside of a slot and then the wire is wound to a magnetic pole.

As a result of this, when the slot fill of segmented core winding method is considered as 100, the winding efficiency of new winding method increases more than 20% comparing to nozzle or hook winding. This means that, almost the same efficiency like for segmented core winding method can be reached. The new winding method in comparison with the segmented core winding method is low in cost because the number of wire connections is minimized. Another substantial advantage is the fact that the cost of processes and equipments for core integration and wire connection can be reduced.

Nittoku Engineering makes a further contribution to downsizing and high-efficiency of hybrid motors for automotive industry as well as motors for various electronic devices and electrical tools. Winding machines equipped with this new winding method are supposed to become the mainstream in the near future. For this reason, the company wants to actively focus not only on motor makers but also the home electronics makers, automotive electric-component makers, automobile makers, power generator maker and etc.

Conventional Winding (L) and Newly Developed Winding method (R)



Perfect-layering Winding by nozzle (solid core)	Hook Winding (solid core)	Segmented Core Perfect layering	**New Winding (Solid core)**
*Higher slot fill is not expected due to a space for the nozzle.	*No perfect layering because of limited wire control.	*High slot fill	***High slot fill**