

Discrete Power Converter (or Kornich machine) as Innovative Prime Mover for Alternative Energy

Dear Friends and Colleagues!

As you know during thousands of years the rotating waterwheel was used by humans for converting the energy of moving water into mechanical energy of rotational motion. Waterwheel has become dominant gravity powered prime mover because of its perfect compatibility with fundamental rotating mechanical loads as millstone and electrical generator. The combination of moving water as working medium in the gravity field and waterwheel as prime mover created the paradigm of classical hydro power discipline. Nevertheless, in the contemporary developments we may find the examples of alternative approach to a prevailing framework (paradigm). There are at least two main reasons exist. First, not only water can be used as working medium in the gravity field. In the modern industries we can see a lot of multi-tones technological process with massive flows of alternative working medium, such as brine, slurry, gravel, etc. Potentially, they can be considered as energy carriers for extracting or saving of energy. However, the traditional rotating waterwheel does not appropriate prime mover for this case. It is important to note tha talented American engineer, scientist and educator in Daniel W. Mead even in faraway 1915 wrote in his fundamental book [Water Power Engineering]:

“... Mechanically, energy is exertion of force through space. As result this impressed force produces the motion of working medium in the space. If some mechanism being in contact (collides) with working medium is getting its own motion and is becoming the prime mover. In this way the transformation of energy can be performed up to various useful mechanical loads. Obviously, in hydro power we are dealing with gravity force and water as working medium, however other flowing masses (as sand, gravel, slurry and grain, etc.) may be considered as working medium forced by gravity to input of new original prime movers. ...”.

Thus, we can see clearly the second reason for paradigm shift for the alternative energy – this is development and design of non-traditional prime movers which could be powered by gravity in non-rotational mode and in combination with also non-traditional working medium. This looks like a prevision of fundamental change in this framework. Finally, this new original prime mover was invented (and protected like IP product) as Discrete Power Converter – DPC (or Kornich machine) by Canadian Engineer – Inventor Alexander Kornich). Thus, the implementation of DPC (as original machine - compound levers with cross-linked mechanical feedbacks) in the process of converting of energy (in hydropower particularly) can be considered as paradigm shift because of transition from traditional, continuous principle of operating and construction to another – self oscillation mode. DPC represents the fundamental changes in the basic concept and experimental practice of prime mover powered by gravity as follows:

1. The operation of power converter in the regime of mechanical relaxation

oscillator (unlike continuous rotating of waterwheel) under acting of gravity as input force for mechanism.

Mechanically the relaxation oscillator generates a periodical sequence of short pulses (kinetic strokes) during which the useful work can be performed, and some part of energy will be dissipated as losses (in the form of heat as usual). Between pulses the mechanism is motionless, and the losses do not exist (just potential energy is accumulated).

Because of fact that relaxation time is longer than short pulse the average losses are reduced in compare to continuous presence of losses in the continuous operating mode (like waterwheel).

By analogy this principle does work very well in switch mode power supply (SMPS in electronics) and human heart (as discrete pump of blood).

We can recognize here another paradigm regarding to relaxation oscillator as power converter associated with different areas of science - mechanics, electronics and biology.

2. Capability to provide simultaneously two kinds of mechanical motions in the orthogonal planes: reciprocate in vertical plane (as rocking levers), and reversible rotation (as main shaft) in horizontal plane.

This feature allows to extend broadly the functionality of machine because of different useful mechanical loads can be connected at the same time. For example, two piston pumps can be attached to left and right shoulders of rocking lever and some shaker (sieve) can be attached to main shaft. Thus, a lot of mechanical works can be done without electrical energy in simple way.

3. Possibility of using different flowing working medium (not only water) powered by gravity for generating of mechanical energy.

This is most valuable and useful feature for application of DPC in Renewable Energy. A lot of different free flowing working medium (both, natural and industrial origin) can be used for generating of mechanical energy (as "built-in" subsystems) in various branches of industry. It may be sand, gravel, ore, slurry, brine, saw dust, granulated materials and powders in industry and grain, seeds, nuts, tubers, husk, peelings in agriculture, etc. This possibility is important for modern demand to save energy by "green technologies".

4. Symmetrical clear and simple structure which allows to manufacture of machine easy and apply the mechanical loads in symmetrical manner.

DPC can be built easy from simple materials (even wood) in regular workshop, by local manpower. No special needs to bearing of the main shaft is required because of discrete regime of operation is provided. The group of DPC can be integrated

in some local mechanical power system by cascade connection in series to the same flow of working medium.

5. Usage cross-type mechanical feedback for realization of self-oscillating mechanism of symmetrical type.

The combination of two rocking levers (one as "feeder" with working medium, another as main rocking beam) which linked by mechanical feedback in "compound lever" allows to realize the self-oscillating mode of mechanism.

This is first in the world symmetrical self-oscillating machine as adequate mechanical model of well-known electronic device – *astable multi-vibrator* (AMV). This is clear evidence of similarity of acting of cross-type feedback for realization of mode of relaxation oscillator in different symmetric structures - electronics and mechanics. Therefore, the concept can be used for development and design of innovative mechanisms and machines.

6. Capability to split input flow of working medium into two output equal parts.

This feature of DPC is not involved in power conversion but may be also considered as useful side effect. The principle of operation of machine allows to split the input flow of working medium on two equal output flows. Thus, DPC capable not only to generate the mechanical energy but also to divert symmetrically the input flow at the same time. So that power converter/hopper (loader) might be designed as compound machine.

7. Possibility to generate the sequence of equal periods of time.

Again, this feature of DPC is not involved in power conversion but is associated with possibility of self-oscillator to generate the sequence of time periods, as mechanical timer. This periodical action can be used for some signaling or for timing some technological operations, etc.

DPC project is being now in "seed stage" and corresponds to TRL6 (Technology Readiness Level by US DOE gradation - testing of small scale prototype). Implementation of DPC concepts in practice may produce the effects and potential impacts on the environment and society particularly for less developed countries.

On the base of pp 2, 3, 4, 6 many new simple mechanisms and machines can be designed (as water powered piston pumps, desalination of lever's type, other mechanical drivers) for irrigation, agriculture, food processing under specific local conditions with lack of developed industrial and human resources. It could to reduce hard work for poor men and women in small households by getting the alternative sources of mechanical energy on cooperative base. Thanking to simplicity the manufacturing and maintenance of these machines can be organized also under local conditions which create additional employment and boost local economy.

Thus, development of DPC technology may be considered as Responsible Research and Innovation by main definitions.

More technical details about DPC may be found on web site: <http://dpc-renewable-energy.com/>

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Thank you for your attention,

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