

DISCRETE POWER CONVERTER

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1. Statement of the Problem

In accordance with the classification of simple machines wheel are classified into one of six basic simple mechanisms, but some researchers consider the wheel like some modification of the lever [1]; more precisely, a symmetrical system of rotating levers (as arm-blades) with a common momentary fulcrum (as an axis of rotation of the wheel), relatively which each moment of time acts of mechanical angular momentum.

If the concept of rotating the lever to replace the concept of the rocking lever, you can imagine the kinematic scheme of the new power converter, which is powered by the force of gravity and, unlike a water wheel, implement other kinds of mechanical motion. Thus, we can significantly expand the possibilities of using gravity as the primary driving force of simple mechanisms and remove some of the limitations of the water wheel.

The proposed converter eliminates the following restrictions inherent in the known gravity prime mover, such as the water wheel:

1.1 It is widely known that the water wheel simply and effectively interfaces only with useful mechanical loads of rotational nature (mill stones, electric power generators, etc.). To operate with other loads, e.g. reciprocating (piston pumps, presses, stamps), requires additional intermediate converters (for example, crank-connecting rod mechanism); that reduces overall energy conversion efficiency due to additional losses, and also makes it more complicated and increases the cost of entire converter. From here we can see the attractiveness and need simple mechanisms powered by gravity and to realize the other kinds of mechanical motions, e.g. reciprocating or oscillating.

1.2. When the energy is converted in the water runner (or hydro turbine), it is essentially impossible to obtain a mechanical force more than that exerted on the working blade by the moving water. This force can be increased only by lifting the level from which the water flows relatively to the water wheel itself. However, this way entails great expense, for example the construction of higher dams.

“The main difficulty of water wheels is their dependence on flowing water, which limits where they can be located. Modern hydroelectric dams can be viewed as the descendants of the water wheel as they too take advantage of the movement of water downhill.” [2]

At the same time, it is desirable to increase the mechanical advantage (multiplication of force by lever law) by increasing the length of the lever, but avoiding increasing the excess height of source of moving water over the transducer, as is the case with full circulation of the water wheel.

1.3. In the case of the water wheel (or hydro turbine) only water can be used as the mass which is moving by gravity force; other fluids or free-flowing industrial nature masses (such as pulp, grain, gravel, free-flowing or granulated materials *etc.*) cannot be applied to the water wheel.

Proposed Solution

I have found that this problem could be resolved by inventing a new type of the power converter, which is based on an innovatory idea and has a new design. The principle of operation of the new converter is different from previously known (for example, water wheel) so that continuous operation is replaced by a discrete and periodical one. This means that the energy conversion, *i.e.* doing the work by gravity force on a fluid or a free-flowing mass, is accomplished discretely as automatic discrete sequence of strokes of the rocking lever with accumulated driving masses on its ends.

The innovation is that the traditional simple machine (as water wheel) is replaced by the new compound machine [3] formed from two rocking levers which have been connected in original manner – Discrete Power Converter (DPC or *Kornich machine*).

DPC simultaneously converts the potential energy of either fluid or free-flowing mass which is accumulated in two capacities (buckets) into the kinetic energy of two kinds of motion: the reciprocating motion executed in the vertical plane, and the reciprocating rotational motion (as oscillations), executed in the horizontal plane (so that restriction 1.1. is eliminated).

Output force of DPC can be multiplied repeatedly on each stroke (as well as lever) in depend on its geometrical dimensions (so that restriction 1.2. is eliminated (at least partially)).

Another fluid or free-flowing industrial nature masses (such as pulp, grain, gravel, free-flowing or granulated materials *etc.*) can be applied to DPC because gravity force of fluid or free-flowing mass is not so exerted on working blade as known hydro turbine, but is exerted on capacity (bucket) of special shape and size, in which the flow of the fluid or free-flowing mass has been accumulated before stroke (so that restriction 1.3. is eliminated).

The kinematic scheme of DPC (or *Kornich machine*) is represented on Fig.1

DPC is designed as symmetrical system which consist of an equal-arm beam **3** (as first-class lever), which is tightly connected with the lower shaft **6** (as fulcrum) in the bearing supports relatively to the vertical post **5**. At the ends of the beam the identical storage capacities **1** (as left) and **15** (as right) of a special shape and size (as bucket) are located, in which the flow of the fluid or free-flowing mass **11** is accumulated.

When DPC operates, each arm of the beam **3** can alternately occupy one of the two limiting positions relatively to the horizontal basis (level of pedestal **2**) - the lower or the upper one. The difference in height (**h**) between these two limiting positions (set by two limiters **8**) is the work performed by the converter, which is proportional to the mass of accumulated in the upper capacity **15**.

By gravity force of the mass accumulated in the capacity **15**, that arm (right at Fig.1) of the beam **3** which occupies the upper limiting position moves to the lower one, thus giving rise to a torque about the shaft **6** which provides reciprocating angular motion in the horizontal plane and could be loaded accordingly. Simultaneously, the right arm of the beam **3** acting as a lever relatively to shaft **6** (as fulcrum) imparts the translational downward motion in the vertical plane to the connecting rod **4** which also could be loaded accordingly. The mechanical advantage (as multiplying of gravity force **P** of the mass in capacity **15**) is possible with coefficient (l/d at Fig.1) from geometry of DPC. When the filled capacity **15** switches to the lowest position (level of pedestal **2**), it empties spontaneously owing to its special shape which ensures the necessary displacement angle of the accumulated fluid or free-flowing mass; simultaneously, the opposite arm (left at Fig.1) of the beam **3** moves to the upper limiting position necessary for the filling of the corresponding capacity **1** from source of free-flowing mass **11**.

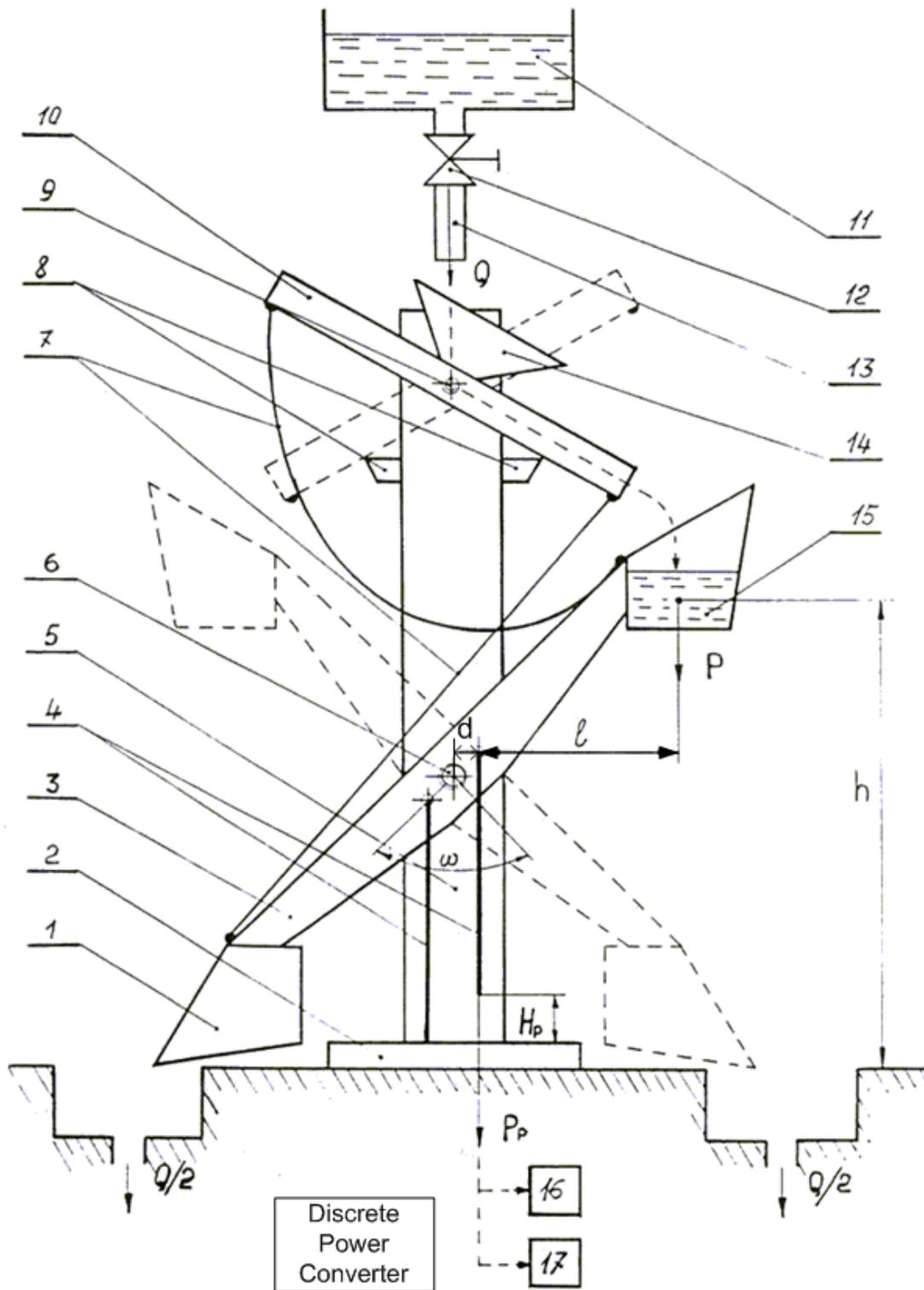


Fig. 1

The alternating switching of the fluid or free-flowing mass flow direction to the left or to the right capacities **1**, **15** is accomplished automatically using a directing pipe **10** (acting as second rocking lever relatively to shaft **9** (as fulcrum) and two flexible mechanical feedbacks **7** (flexible or rigid) that are connecting in cross manner the right and left arm of the beam **3** and the pipe **10** (as lower and upper rocking lever) accordingly.

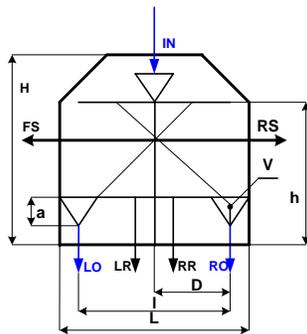
These feedback linkage causes the reciprocating angular motion of the directing pipe **10** about the shaft **9** on vertical pedestal **5**, similar to those of the beam **3** but executed in anti phase; as a result, the flow of the moving mass is always directed only into that empty capacity (right **15** or left **1**) which at the moment occupies the upper limiting position. Free-flowing mass is going through control valve **12** and pipe nipple **13** to the funnel **14** on the feeding pipe **10**

Owing to the action of mechanical feedback and spending part of the input power for the returning of the device to the initial state the mechanism operates in the free-running mode with two stable states and the switching between them (as oscillator), similar, for example, to the regime of the electronic device which called astable multivibrator [4]. Period of oscillating (and average output power accordingly) can be regulated by control valve **12**.

Thus, the proposed converter can be utilized as a prime mover driven by gravity force of free-flowing mass (including water) for various useful mechanisms **16**, **17**, operating in reciprocating angular and translational modes, without using the other kinds of energy (electrical, etc.).

On the base of above content the Discrete Power Converter (DPC or *Kornich machine*) may be defined as:

“ Discrete Power Converter (DPC or *Kornich machine*) is symmetrical compound machine based on particular combination in vertical plane two rocking levers with two mechanical feedbacks and two capacities, which is driven in oscillating mode by gravity force of free-flowing mass and it is able to transfer energy in the form of reciprocating motion, both in vertical and horizontal planes. ”



#	Symbol	Unit	Description
1	IN	m ³ /sec	Input of moving mass
2	LO	m ³ /sec	Left output of moving mass
3	RO	m ³ /sec	Right output of moving mass
4	LR	m	Left driver rod
5	RR	m	Right driver rod
6	FS	m	Front shaft
7	RS	m	Rear shaft
8	a	m	Main construction parameter
9	h	m	Head
10	l	m	Length of beam
11	D	m	Projection of lever
12	L	m	Total length
13	H	m	Total height
14	V	m ³	Volume of capacity

1. http://en.wikipedia.org/wiki/Simple_machine;
2. http://en.wikipedia.org/wiki/Water_wheel
3. http://en.wikipedia.org/wiki/Kinematic_chain
4. http://en.wikipedia.org/wiki/Astable_multivibrator

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