# Discrete Power Converter

By gravity powered

Converting the energy in the gravitational field

- Each physical mass elevated against Earth's gravity accumulates the potential energy associated with gravity force (P), amount of mass (m) and height of lifting (H).

- The more value of the mass and height, the more of *potential energy* is accumulated   Ep = P x H = m x g x H ;   g – constant gravity

- When a mass is falling down from some height (H) under gravity force (P) with constant acceleration of (g) the potential energy (Ep) converts into *kinetic energy* (Ek) associated with motion of mass (m); Ek = m x (V x V)/2; V – speed of moving mass.

- If the moving mass (m1) collides with another mass (m2) the transfer of energy (or interaction) will happened, and useful work can be done if (m2) represents the element of practical mechanical load. The clear evident example of this case is hitting of pile by falling pile driver (hammer) in the construction work.


pulley

log
about 1 foot
in diameter
and 5 feet
long

PILE DRIVER
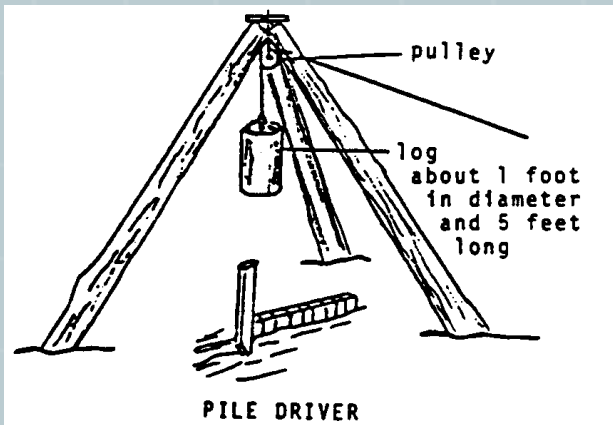
- In this interaction between two physical solid bodies the hummer is defined as *prime mover* https://en.wikipedia.org/wiki/Prime_mover which is forced by gravity and interacts with load directly. This is simplest way of converting of potential gravitational energy in useful work.

- However the more complicated cases should be considered when *simple machines* https://en.wikipedia.org/wiki/Simple_machine and *working medium* https://en.wikipedia.org/wiki/Processing_medium are involved in the converting of energy.

Working medium and simple machines in the converting of gravitational energy

exertion of force through space
(the field of acting force -
gravitation, for example)

working medium (water - in hydro power)

being in contact (collides)   linkage

PRIME MOVER

USEFUL MECHANICAL LOAD

gravity force

the motion of working medium   the motion of prime mover   (!)   the motion of load

optimization

Wheel Rotation

Flume

- The *trebuchet* as mechanical machine of weapon also has the counterweight moving down by gravity. However, unlike pile driver, it has *mechanical linkage* with another physical solid body – *simple machine*, as rocking *lever*.

- The counterweight interacts with short shoulder of lever and long shoulder of lever interacts with load – projectile.

- The kinetic energy from *prime mover* (the falling of counterweight) is transferred by mechanical linkage to simple machine – lever.

- Finally *trebuchet* represents the *compound machine* operating in the *discrete regime*, with pauses between working strokes.
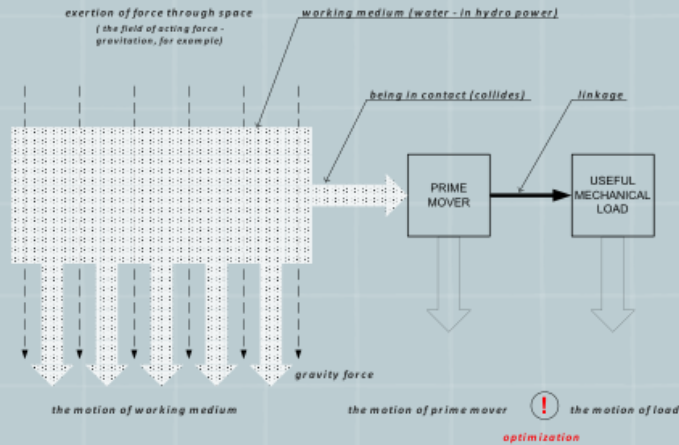
- Another distinctive way in the converting of gravitational energy is associated with flowing masses which also are forced downward by gravity.

- The kinetic energy of flowing mass (water, for example) can be transferred to *prime mover* (as solid body) just by interacting of their *momentums* in collision between them.

- This flowing mass plays the important role as *working medium* in process of converting energy *instead of mechanical linkage* between solid bodies.

- Actually the *working medium* transfers kinetic energy directly to the *prime mover.*

- When flow of water (as *working medium*) interacts with water wheel (as prime mover in the form of another simple machine – *wheel an axis*) we have classical fundamental scheme of hydro power in *continuous regime* which is used by humanity already thousands of years.

- However, only if the water can be used as *working medium* for practical applications of the gravitational energy ?
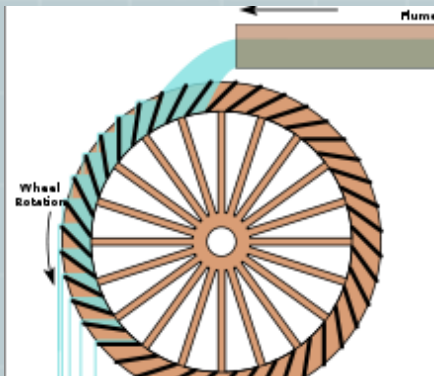
Alternative working mediums in the converting of gravitational energy
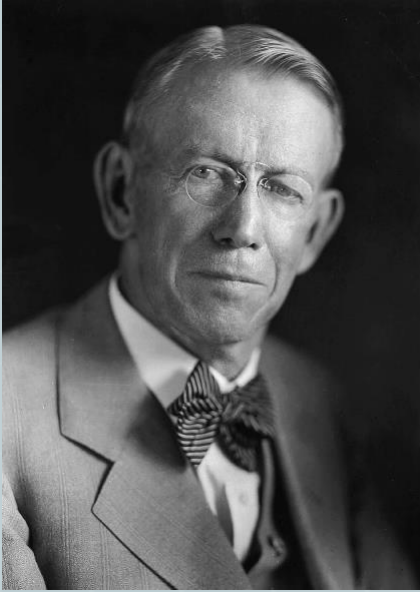
Professor D.W. Mead, 1932 [2]

- A famous scientist and educator in hydro power Daniel W. Mead even in 1915 wrote in his fundamental book [1] about possibility to use of alternative working mediums powered by gravity:

 " … 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. …"   (underlined by A. Kornich)

- In fact, this statement can be considered as challenge for the development and design of innovative prime movers powered by gravity.

- Obviously, the traditional prime movers (as water wheel) are not very suitable for working with alternative working mediums for many reasons.

- The importance to minimize of linkage between prime mover and useful mechanical load (ideally by direct connection) to increase of efficiency of machine is also formulated:

 " … Every transmission or transformation of energy entails a loss, hence, starting with a given quantity of energy, it gradually dis- appears through the various losses involved in the mechanism or machines used. Other things being equal, the simpler the trans- mission or transformation, the greater the quantity of the original amount of energy that can be utilized. …" [1]

- Moreover, the compatability of prime mover, working medium and mechanical load is the main criterion for effective their operation.

 "… other losses depend both on the nature of the working medium (water, air, steam or electric current) and on the design, construction, maintenance and conditions of operation of the machine … and … It is therefore obvious that it is usually desirable to so select, install, maintain and operate machinery that it may work as nearly as possible with the least comparative losses or under the most efficient conditions …" [1]

- Thus we can see the actuality and demand of design of innovative prime movers with diversity of their output motions accordingly to various mechanical loads, even a hundred years ago.

1.   DANIEL W. MEAD; (*1915) WATER POWER ENGINEERING THE THEORY, INVESTIGATION AND DEVELOPMENT;* NEW YORK   McGRAw-HiLL BOOK Co. 1915
2.   Daniel W. Mead, Pioneer Educator, Ethicist, and Consultant, by Mary P. Anderson in "Ground Water"

Discrete Power Converter (DPC) as innovative mechanical prime mover powered by gravity

Water wheel as system of rotating levers

flowing mass

h_1

R R

$P=mg$

shaft $T=P*R=mgR$

Discrete Power Converter (DPC) as rocking symmetrical lever

R

$P=mg$ h_2

R

$a=45°$ F
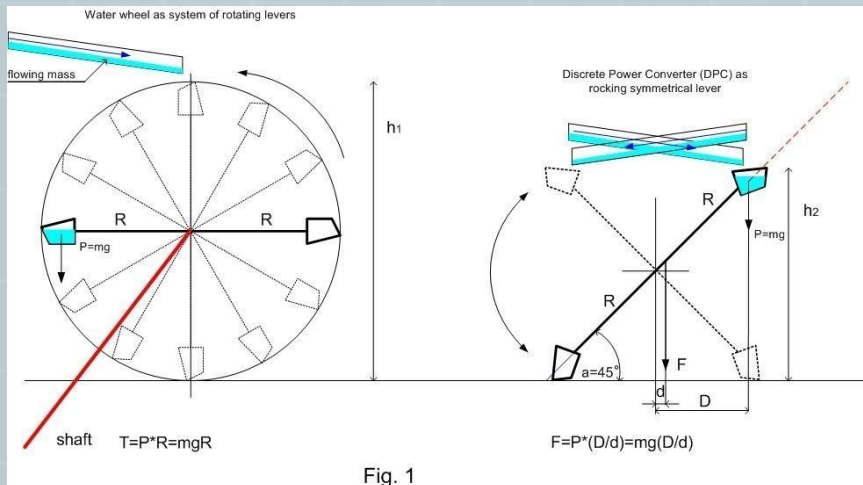
d D

$F=P*(D/d)=mg(D/d)$

Fig. 1

- The traditional water wheel can be considered as system of rotating levers (at each moment of time and relatively to shaft as common pivot). (see Fig. 1)

- Gravity force (as weight of water in the bucket) is applied to the length of lever (equal to radius R of water wheel) and create the torque relatively to shaft.

- Water wheel is rotating by torque in combination with changing buckets at position of collision with water and inertia.

- Because of continuous regime of operating the losses (dissipation of power as heating in bearing) are presented in water wheel also continuously.

- The *main innovation idea* in DPC design is to replace the system of rotating levers (like in water wheel) on single rocking symmetrical lever (or rocking beam) with two buckets on the opposite ends and with pivot in the center of the shaft – this is the *first innovative step*.

- In this configuration a rocking beam can perform reciprocate motion in vertical plane (as working stroke) between high (Hp) and low (Lp) position alternately for left shoulder (LS) and right shoulder (RS) of beam.

- In high position a bucket should be filled by working medium (water, in simplest case) and in low position a bucket should be self emptied (if shape is right).

- The each shoulder of rocking beam can be connected easy to the mechanical load with the same reciprocate nature of motion (piston pump, for example). The needless of any intermediate mechanism (gear, crank shaft, etc) increases of efficiency of energy transfer.

- Because of load can be placed between pivot (shaft) and bucket (point, where gravity force acts as effort) on the distance (d) on Fig. 1; the (RS) acts as Class 2 lever relatively to load and mechanical advantage always greater than 1.

- Therefore DPC is able *to multiply the gravity force* associated with mass of working medium which was accumulated in bucket in high position, and stronger force will be applied to load.
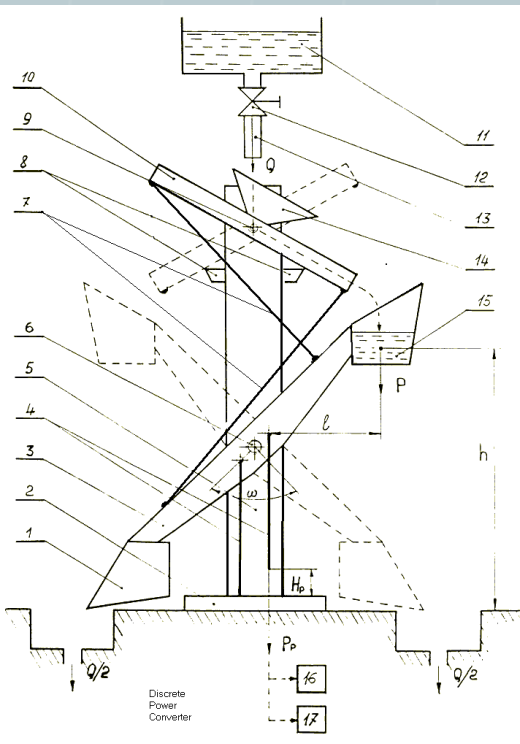
Fig. 2

- However, to provide the reciprocating motion of rocking beam in vertical plane we need to switch alternately the flowing mass between buckets on the opposite ends of beam in their high position.

- It is realized by means of another symmetrical a rocking lever (**10** on Fig. 2) which is placed above of the rocking beam (**3**) and it has the fulcrum (**9**) on the same vertical axis of DPC machine.

- This a "feeding lever" (**10**) is performed as pipe or narrow tray with attached intake assembly (**14**) in the center in such a way, that it delivers the moving mass to the bucket (**15**) of a rocking beam (**3**) in its high position accordingly.

- Then the working medium can be accumulated in bucket (**15**) in its' high position (Hp) and create the effort on the end of a rocking beam (**3**) as gravity force P = m x g (m - accumulated mass).

- The usage of a rocking "feeding lever" in the kinematic scheme of original mechanism of DPC – this is the _second innovation step_.

- The next step of design is the right switching of "feeding lever" (**10**) what means to direct of flowing mass only in that bucket of main beam (**3**) which is in high position at the moment of operating of DPC.

- To do this the "feeding lever" (**10**) and rocking beam (**3**) should rocking in the "anti-phase": when right shoulder of the "feeding lever"(**10**) is in low position (and provide the direction of flowing mass "to-the-right"); the left shoulder of rocking beam (**3**) should be in low position (hence, the right shoulder of rocking beam (**3**) will be in high position accordingly) for receiving of flowing mass in its higher bucket (**15**).

- Due to symmetrical structure of DPC the same behavior should present of a left shoulder of a rocking beam (**3**).

- This requirement will be satisfied if we apply two symmetrical "mechanical feedbacks" (**7**) of crosses type: by mechanical linkage (hard or flexible) which connect the left shoulder of a rocking beam (**3**) with the right shoulder of a "feeding lever"(**10**) and contrariwise.

- The insertion of this symmetrical "mechanical feedback" in the kinematics of DPC– this is the _third innovation step_.

- More detailed information about principle of operation of DPC, technical description and distinctive comparative features of DPC as innovation mechanical prime mover can be found on:

- http://dpc-renewable-energy.com/wp-content/uploads/2014/06/DPC-2.pdf   Complete technical description of DPC

- http://dpc-renewable-energy.com/?page_id=236   Summary

The proof of feasibility and invention of DPC

The Official Bulletin
of INDUSTRIAL PROPERTY OFFICE
of Czech Republic
ISSN 1211 4197/12.4.2000

Alexander Kornich
Inventor of DPC

Model of DPC (# 2)

- As result of the consequent applications of three innovative steps the original mechanical prime mover was invented by Alexander Kornich.
https://www.linkedin.com/in/alexander-kornich-38b89814?trk=nav_responsive_tab_profile

- The Intellectual Property protection document was issued by INDUSTRIAL PROPERTY OFFICE of Czech Republic.

- To prove the feasibility of operation DPC as machine a set of working models was built:

- Small model before patent pending (was tested without any mechanical load, just for operating principle verification);

- The second model (1.2×1.2×0.25) m with capacity of bucket (1.5 – 2) liter was tested successively under mechanical load (two symmetrical piston air pumps for tire pumping) # 2 on picture below;

- The third prototype (1.9×1.5×0.4) m is ready for the testing with natural source of falling (flowing) water.

- All models were performed primitively enough however have proved the concept of DPC clearly.

- The demonstration model of DPC you can see now in the operation at:
https://www.youtube.com/watch?v=8W5SY651wxg&feature=youtu.be

- DPC project is still being in "seed stage"; its Technology Readiness Levels (TRL)
https://en.wikipedia.org/wiki/Technology_readiness_level
may be defined as TRL 5 for the DOE:
"…Fidelity of breadboard technology improves significantly - The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components. …"

- The next significant step in DPC project should be done as building full scale prototype with natural source of working medium (as pilot plant).

It will allow to go to the TRL 6: "… Model/prototype is tested in relevant environment - Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment. …"
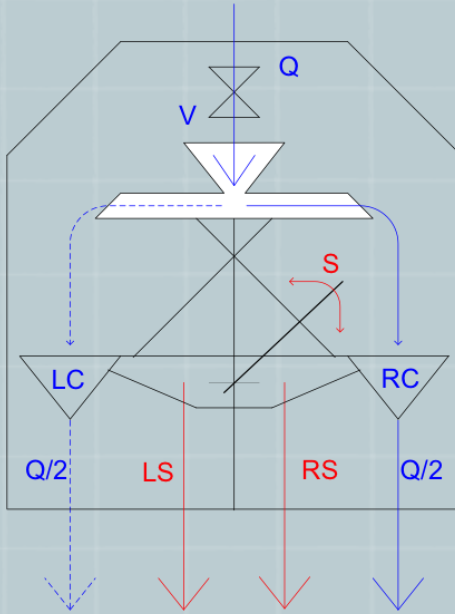
Distinctive features of DPC

Fig. 3

- The basic distinctive features and useful functions are illustrated by functional scheme of DPC (see Fig.3)

- DPC has one functional input (Q) as input flow of working medium and six functional outputs.

- The various other (not only water) flowing masses (as sand, gravel, slurry and grain, granulated materials, etc) can be used a as working medium forced by gravity to this input of DPC.

- The potential energy accumulated in buckets (LC or RC) and then released as kinetic energy of working stroke can provide two symmetrical functional outputs (LS and RS) as the reciprocating motion of left and right shoulders of rocking beam in the vertical plane; and reversible rotation of main shaft (S) in the horizontal plane simultaneously.

- All that three outputs (LS, RS and S) can be loaded at the same time by some appropriate (in the terms of similarity of their motions) mechanical loads (for example, two piston pumps and one sieve).

- DPC is capable to multiply the gravity force of working medium in the bucket by law of lever (mechanical advantage) and a force during working stroke (as mechanical pulse) can reach significant value depending on geometry of DPC machine.

- The input flow(Q) goes through a construction of DPC from top to the bottom and is divided as result on two functional outputs equal (Q/2) because of symmetrical structure of DPC. Each of flow Q/2 can be diverted accordingly to size and geometry of DPC.

- Thus , the DPC in addition to power converting can perform the function of batcher.

- DPC can provide the discrete mode of operation, which means that periodical consequence of working strokes (as mechanical impulse) of the rocking beam may be generated with infra low frequency (as oscillating mode).

- Each period of operation consist of two time intervals: accumulation of working medium into bucket; and release that energy in the kinetic form of working stroke of rocking beam. Therefore the DPC can perform the function of mechanical timer by generating the intervals of time.

- Conclusion can be made:
DPC (or *Kornich machine*) is the first in the world mechanical prime mover powered by gravity of various working medium; it is operating in discrete regime of relaxation mechanical oscillator and able to provide reciprocating and reverse rocking output motions simultaneously, as mechanical power converter.

Applications of DPC

- Possible areas of application of DPC may be classified:

1. **by nature of working medium**

    1.1 Natural resources that are present and can be found in the environment or are formed as a result of natural growth, and to its physical properties can be assigned to free-flowing masses (see Table 1)

Natural resources of free-flowing masses as working medium for DPC	
1. water	5. ice
2. sand	6. grain
3. gravel	7. seeds
4. snow	8. nuts, cones, kind of fruits or vegetables

    1.2   Artificial resources resulting from industrial production or serving as components of various multi-ton technological processes (both continuous and discrete).   Examples of such substances are represent in the (Table 2).

Artificial resources of free-flowing masses as working medium for DPC	
1. pulp	5. powder
2. slurry	6. sawdust
3. blend	7. ash
4. granulated materials/small parts	8. water mixture / dissolver

2. **by nature of output function (type of output motions)**

2.1 Reciprocating motion in vertical plane (as working stroke) for such of technological operation:

- piston pumping, lever pumping, mechanical driving (for irrigation, water pump storage, hydraulic cylinders, air compressor)
- cutting, pressing, forming, bending, crushing (for construction materials, building, manufacturing industry)
- grounding, chopping, squeezing, shredding, mixing (for agriculture, crops processing, food processing)

2.2 Reverse rotation of main shaft in horizontal plane (as reverse rocking) for such of technological operation:

- grating, sieving, peeling, mixing, washing (for construction materials, agriculture, crops processing, food processing)

More detailed information can be found at http://dpc-renewable-energy.com/?page_id=28

Applications of DPC

Input stream of moving mass

(see Table 1, 2; # 4.1 – 4.11)

Q

RS

H

RR

LR

FS

Q/2

Output stream

Q/2

Output stream

As mechanical load there can be:

1. Sieve
2. Coarse screen
3. Mixer
4. Shaker washer
5. Shaker grate
6. Shaker shaft
7. Mechanical heater

As mechanical load there can be:

1. Water piston pump
2. Air piston pump
3. Juice press
4. Punch press for some materials
5. Press former for some materials
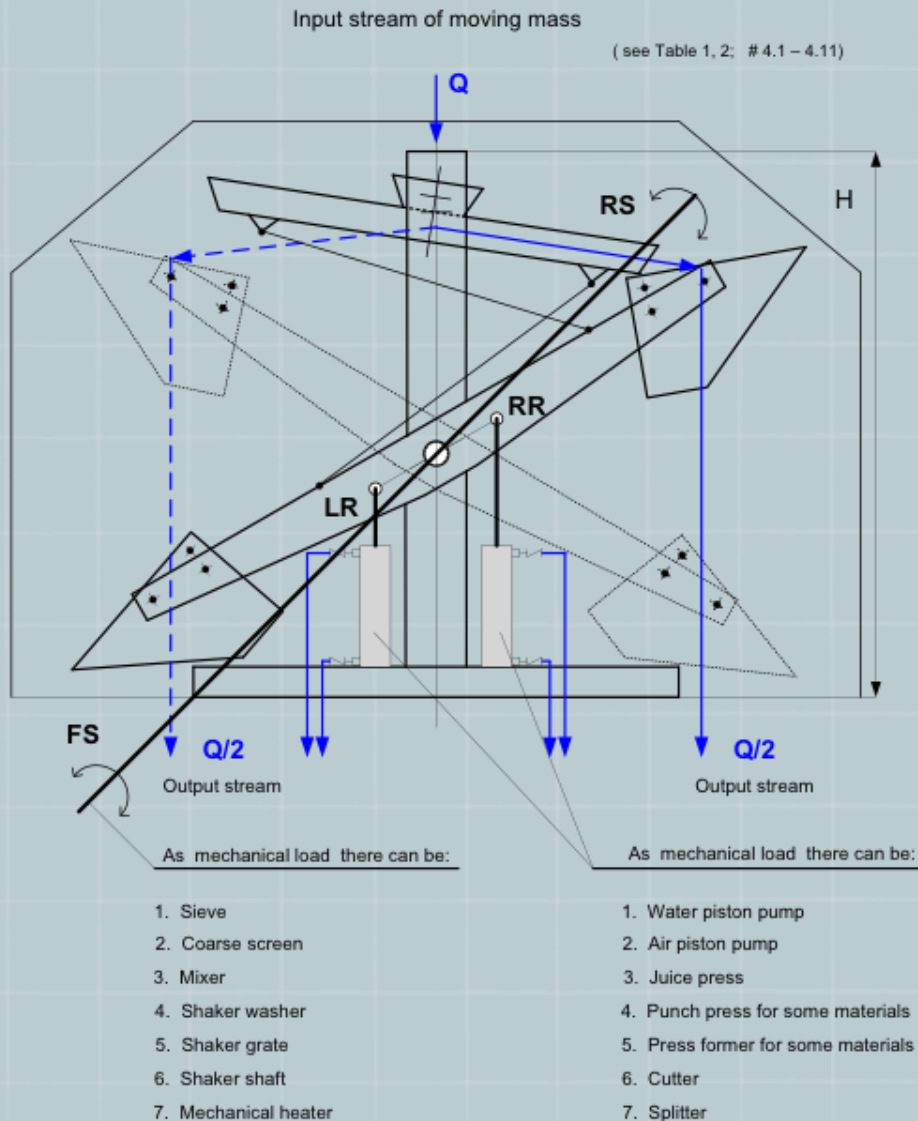6. Cutter
7. Splitter

Fig. 1

- This diagram illustrates the possibility to connect various practical mechanical loads to functional outputs of DPC (the loads can be connected simultaneously).

- The areas of industry which are most suitable for the implementing of DPC :

- hydroelectric power engineering (micro-hydroelectric plants);
- water supply, irrigation and watering;
- water purification and sewerage;
- ore mining and processing industry;
- chemical industry (multi-ton production);
- metallurgical industry (multi-ton production);
- building materials industry;
- food industry (multi-ton production);
- special application: small power units without heat radiation and noise

- Objects both of natural and artificial origin as potential sources of working medium for DPC :

- waterfalls;
- mountain lakes and rivers;
- open casts for sand, crushed stone and gravel exploitation;
- elevators and drying units for grain and seeds;
- open casts for mining and processing of comminuted ores and minerals;
- granulation towers, columns and other devices;
- drying complexes and units with downward displacements of multi-ton free-flowing masses;
- transportation complexes and units involved in vertical lifting;
- systems for waste water disposal (sewage) and drainage systems, slurry disposal, brine disposal.
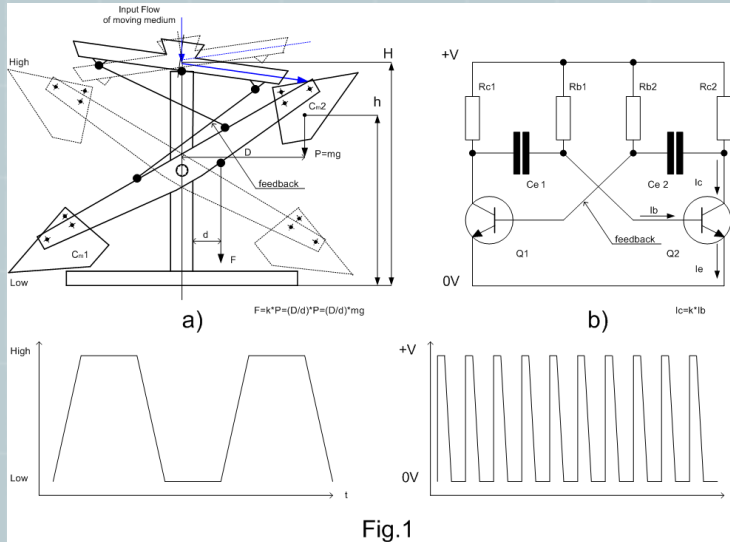
Educational value of DPC

Fig.1

- "…The electronic–hydraulic analogy … is the most widely used analogy for "electron fluid" in a metal conductor.
  In electronic-hydraulic analogy the *current* represents of *flow* and *electric potential* (or *voltage*) represents the hydraulic *head*. …" [1].

- This methodology is used successively for visualization of electrical processes in modeling and educational purpose.

- DPC as subject of *electronic–hydraulic analogy* represents not only similarity of hydraulic equivalents of some electronic components (as resistor, capacitor, etc) but even clear similarity between operation of DPC (as mechanical relaxation oscillator) and operation of electronic device such as (AMV) - Astable Multivibrator (as electrical relaxation oscillator).

- In the terms of new paradigm of hydraulic analogy we can see (Fig. 1):

- Symmetrical physical structure (as "left shoulder" and "right shoulder" of electronic device (AMV) and mechanical machine (DPC).

- The analogue of two flows (as energy carriers) from point of higher potential to point of lower potential: flow of working medium (as physical mass) from "head" (H) to ("ground") in DPC and flow of electrons (as current) from higher electrical potential (+V) to "ground" (0V) in AMW.

- The similarity of presence in both devices two symmetrical capacitance with equal function: electrical capacitors in AMV for accumulating of electrons (as source of electrical current) and physical capacitance (as bucket) for accumulating of working medium (as source of a moving flow). The value of capacitance in both cases determines the value of period of oscillations.

- The equivalence of two symmetrical power amplifiers in the physical structure of AMV and DPC , accordingly: transistors (Q1, Q2 for AMV) which amplify (electrically) the collector current (Ic) proportionally to base current (Ib); and levers (for DPC) which amplify (mechanically) the gravity force of mass accumulated in the bucket by law of lever. (Ic = k*Ib; for AMW and F = k*P = k*m*g; for DPC)

- The similarity of two symmetrical feedback (electrical or mechanical nature) "crossing" type in the physical structure of AMV and DPC which transfer part of output power from "left shoulder" to input of "right shoulder" and contrariwise.

- The analogue of consequent "switching effect" (both, electrical or mechanical nature) from state of "high potential" to state of "low potential" in physical structures of AMW and DPC.

- The relative detailed information can be found at http://dpc-renewable-energy.com/wp-content/uploads/2014/10/DPC-EdKit.pdf

Testimonials and Awards
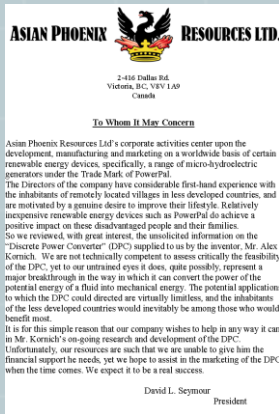
510-73 Gorge Rd. West
VICTORIA, BC, V9A 1L9
CANADA
Tel: 1-250-361-4348
Fax: 1-250-360-9012
info@powerpal.com

10th July 2016

… Mr. Alexander Kornich has recently drawn our attention to his invention, the Discrete Power Converter (DPC), and we feel that it has the real potential to be a "game-changer" as far as its ability to convert the force of gravity from falling masses into mechanical energy that can be applied to a multitude of beneficial purposes.

… The simplicity of the design is impressive. But it is the wide range of mechanical uses to which it can potentially be put, both effectively and beneficially, that is even more impressive.

Therefore, it will have immediate and significant appeal to the rural residents of less developed countries.

TO WHOM IT MAY CONCERN
DISCRETE POWER
CONVERTER (DPC)

David L. Seymour, President & CEO
Asian Phoenix Resources Ltd.

DEAR MR. KORNICH:
PLEASE EMAIL OR SEND SOME INFORMATION ABOUT THE DEVICE AND SCALE OF POWERS.......
IT SOUNDS VERY NOVEL....... AND IT MAY HAVE A GOOD   NUMBER OF APPLICATIONS IN RENEWABLE ENERGY /SMALL MICROHYDRO UTILIZATION IN DEVELOPING COUNTRIES.... ETC.. THANK YOU PLEASE EMAIL ADDITIONAL INFORMATION OR MAIL
PROF. DR. ADEL M. SHARAF; ECE DEPT.   UNB,, CANADA

Last Year's Best Author Award
Winner: Alexander Kornich
Renewable Energy Society News

Renewable Energy Society Newsletter

Renewable Energy Society News

… At the end of this newsletter we have a photo of last year's winner for Renewable Energy Society best author award, Alexander Kornich. You see the small trophy in the background near his renewable energy machine.

Nova Muscosa Amplayo, Calamba, Misamis Occidental, Philippines

Dear Alex,
Your DPC sounds very interesting and practical. The more I think about it, the more I feel this way. I also imagine that it could be manufactured very cheaply...
...I think that water pumping would be the best application.
It could be a useful way to pump water, cheaper than a ram pump.
The water could be used for village water supply and for hill slope irrigation.

Glenn   aphoenix@hn.vnn.vn

http://us7.campaign-archive1.com/?u=45386318270ff64d5dd0b000e&id=e92e29365a&e=98ed08c15f

Dear colleagues and friends,

The DPC project is being still in "seed stage" and a lot of works should be done to implement it on practice.
However, I believe that engineering community, enthusiasts of small-scale alternative energy and amateurs
may to contribute their efforts and time in the future developing of DPC as innovative mechanical prime mover powered by gravity.
I am opened for any kind of cooperation with any interested parties in partnership.
Yours,

Alexander Kornich

for contacts: cell 1-604-537-1414;
E-mail: ka6003@gmail.com ; tech.transfer@yahoo.com ; Skype: alkorn95