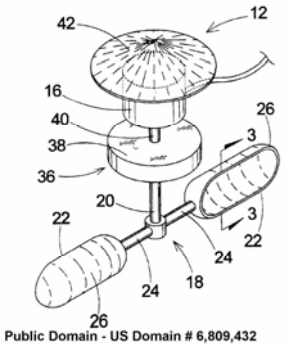
STUDENT'S CORNER # 2 - By ABRAM TEPLITSKIY, Ph.D.

Our first inventive meeting in Student's Corner in January brought some problems to solve. Now we'll consider solution of a problem about wind. We are sure that majority of students - readers know that during inserting a magnet inside a wire coil, due to electromagnetic induction in coil would flow electrical current. It is a well-known physical effect, which is illustrated by experiments made by great physicist – Michael Faraday. It was a chance occurrence that led the British scientist Michael Faraday to discover electromagnetic induction. It was 1831. Scientists already knew that an electric current could be used to create a magnetic field. Faraday and others were trying to achieve the opposite: They wanted to use a magnetic field to create an electric current. Faraday was conducting an experiment, in which he wrapped two lengths of insulated wire around a soft iron ring. One of the lengths was part of a circuit that included a battery. The second was part of a different circuit containing a galvanometer that could measure any current passing through it. The wires were insulated so that no current could flow through the iron ring between the circuits. Faraday knew he could create a magnetic field in the iron ring by running electricity through the first coil. His goal was to use this magnetic field to create a current in the second coil. On the morning of August 29, Faraday connected the galvanometer first and then connected the battery. To his delight, he detected a momentary current in the second circuit; connecting the battery after the galvanometer meant that the galvanometer was measuring what happened as the current changed in the upper circuit. Faraday rapidly pushed his work ahead. In the next few months, he discovered that by moving a wire in a magnetic field he could also generate a current in a coil. Conclusion - if we have a coil and magnet, we can generate electricity!

Courtesy of Igor Endovtsev

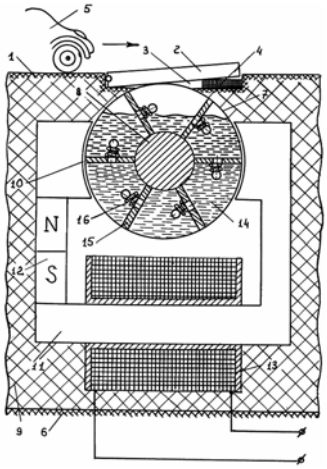
Now think, how we can relative motion of the magnet and coil if we have wind flow from cars passing by? Below you can see one realization of this idea. Wind is rotating part 3 of this "generator" around, for example parts 38 and 42, containing wire coils. According to Faraday effect, coils will

produce electricity; we can say “free” electricity. It is an answer to our first home exercise for **First Student’s Corner**.

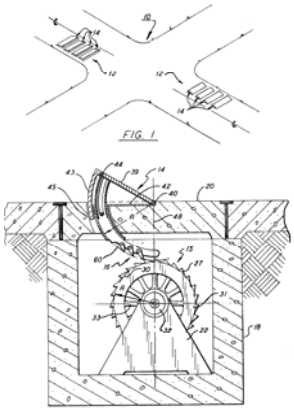


Public Domain - US Domain # 6,809,432

But wind from cars passing by is not the biggest contributor to electrical potential. The main contributor could be energy of cars, which pressurize the road while moving. And it’s why in many industrialized countries appeared a lot of patents, which utilize such free source of electrical energy. We would present examples of generators developed in two leading space countries – **USA and Russian Federation.**



a



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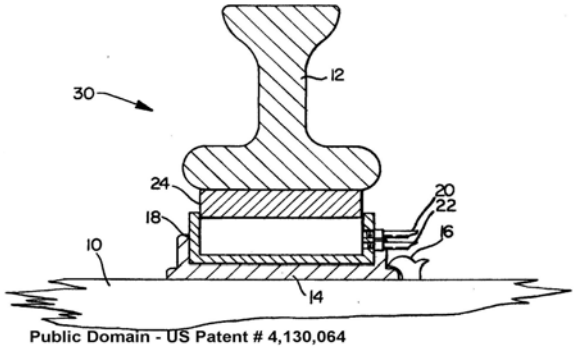


Public Domain - US Patent # 4,130,064

(c)

Generators Activated by Moving Cars (a) and (b) and Railroad Tracks (c)

Generating technologies, illustrated above, developed in the **Russian Federation (a)** and the **United States of America (b)** and **(c).** Principle of activation of all three types of generators is similar. Wheels of automobile cars (or railroad trucks) while moving are stressing pedals of generator units, which by plunger are pushing hydraulic oil or mechanical lever, which in a turn rotate the generator coil around the magnet or vise versa. As result of such rotation around the magnet the electricity is generating. Before such types of generators were developed a lot of energy was wasted.

Now let's consider another opportunity - could usual toothbrush produce electricity? Think, and while thinking, consider **Russian Federation patent** on a toothbrush-generator. Two main parts of toothbrush are a handle and brushing head. If we will put a permanent magnet in tooth-head, and provide possibility for reciprocal movement, we will make an electromagnetic generator! Tooth-head made from electro conductive material. While tooth-brushing tooth-head is crossing the lines of magnetic field, therefore it appears an electro motion force, which develops the difference of electrical potentials between tooth-head and cleaning surface of the teeth, which increases the tooth cleaning effectiveness. Also permanent magnet acted on gums and facilitates blood circulation in them.

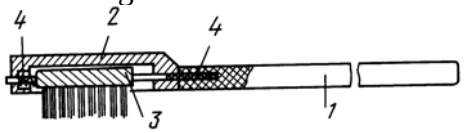
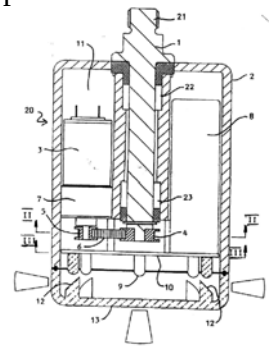


Fig.2. Toothbrush – Generator
Public Domain – RU Patent #2109475

One more example – a bicycle, where, we can say, everything is rotating. Let's take for example a pedal. Can we make a generator, for example, in a pedal? Yes! See following picture. Generator is installed in the conductive contour. Generator drive 3 is rotating by rollers 4 and 5 of not equal diameter, which are connected by belt 6. Roller 5 with smaller diameter rotates gears, installed in frame 7 for additional increasing the speed of generator rotating. Due to this rotation the constant luminescence of lightning elements is provided.



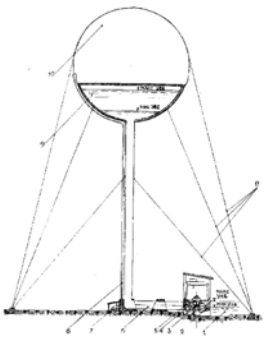
Generator in Bicycle Pedal
Public Domain – Russian Federation Patent #262346437

Now we'll discuss main sources of generating electricity, which were developed during mankind history: energy of wind, energy of water, and energy of sun shining.

Hydraulic method of generating electricity is based on the energy of water, which while falling from the high level of a dam to the lower lever of a river, on its way is rotating the axle of a turbine, which in a turn is rotating the generator. While rotating electrical coil around the magnet, the electricity is generating, as we saw in previous materials. A principal structure of Hydraulic electro station is shown in the picture below.

General Look Picture of Dam of
Bratsk Hydraulic Power Plant (Russian Federation)
Courtesy of Igor Endovtsev

But often consumers don't need a lot of electricity at nighttime, where we can put extra electricity? This question already has an answer – hydroaccumulative power plant. At daytime such power plant works as regular one, using water moving down over the dam. But at night powerful pumps would pump water flow up, in a special reservoir, and accumulate this water for next "working" day, when this extra water will facilitate producing more electricity. The scheme of such unusual Hydropower plant is shown below. The reservoir is placed in elevated capacity. In the morning water from this elevated reservoir would add its power for generating electricity.



Public Domain – RU Patent #2106453

Another two types of **Power Plants**, which are based of a natural source of energy, are **Wind Power Plant** and **Sun Power Plant**. Besides energy of water attention of people was attracted to energy of Sun to generate electricity. In picture below is shown a Sun Power Plant, main part of which is a Photovoltaic Cell, which transforms falling sun light in electrical current.

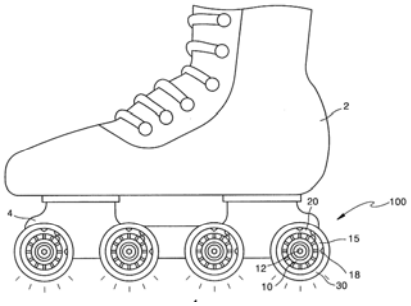
General Look of a Photovoltaic Cell
Courtesy of Igor Endovtsev

In RU Patent #**2254522** it was developed a spherical transparent concentrator, which is filled by transparent liquid – at summer with water, and at winter with spiritis. Sun Power Plant of such type consists on a transparent sphere, filled with transparent liquid like mentioned above spirits, under which a photovoltaic transformer like shown in above picture is placed. In Sun Power plant a lot of such photovoltaic transformers are combined to produce huge amount of power. Such Sun power plants are effective in areas with a lot of sunny days, in mountain area, etc. Source of energy at Wind Power Plants as it follows from title, is wind, which rotates generators, as shown in the picture below.

General Look of Wind Power Plant
Courtesy of Igor Endovtsev

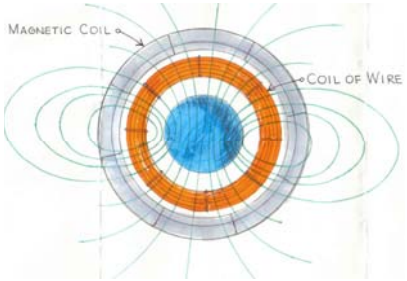
Can you propose a generator for skates, which while skating would produce enough energy to lighten around area, in which you are skating?

If you can’t yet, look on the picture of such device invented by your coevals from Russian federation, and try to develop one by your own.



Public Domain – Russian federation Patent # 2264687

Generator for skates shown above contains a generator and light-emitting wheel, which makes safer in dark time. We also find a generator based in ball-gearing, and our artists **Merle and KellyCunningham** kindly made a picture to illustrate how a generator works in ball bearing.



Courtesy of Merle and Kelly Cunningham

We are waiting your questions, and answers on our questions, which we put in our first Student’s Corner. We’ll also discuss previous question - how people could use in practice apricot’s pits and seeds of other fruits and plants.