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REFLECTIVE PANELS FOR SOLAR AIR CONDITIONING AND HEALTH-SAFE HOUSING

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May 18, 2020, Novi Sad, Serbia

ABSTRACT

This paper presents the results of the use of reflective panels on buildings during the last decades. Given the favorable results and low price, a wider application on residential, commercial and agricultural buildings is proposed. The model is based on high-gloss foils, sheets or coatings on a solid panel for the purpose of low-temperature heating, lighting, disinfection or cooling on the principle of directing, i.e. increasing or decreasing the usual concentration of solar radiation on the windows of buildings.

In the heating season, it is possible to ventilate the room thanks to the higher density of solar radiation that passes through the windows, and during the summer, the reflecting panels contribute to cooling because the solar radiation reflects into the atmosphere and thus contributes to reducing global warming.

Key words: reflective panels, insolation, disinfection, low cost, heating and lighting, buildings, windows, global warming

INTRODUCTION

When using alternative energy sources such as solar energy, questions regarding the price of the device, economic profitability, etc. are often raised. However, reflective panels which are installed next to the windows of buildings at a low price, are unprecedented, but they require an additional use of another active device whose share in heating or cooling is reduced to a minimum. With such a combination of passive and active systems, the energetic autonomy of the building can be achieved at a much lower price than with the previous designs.

In addition, in the heating season, reflective panels compensate for the low density of solar radiation with a relatively high degree of efficiency of about 70%, which is currently unattainable with most active systems.

Aleksandar Nikolic, a future electrical engineer who built the first residential building with reflective panels and earthen protection in the late 1990s, started improvising with mirrors and aluminum foils next to the windows of existing houses in Novi Sad, Serbia in 1978. He tracked all the results and was in favour of simple and cheap solutions, which was in stark contrast to the majority who were enthusiastic about the "colonization of the Moon" as well as various complex solutions of "great science"!

The vast majority of expensive complicated constructions with long-term accumulation of solar energy were complete fiascos, so numerous investments such in solar installations such as the one on Letenka [a location on Fruška gora near Novi Sad, Serbia] in 1980, and the solar house of Zaga Begovic in Kac [a suburban settlement not far away from Novi Sad] were a waste of money.

Unlike "the great science" and great problems accompanying it, Aleksandar Nikolic has been successfully using reflective panels for almost three decades, which nevertheless remain in the shadow of various extravagant architectural solutions designed by "untalented scientists", as they are rightly called by Prof. Dr. Veselin Savić (neuropsychiatrist, 1913–1990). However, with the new facts, we can return to rational solutions.

EXAMPLES OF USE OF REFLECTIVE PANELS AT 45° OF GEOGRAPHICAL LATITUDE

In winter when the sunrays come at a small angle of 21° – 45° (at the maximum height of the Sun) (Figure 1) the solar radiation is increased 2.5 times as the reflective panels placed below and above the windows capture the sunlight and reflect it into the room. In addition, the position of the panels allows sufficient ventilation of the rooms while the Sun's radiation is captured, which has a positive effect on the health of the inhabitants. Moreover, UV rays destroy viruses and bacteria, and at the same time synthesize vitamin D in the skin, which is extremely important in the winter.

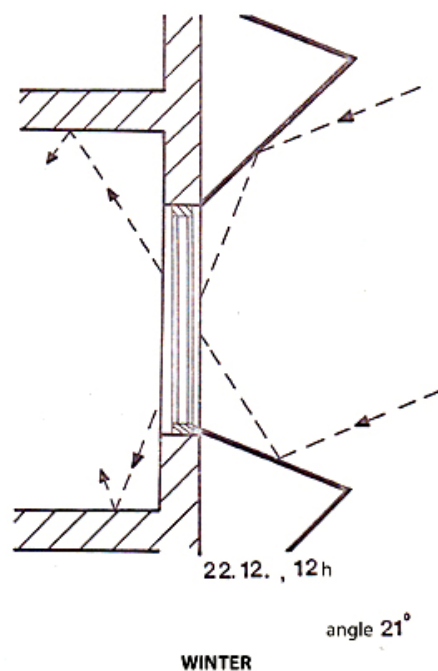


Figure 1.

As the sunrays pass through the thickest layers of the atmosphere in the winter, they are significantly dimmed, but the use of reflective panels compensates for this in the simplest way.



Figure 2. Reflective panels – the third decade of their use. As it can be seen in the photos, the bottom panels are movable.

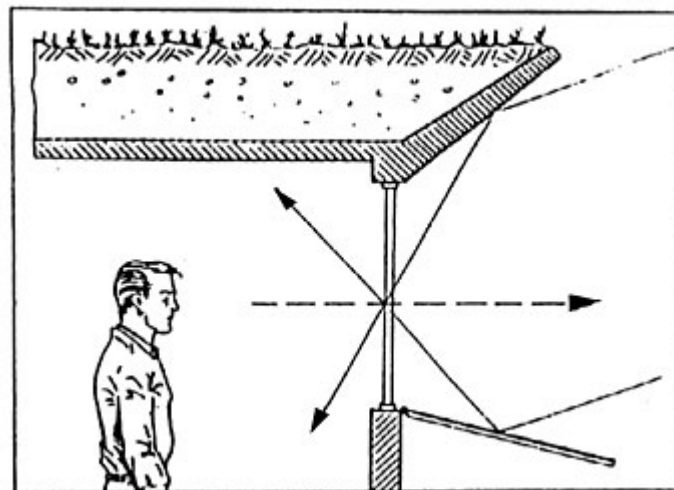


Figure 3. The view to the outside is unobstructed even during the heating season.



Figure 4. Self-heating ecological buildings – residential, commercial and agricultural buildings with a stable temperature.

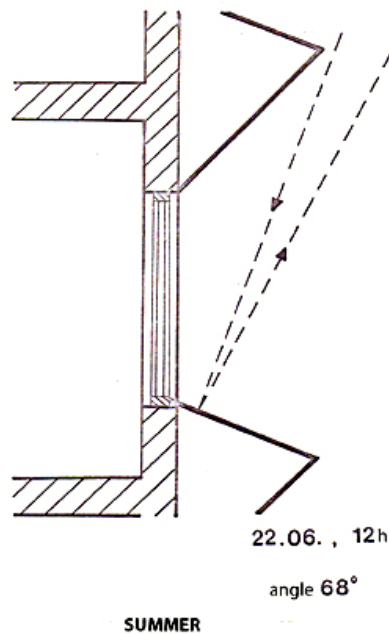


Figure 5. In summer, when the sunrays with Earth form an angle of $68^\circ - 45^\circ$ (at the maximum height of the Sun), the reflecting panels shade the glass surfaces and the entire southern wall of the building, regardless of the number of storeys (Figure 4).

Greater application of such simple solutions would also reduce global warming, since in the summer, reflective panels reflect the sunrays into the atmosphere.


(19) REPUBLIKA SRBIJA	(12) Patentni spis	(11) 51093 B
		(51) Int. Cl. ⁽⁸⁾ E 03 B 3/02 (2006.01) F 24 J 2/10 (2006.01)
ZAVOD ZA INTELEKTUALNU SVOJINU BEOGRAD		
(21) Broj prijave: P-2007/0420 (22) Datum podnošenja prijave: 29.10.2007. (43) Datum objavljivanja prijave: 08.09.2009. (45) Datum objavljivanja patenta: 31.10.2010. (30) Međunarodno pravo prvenstva: RS 29.10.2007. P-2007/0420	(73) Nosilac patenta: MILKOVIĆ, Veljko, Bulevar cara Lazara 56, 21000 Novi Sad, RS (72) Pronalazač: MILKOVIĆ, Veljko (74) Zastupnik:	(51) Int. Cl. ⁽⁸⁾ E 03 B 3/02 (2006.01) F 24 J 2/10 (2006.01)
(54) Naziv: GRAĐEVINSKI OBJEKAT SA ZEMLJANOM ZAŠTITOM I REFLEKTUJUĆIM POVRŠINAMA		
(57) Apstrakt: Pronalazak, građevinski objekat sa zemljanom zaštitom i reflektujućim površinama, sastoji se iz betonske konstrukcije (2) koja je od gore i sa svih strana osim sa južne obložena zemljom, pri čemu je betonska konstrukcija krova (17) iznad prozora (7) produžena u nadstrešnicu (11) koja je otklonjena prema Suncu. Na donju stranu nadstrešnice (11) iznad prozora (7) pomoću šarki (10), koje su pričvršćene na nadstrešnicu (11), okačene su reflektujuće površine (9) od aluminijumskih ili prokronskih limova, ili paneli od drveta ili plastike sa sjajnim premazima, koji se pomoću ručica (8) koje su pričvršćene na nadstrešnicu (11), mogu prisloniti uz nadstrešnicu (11). Ispod prozora (7) pomoću šarki (6), koje su pričvršćene na zid, okačene su druge reflektujuće površine (5), koje mogu biti otklonjene od zida pomoću podupirača (4) sa šarkama (3), koje su takođe pričvršćene na zid. Betonska konstrukcija krova (17) nad građevinom je u poprečnom preseku trouglasta i ispunjena vazduhom, a iznad gornje površine krova (17), koja je pod blagim nagibom, nanesen je hidroizolacioni materijal (16), a iznad njega pesak (15), zatim sloj gline (14) i humus (13) sa travom i ukrasnim biljem (12). Sa zadnje strane građevine, naspram niže ivice krova (17), ukopan je bazen (1) za sakupljanje atmosferskih voda, na čiji je orvor sa gornje strane postavljena rešetka (18), a iznad nje fini šljunak (19).		

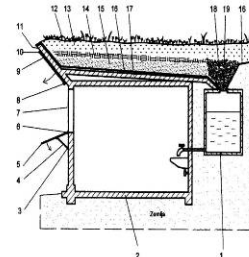
Figure 6. Patent no. 51093 B

A Building with Earth Protection and Reflective Surfaces

inventor: Veljko Milkovic

application number: P-2007/0420
application date: October 29, 2007
patent date: October 31, 2010

RS 51093 B



[a p p e n d i x]

THE INFLUENCE OF SUNLIGHT ON HUMAN HEALTH

Larisa Porobic

The Sun (light) is the source of life.

All natural processes on Earth depend on sunlight and so does human health.

Many scientists today believe that, together with a proper diet and a balanced lifestyle, sunlight is the best protection against many diseases.

According to a lot of research conducted around the world, moderate exposure to ultraviolet sunlight is one of the most effective treatment methods that has ever existed.

As modern man spends more and more time indoors, at home or at work, it is VERY IMPORTANT THAT THERE IS ENOUGH NATURAL (SUN) LIGHT IN THAT ENVIRONMENT DURING THE DAY.

INFLUENCE OF SUNLIGHT ON THE HUMAN ORGANISM

1. SYNTHESIS OF VITAMIN D IN SKIN

By the action of sunlight on the skin, the body is able to produce vitamin D. It regulates the concentration of calcium and phosphate in the blood. This vitamin is important for the resorption of the calcium from the intestines into the blood and its use in formation of healthy bones and teeth. It prevents rickets in children and reduces the possibility of osteoporosis in adults.

The role of vitamin D:

- Prevents bone loss – demineralization (osteoporosis);
- Prevents the development of rickets in children (stunted growth and deformation of long bones);
- Affects the proper functioning of muscles and nerves;
- Strengthens the immune system;
- Lowers blood cholesterol levels.

Recent research links vitamin D deficiency in the body with depression, multiple sclerosis, breast and prostate cancer, osteoporosis, diabetes and obesity.

Children who spend too much time indoors, at the computer, etc., are at risk of developing rickets in the setting of disturbed mineralization of developing bones, most importantly due to the vitamin D deficiency and the lack of sunlight.

2. POSITIVE INFLUENCE ON MOOD AND COGNITIVE ABILITIES

Lack of light caused by prolonged stay indoors or in the period of autumn and winter leads to a change in mood, which darkens (seasonal depression), and a decrease in cognitive abilities. Due to minimal exposure to daylight, we feel lethargic and depressed. **Sunlight improves mood in many people because it produces a sense of satisfaction and is an important supplement to the treatment of acute and chronic depression.**

Due to the lack of daylight, the body produces more melatonin than it needs, leading to drowsiness; if such conditions are prolonged, melancholy, lack of strength, lethargy, difficulty concentrating and a general decrease in vitality occur.

3. POSITIVE IMPACT ON SLEEP QUALITY

In the past few years, it has been established that melatonin, a natural body hormone, in appropriate concentrations promotes good sleep. The body carefully regulates the production of melatonin. This process is mainly controlled by the external cycle of light and darkness. Optimal melatonin production occurs only at night, in the dark. The pineal gland, located in the center of the brain, is the "clock" that regulates this process in a timely manner.

Melatonin is not stored in the body. We need enough melatonin every night to have a good night's sleep.

Studies show that daily exposure to natural sunlight stimulates the release of melatonin.

4. REDUCTION OF BLOOD PRESSURE AND FREQUENCY OF HEART DISEASES

Our bodies get vitamin D from the Sun, but as the British dermatologist Dr. Richard Weller says, sunlight can contribute to another surprising blessing. New research by his team shows that **nitric oxide (NO), a chemical transmitter, is deposited in huge amounts in the skin** and can be released by UV light making/having a positive impact to blood pressure and the cardiovascular system. This could be the beginning of the explanation of why people in e.g. Mediterranean region have fewer cardiovascular diseases, although so far this phenomenon has been attributed to the Mediterranean diet.

Australians have for about a third less heart diseases than the British – fewer deaths from heart attacks, heart failure, fewer strokes. Generally speaking, they are healthier.

So, nitric oxide is not only found in the cardiovascular system. It is also created in the skin and is a part of mechanism different from that of the vitamin D.

Lack of sunlight can increase the concentration of cholesterol in the blood by increasing metabolism of **squalene** and synthesis of cholesterol instead of vitamin D, which would be opposite if/when exposed to sunlight. This mechanism can also explain why the concentration of cholesterol increases in the winter months. So, when the exposure to the Sun is insufficient, the result is the reduced production of vitamin D and then begins the production of cholesterol, which increases the total amount of cholesterol in the blood.

5. ANTIMICROBIAL EFFECT ON THE SKIN AND IN OUR ENVIRONMENT

Sunlight effectively destroys microbes. UV rays destroy bacteria and viruses by acting on their DNA and RNA, preventing them from multiplying.

The dust under the bed in the hospital rooms contains bacteria, while there are none on the window sill. Ordinary daylight, when it is a sunny day, kills bacteria and viruses. That is why it is important to leave in the Sun and ventilate blankets, covers and other items that we often do not wash or sterilize in the washing machine.

There can be many microbes in the air that cause dangerous infections. If a certain dose of UV radiation is emitted, there is considerable certainty that the human body is protected from danger.

This mechanism of impact of UV rays on the destruction of microbes has been used to disinfect air in hospitals and patients' rooms with UV lamps and similar mobile devices.

This type of disinfection can also be applied during epidemics, such as the current COVID-19.

"Virus killer" robots around the world are on the front line and are destroying microbes with ultraviolet rays.

CONCLUSION

The system of reflective panels is a solar device based on the well-known laws of reflection. Its role is to direct and thus, if necessary, increase or decrease the usual concentration, the density of solar radiation on objects used by people, domestic animals or plants, for the purpose of heating and lighting or cooling.

The reflective panel system is by far the most economical and simplest among solar systems and other known unconventional and conventional energy sources and by far the least harmful to the environment.

From the technical, technological, economic and general social aspect, a very fast expansion of the application of the system of reflecting panels is possible and would be justified, with very large energy, health, ecological and other social benefits.

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Published in Novi Sad, Serbia
May 18, 2020

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