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Development of Aluminum in Architecture

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ABSTRACT
Generally speaking, the task of the architecture is to create suitable atmosphere for performing a certain function of the human being. Though today, the interior and exterior space are shaped with equal responsibility and seriousness, the interior ambient is the one in which man spends most of his time. A building as a closed space provides protection from outside climate and weather changes and provides necessary conditions for work and living no matter the outside weather and climate conditions, sounds and noises. The outside walls with the windows are the vital shell under whose protection many useful human activities take place. The evolution of the window is as old as the architecture itself. Since the beginnings of architecture, man has been working on developing the window. One of the features of that evolution of the window is a relation of the surface of the hole of the window towards the outside walls. The advancing of the technology had its influence over the range of capacity of the construction which on the other hand had its influence over the enlarging the window's dimensions. From this we conclude that windows and window openings were and still are important instrument of expressing in the architecture. Besides providing daylight and air in the rooms, the windows also are a visual contact with the nature and underline the role of the building as a human being habitat like no other element of the building.
Keywords – architecture, aluminum, climate conditions, function, windows.

I. INTRODUCTION

For a long time the basic and usual material for a window was the wood. Gradually man begun using metal constructions and nowadays light metal constructions. Profiled metal constructions have a number of good sides especially if they are used for big dimension windows; that is firmness and resistance towards deformation from the outside influences. But their quite high price is one of the reasons for a man to use wooden windows especially in the massive building construction. The work with aluminum understands preciseness and accurateness of details, knowledge about constructing and anything else that in other case could be crucial for a successful architectonic achievement. In other words the application of the aluminum in architecture is not liable to any improvising, so none of what was previously considered "normal" in manufacturing of the traditional building. The architect has a duty to establish the primary role of the plastic expression as a specific element without whom the architecture cannot exist. The human being in the course of its long development made efforts to make the production of its products easier and not to lose their beauty during the process.

II. ARCHITECTURE OF THE HIGH TECHNOLOGY

The Producers of every element for the needs of the human have always been torn apart

Between the functional and the esthetic. Depending on the period of development stage, the sort of the product and the buyers' needs the first or the second component prevailed. Generally spoken the utility products gained the functional component as a stronger part while the products for spiritual needs gained the esthetic and artistic component. However, one is certain: the utility products have not lost the second component. On the contrary, consciously or not, it has been included in the process of production. Mostly it was made on purpose. In building its homes man applied the whole knowledge and skills. Even when it was necessary the problem "a roof over the head" to be solved man made it in a remarkably practical way, but in the end the object still had some esthetic characteristics.

Pic. 1.

III. CONDITIONS WHICH INFLUENCE THE CLASIFICATION OF THE FACADE ELEMENTS

In the development of the refabricated facade elements in the contemporary architecture many kinds of elements occur. The problem appears in the way of their systematization. The question is by what methodology is most right for their systematization. The most simply vision is by:

1. Their function
2. Shape and esthetic
3. Their dimension
4. The material used

The function and shape of the facade elements are features which are main. They are in mutual dependence, and the remaining two features could be regarded as additional. So in the further discussion the accent will be put on the function and the esthetic.

3.1. Function of the facade elements

Regardless all other components the mutual function of all kinds facade elements is in the creating of the inner space ex. separating it from the outer space and creating conditions in which the microclimate different from the outer can exist. Thus, we are forced to give those elements physical shape since every physical shape has its own (none) esthetic features. In that way the function and the esthetics are in dialectical unity. The most important conditions that influence the determining of the function and the facade elements are:

-The climate
-The function of the building
-The wealth of the investor
-The technical "culture" of the constructor

The climate has direct influence over the determining of the function of the facade elements. For example the role of the facade elements as brisolei is entirely positive in the warm climate regions and completely negative in cold regions. But the facade elements with huge glass windows are not suitable neither for warm nor for cold regions-but for normal climate regions. The function of the elements in a building can change from facade to facade depending on the orientation. So elements which protect from the sun on the east and the west side could not be used on the west side. The function of the building: In determining the function of the facade elements has such influence that many times we could recognize its function by its exterior look. Sure we would not use decorative facade elements in constructing a storage building or to use brisolei in the construction of an industrial building. The assets of the investor should not have big influence in determining the function of the facade elements. The function should be achieved by the architect and at the same time he should solve the eventual use of more economic material.

3.2. Dimensions of the facade elements

The dimensions of the facade elements mainly depend on:

-the level of the building technics
-kind of the material used
-shape and esthetic needs

The level of the building technics gives opportunity for using mouthing elements with bigger dimensions made of heavier materials. If the level is lower than we use mounting elements with smaller dimensions made of lighter material, which is not necessarily a rule.

The kind of the used material is in direct relation with the dimension of the facade element and the physical shape depends on it. In the process of choosing the material we should be guided by the function and the goal is to be economical in the construction.

Shape and esthetic needs are not of great influence on the dimensions of the facade elements since we can for example gain chopped up structure of the facade with bigger panels but that will only be possible if the physical characteristics of the material allow it.

3.3. The used material

The classification of the facade elements by the used materials would be very wide one and yet the comparison is of no big importance. We saw that material has influence over the function of the elements and their shape and dimension through which the role of the material is already (at least greater part) described. Here we only have to mention the choice of the material in relation with:

-The function of the object and
-The function of the material

The function of the object plays important role in the choice of the material. Some aspirations in the modern architecture brought the use of the NATUR -Concrete even in the buildings for living. Now in some countries in the world we have notices that this material is harmful for the human metabolism.

IV. ALUMINUM USAGE IN THE ARCHITECTURE

The role of an outside wall could be with more functions: constructive statically, architectonic esthetical, functional-limiting of the space, providing the needed inner regime, opposing the climate changes like: rain, snow, wind, heat, cold, sun, diffusion, condensation and noise. All these needs and tasks were solved by so called traditional building materials like: stone, brick, concrete etc. But nowadays the fast development of the

technology in the building materials industry, there is an expansion of new building materials with high qualities: they are light, have good sound and heat isolation, they are good for transport and mounting, have possibilities for dry mounting and elimination of all wet processes in the construction, they are immune to oxidation and diffusion of the steam and give new opportunities for architectonic shaping.

Such new building materials replace the traditional materials as brick, stone and concrete because they satisfy the needs of an outside wall. Combining them we get a new kind of so called wall panels (of two and more layers). Each of the elements of the "sandwich wall" has a certain task to protect from one or more climate changes. The mutual characteristic of all kind of facade wall panels "curtain wall" is that they do not carry but are carried and refabricated. Because of its relatively small weigh (ca 80 kg. /m2) they are often called "curtain walls".

In the literature a lot of opinions about the definition of the "wall curtain" can be found. In the american literature we find that "wall curtain" is any facade wall that does not carry the load of the upper floor but is carried by the construction of the object. According to that curtain wall could be refabricated brick wall, light concrete wall etc. In that case it is regarded as an old curtain wall or the opposite if we talk about lighter refabricated facade panels they are referred to as new curtain wall.

In the German literature under the name of the curtain wall we read about light facade membrane made of: glass, tinplate, plastic, aluminum or sandwich light and heavy refabricated panels.

Such construction of curtain wall most frequently is placed in front of the carrying skeleton construction and is fastened to it through direct points through which the load from the wall or from the forces of wind is transferred.

Pic. 2

4.1. First beginnings

Aluminum, a typical product of the industrial and technological revolution discovered at the end of the last century found its place after its alloys were discovered. We can claim that the development of the airplane industry in the Second World War had an important role in the production of aluminum as well as in the development of the similar industries linked with the processing of the aluminum. Aluminum keeps its important place until today and has the tendency to keep it in future.

4.2. Matters of influence on the further development

Though the conditions for application of the aluminum existed from the very beginning of its inventing the beginning was very slow step by step and the mass application of it was got its real place in the seventies. That this is a fact there are three reasons:

-Relatively expensive process of getting the raw aluminum
-Relatively complicated way of production construction and making components and products of aluminum.

Traditional resistance of the architects towards any new thing. It is known that the price of the aluminum is about three times bigger than the price of the steel. Part of the difference in the price could be compensated taking into consideration that aluminum with lower firmness is three times lighter than steel.

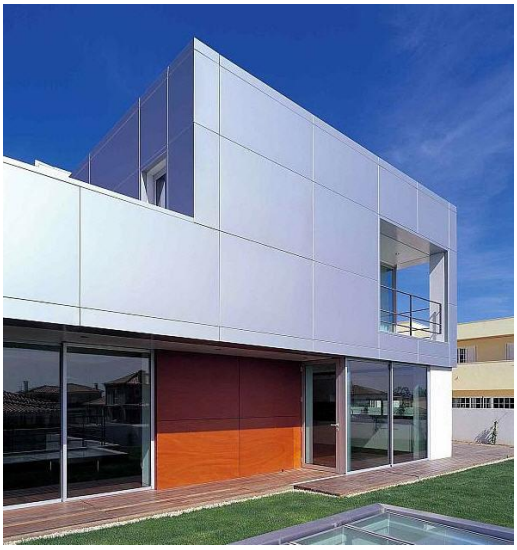
The resistance of the architects to work with the new methods of drawing up plans production and construction which require industrial building instead of manufacturing is the other reason that aluminum is more and more difficult to except as a building material. Since aluminum besides the modern glass with which it is very often found in symbiosis, is most delicate material on the architectonic objects, it requires from the constructors and from the producers knowledge about the artistic shape and its technical and technological physical features.

Work with aluminum understands precision and punctuality of details, knowing of the civil physics and everything else that in many cases could be crucial for successful architectonic achievement. In other words, the application of the aluminum on architectonic objects does not stand any improvisations repairing or additional repairs and interventions that is nothing of what is considered "normal" in the manufacturing or traditional construction.

The third reason is the traditional resistance of the architects towards any new thing and materials as well so in this case towards the aluminum. At first glance it seems that it comes out

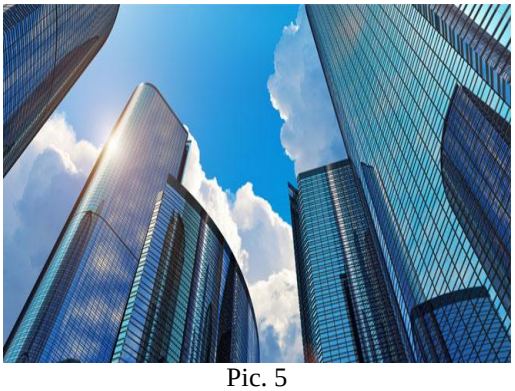
from the previous reason since every innovation requires certain efforts so architects often are accused of being "lazy to learn and keep with the tradition".

So what is the situation with the aluminum and its application in the architecture? It seems that the above mentioned three reasons are gradually being overcome. When architects would know about aluminum at least to that extend that they know the concrete or the steel we can say that the possibilities for shaping the aluminum are understood and that there are no limits to its mass application in the architecture.



Pic. 3

Pic. 4



Pic. 5

V. CONCLUSION

The outside wall (facade sheet) underlies to special criteria of the architectonic choice and is a synthesis of all efforts to achieve polychromic, dimensional harmony a number of technical and economic decisions to the circled architectonic idea.

On the road to making an idea come true there are lots of obstacles which have to be taken into consideration. The outside wall or surface construction basically consists of transparent and none transparent surface constructions.

Transparent surface constructions are determinate by the total surface of the outside wall with functions like: protection from heat, moist, noise, fire, light, by which there is a complex interaction that is crucial for the microclimate of the space and for the expenses in connection with it.

Today's needs for saving the energy through surface constructions of the buildings require right choices from us and it is heavier to make them in the relation of total expenses of building, maintenance, heating, lighting etc. They can be determined only by evaluating analysis with experienced mutual functional relations.

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