The Effect of Technological Progress on the Quality and Aesthetics of Modern Sanitary Facilities

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Abstract. Taking into account the possibilities of modern technology and its application in the area of hygiene and sanitation, we can observe a significant change in the quality of the bathroom resulting from the transformation of individual bathroom systems and devices that do not avoid rapid technological development, adapting them to the requirements of modern times.

Although the latest technology achievements in the field of bathroom facilities often surprise with their complexity, the amount of features and capabilities of the technique, by which apparently may seem complicated, however, degree of comfort which they offer is convincing about the proper actions of designers and manufacturers. Actions which primary purpose is the convenience, safety and functionality of the use of technologically and aesthetically advanced devices. Also, their hygiene, mobility and ease of use and the ability to easily keep clean are necessary. The solutions used in modern bathrooms are designed to simplify and reduce the cost of their construction. Saving of water and energy is also an important issue.

The possibility to use any innovations provides much greater freedom in shaping and arranging, the opportunity to implement the original design ideas, and thereby the ability to create individual, unique hygienic-sanitary objects. All these actions result from the requirements of the present times and emerging needs of the modern user and are based on numerous studies and analyzes concerning the possibility of shaping the bathroom.

Keywords: Sanitary facilities · Technological progress · Modern bathroom design trends · Modern technology in the bathroom · Sustainable bathroom · Ergonomics

1 Introduction

Realizing the potential of modern technologies in the field of hygiene and sanitary area, now understood not only as a place of hygiene, but also a place of recreation, significantly helped to change the appearance and functionality. An important change of

M. Antona and C. Stephanidis (Eds.): UAHCI 2015, Part IV, LNCS 9178, pp. 291–302, 2015.
DOI: 10.1007/978-3-319-20687-5_28

bathroom quality is the result of transformation of individual bathroom systems, equipment and appliances. Many of them were subjected to continuous development and numerous modifications and completely changed their appearance, becoming independent of the prior models, and even eliminating them. Their shape, structure, production technology, and even the principles of operation, have been changed. In other with coexisting bathroom fittings and devices occurred only slight changes, often imperceptible at first glance. Referring to the solutions of many years ago, while retaining their basic characteristics, they have become a kind of continuation of the older generation devices. However, they did not avoid rapid technical and technological development, adapting them to the requirements of modern times and the changing needs of the contemporary user.

2 The Technical Quality of Tap Fittings

Elements which not only permanently changed the appearance, but primarily affected the functionality of the bathrooms are elements of tap fittings. For a long time the classic models with handles and two separate valves were the only choice. They consumed relatively large amount of water while achieving the desired temperature. Also the control process was uncomfortable, and the position of the handles did not give even an approximate idea of the temperature of the water flowing from the faucet. It was completely out of the control of the user eyesight. Therefore, the structural simplicity and low price of these solutions have been relegated to the background. Need of eliminate defects caused that designers and manufacturers of fittings have started working on the idea of the device that does not require too much force for handling, and using free hand movements could be a quick and easy way to control both stream flow and water temperature. The solution that emerged at the turn of sixties and seventies, the so-called "ceramic cartridge", in its basic form has survived to this day, and affects the shape of modern single lever mixer taps. Single lever faucets were not the only solution that has affected the quality of use of sanitary fittings. Already known thermostatic faucets have become more and more popular in the early seventies significantly increasing safety and comfort of use of tub and shower. Systems used in thermostatic faucets have allowed precise and stable maintenance of the water temperature setting, regardless of changes in the installation. The main idea of the thermostat has remained unchanged to this day [4, 11, 15] (Fig. 1).

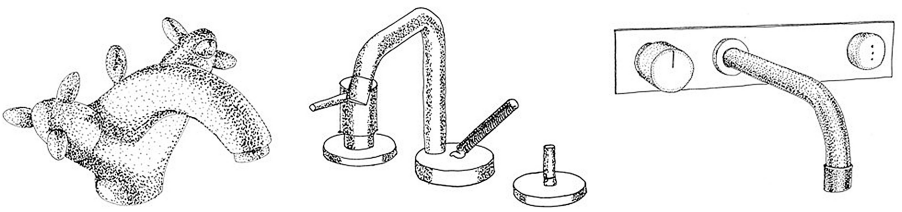

Fig. 1. Sample forms of modern tap fittings as a fusion of the latest technology and design (Source: own work).

The real breakthrough in creating a modern tap fittings came with the use of electronics. In the second half of the eighties a small group of the largest tap fittings manufacturers began to widely introduce its first touchless electronic taps. In addition to water-saving features, electronic taps also enabled unprecedented hygiene of use through free-touch operation. These solutions have largely contributed to improving the quality and comfort of use of bathroom fittings by persons with disabilities. These devices are constantly innovated, which is reflected in the latest top achievements in the field of digital and electronic batteries. They represent a new quality in terms of water flow control. For maximum hygiene, they provide possibility to program regular automatic flushing one to few days after the last usage to avoid water stagnation – an important feature for facilities that are not used on a daily basis [5, 17].

3 The Impact of Technological Progress on the Quality of Use and Aesthetics of Bathing Facilities

Among the complex bathroom equipment, shower is an element that despite the common associations related to standard shower head, handle and wall bar focuses the attention of designers and manufacturers of fittings. Since the time of the introduction of the shower bar by Hansgrohe in the fifties, can be seen two ways to find the perfect shower. First is a continuous process of improving the classic version of the shower, or modifications of shower head and handle and their fasteners and connections. The second is the search for a new form of shower set [8, 11].

3.1 Modifications of Shower Head and Handle

The first way has led to various forms of shower heads that provide several types of flow, in addition to the standard and diffuse stream, also special streams - massage jet, aerated, economic, etc. The shower heads are protected against limescale and other impurities, which are probably the greatest threat to their efficient functioning. Other improvements, which strongly affect the quality of shower set are a silicone nozzles at the outlet openings, filters hidden in the handle that can be rinsed and special pins hidden in the head that push the sludge from the nozzle [11].

Numerous innovations also include the entire hand shower. In the latest hand showers traditional handles are equipped with the Rota Head - pressing the button allows you to rotate and set the head in any position. The direction of the stream is determined by the rotation of the head, without moving the handle. This feature also allows the massage side stream even when the shower is mounted on a immovable wall bar. Shapes and sizes of mobile hand shower have been adapted to the different sizes of the hand and provide selected direction of the stream offering three types of this - gentle, uniform and normal. Modification the type of stream can be done in a simple way, by moving the slider on the side of the hand shower [3, 8, 11] (Fig. 2).

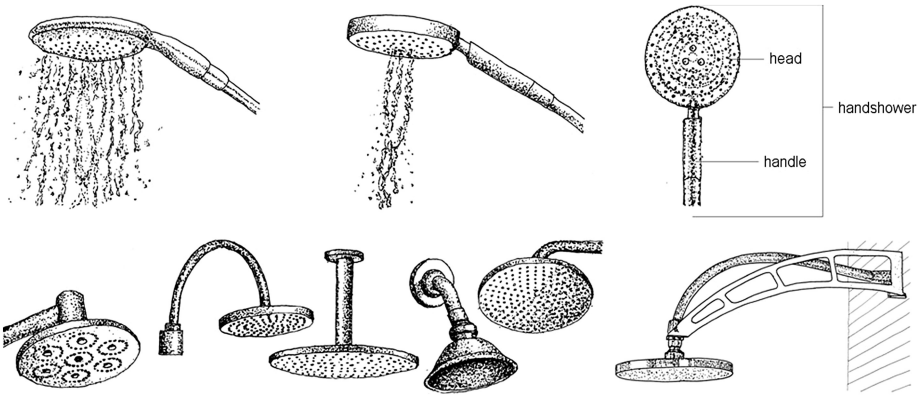

Fig. 2. The classic version of the shower head and the handle is still improved (Source: own work).

3.2 Modification of Shower Sets

Complex modifications influencing the form of shower and shower sets are the result of the continuous analysis of designers and manufacturers. In solutions combining the idea of panel and shower set, classic handle is replaced with rotating arm (angle of rotation 180 degrees) to which two shower heads are fixed. Movable heads with handle allow for easy set the shower at the top or side position. Two types of stream, plain and pulse, make the user, in addition to the classic shower, can take advantage of the massage panel [11] (Fig. 3).

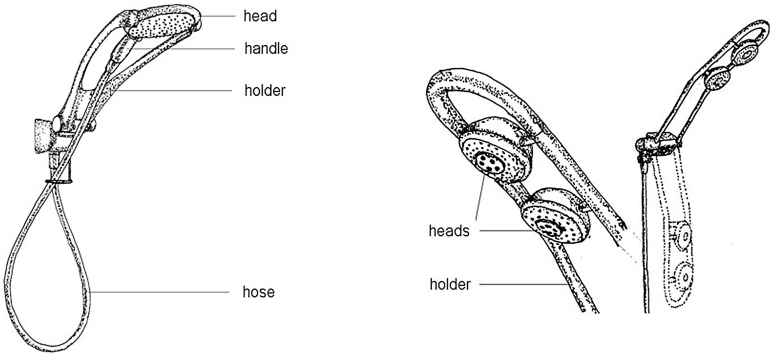

Fig. 3. Movable heads with handle allow for easy set the shower at the top or side position (Source: own work).

Shower panels and columns are other interesting solutions. With a combination of recessed and surface-mounted components all elements of the installation can be hidden in the wall. Column resembling classic shower bar, topped with shower head

usually with the function of rain shower, is the outer, visible part. Shower handle and retractable shower hose is pulled out in the bottom of the column. The heads are usually equipped with numerous nozzles and in addition to conventional shower, allow for hydromassage, or imitate a waterfall [1, 6, 8, 11] (Figs. 4 and 5).

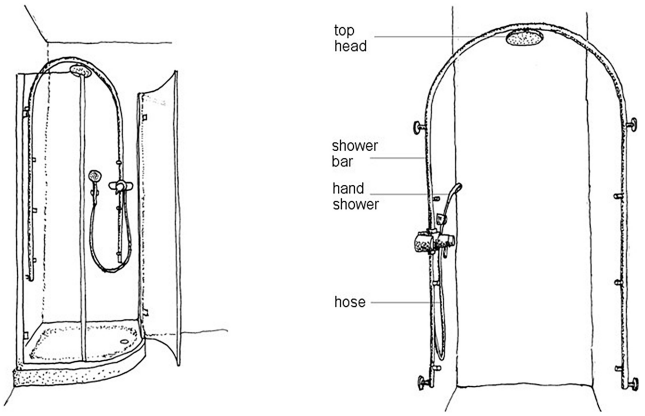

Fig. 4. The arc-shaped shower set, upper and hand, can be mounted both in the cabin and between two walls (Source: own work).

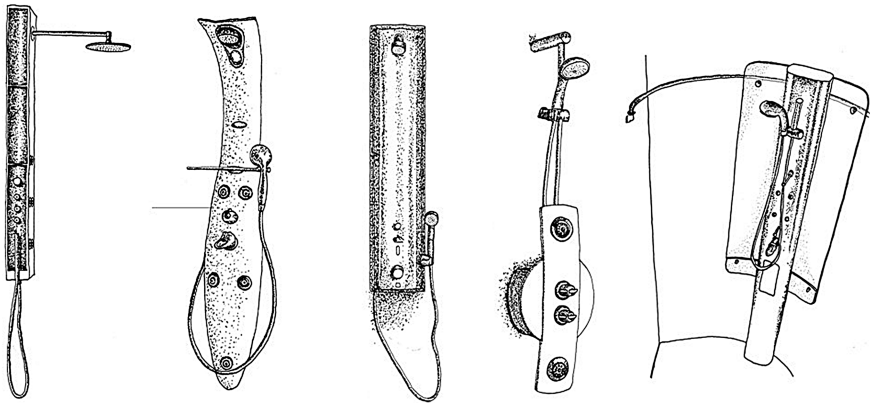

Fig. 5. Additional side shower nozzles are used for hydromassage. (Source: own work)

Modern shower features were supplemented not only the possibility of a massage, but also an increasingly popular "rain". Rainfall shower heads are mostly in the form of flat plate or bowl. However, you can find more unconventional solutions different from traditional forms. Evolution includes not only the form of rainfall showerhead, but also the ways of their installation. Rainfall showerheads can be installed directly on the

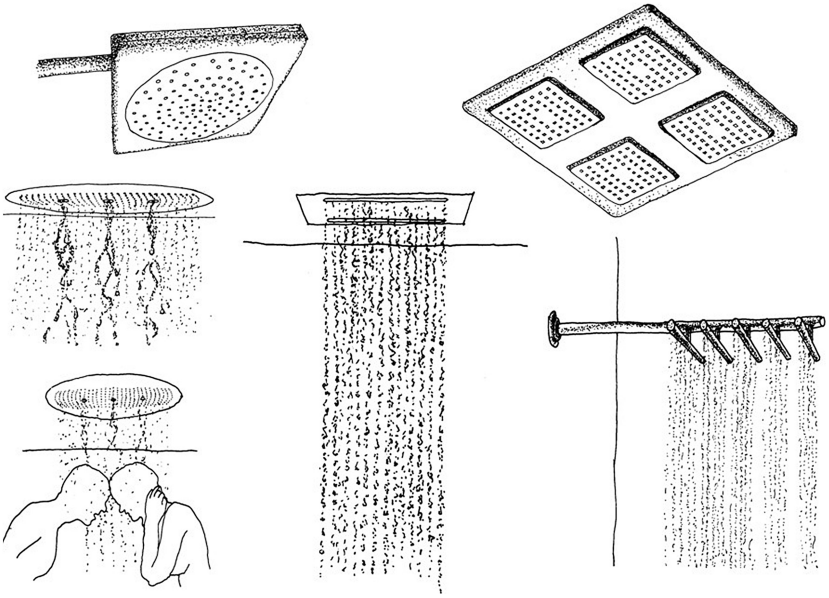

Fig. 6. Innovative ideas for rainfall showerheads helped create functionally and stylistically interesting solution of shower for two people (Source: own work).

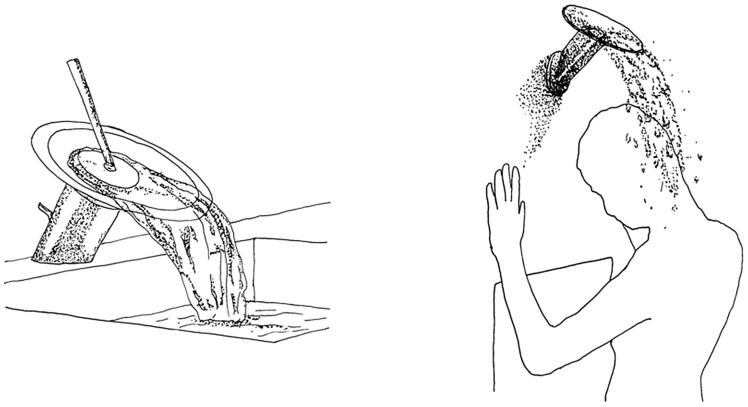

Fig. 7. In the cascade systems flow of water is regulated by a recessed mounted thermostat. (Source: own work).

ceiling or on the wall. This allows for independent of the other elements of the shower construction [8, 11, 16].

Cascade or waterfall shower is one of the modern trends in bathing facilities. This system is used for shower sets and basin mixer fittings [3] (Figs. 6 and 7).

Recessed-mounted shower-massage system is a solution that is becoming increasingly popular. Flush-mounted on one, two or three walls it gives you more opportunities to arrange in comparison with shower panel. It's not just about the number of side nozzles, but also about their setting that allows you to direct the stream to any part of the body, and thus adjusts the massage to individual preferences [7, 11] (Fig. 8).

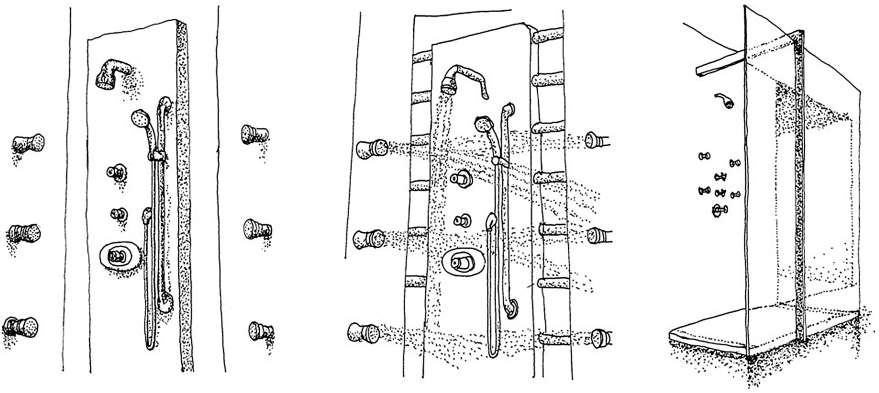

Fig. 8. The use of flush-mounted massage - shower systems, has introduced a new quality in the field of shower equipment (Source: own work).

3.3 Modifications of Shower Cabins

Modern shower cabins are equipped with functions for both hygiene and relaxation. Among them you can find models suitable for standard bathroom and for bathing room. Cabins are made of high quality materials, with a tendency to a maximum of lightness and transparency. They allow the user to have the easiest access to the shower and the comfortable use of it, without causing complete closure and a sense of isolation from the rest of the bathroom during this action. Contemporary trends in the design of the cabins tend strongly towards minimizing the number of structural profiles for the maximal surface of fillings which diversity of materials and patterns is practically unlimited. The user can choose between the smooth, transparent surface, or decorated, structural. The surface of the cabin is usually made of polystyrene and "safety" tempered glass. In order to increase the comfort of use of cabins, for the sake of maximum hygiene, on their surfaces are used special coatings that protect against dirt, sludge and bacteria [14, 22].

An important issue in terms of convenience and safety of cabin use is easy access to the inside. Such structures and attachments are used that allow for effortlessly maneuver to open the cabin door. They also enable fast, easy, possible without additional tools, moving them from the guides for precise cleaning of places that are often inaccessible. An important feature of modern cabins is diversity in terms of size, which allows for easy adaptation to the needs of users. Cabin seal is a separate issue which is appreciated by the users especially in the case of any problems. More perfect sealing

systems are used for this reason. Also, other elements of shower cabins, such as hinges, handles, or various types of connectors are gradually modified. Easy access to the interior of the cabin is also possible thanks to modern shower bases that are very low and shallow. Increasingly, they are completely eliminated, and such solutions are the best complement to the modern concept of removal of divisions in the bathroom space [14, 22].

Modern shower cabins are multifunctional. They combine the functions of hygiene, health and relaxation. They provide an opportunity of chromotherapy, aromatherapy and music therapy. They can be used as a steam room. All of these features are available via the control panel or the remote control [10, 13, 19, 21] (Fig. 9 and 10).

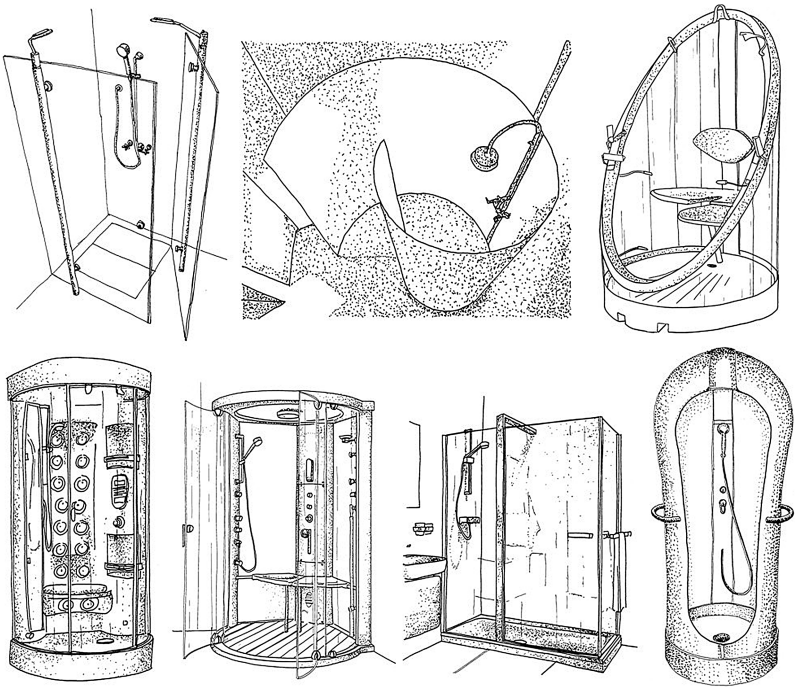

Fig. 9. Examples of forms of shower cabins (Source: own work)

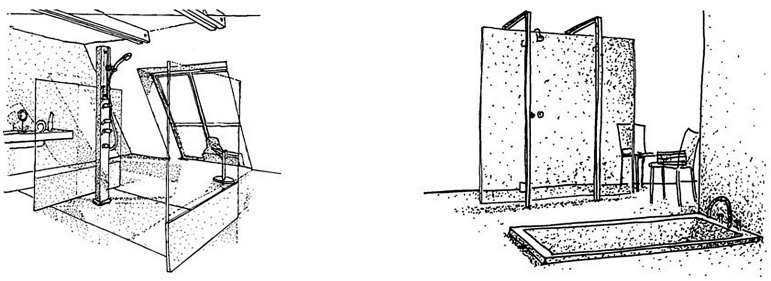

Fig. 10. The glass elements in the bathrooms (Source: own work)

3.4 Characteristics of Contemporary Bathtubs

The trend in the pursuit of transparency also includes another part of bathroom equipment such as bathtubs. We can talk about a unification of the bathroom because transparent tubs are referring in its design to modern shower cabins. Sometimes the glass is the predominant part of the tub, reminiscent of "aquarium", sometimes its use is limited to glass fragments or entire walls. The use of glass does not interfere with the placement of hydromassage nozzles in the tub, on the contrary, their launch and the introduction of water into a dynamic movement can affect the visual and aesthetic quality of use of the bath. Illuminated bathtubs are an additional attraction [2, 12, 20] (Figs. 11 and 12).

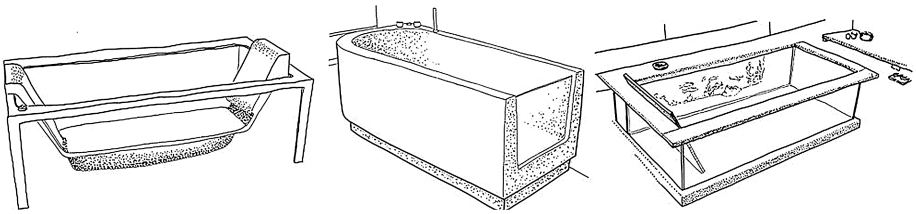

Fig. 11. Examples of the use of glass in bathtubs (Source: own work)

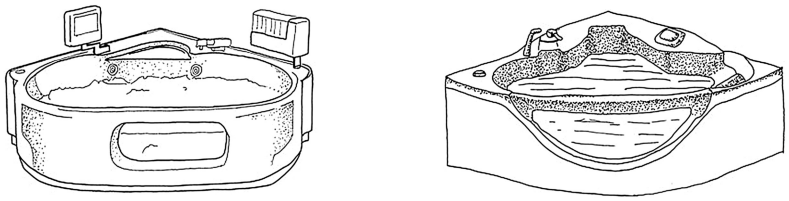

Fig. 12. Bathtubs with hydromassage and with glass „window" (Source: own work)

4 Contemporary Trends in Shaping of the Toilet Seats

The toilet seat is an integral part of the toilet bowl, while perhaps the most decisive for the convenience of using it. The first toilet seats, as the name suggests, were made of wood. A variety of shapes and colors appeared, when the plastic, easily and well formed, began to be used in their manufacture. The shape of the toilet seat can be unrestricted. Usually, however, it is a subordinate to sanitary ceramics form. Nowadays, it is not always conventional, so among the toilet seats can also be found other than the traditional - round, oval, square, octagonal, etc. Also, the cover of toilet seat may not be typical. It can be smooth, textured, decorated with various patterns. Wooden toilet seats are still manufactured. They are usually simple and smooth, very often treated with special preservatives [9].

Proper mounting toilet seat on the toilet bowl is an important matter, on which depends the convenient use of the toilet. Various methods are known, however usually attachment made of plastic, chrome-plated or gold-plated metal is used for this purpose. Systems for rapid assembly and disassembly of the toilet seat, which play an important role when it comes to maintaining the hygiene of both toilet seat and bowl are becoming increasingly popular. Special hinges or so-called "quick couplers" are used in these systems. Automatic, "soft close system" of closing toilet seat and cover is already quite standard solution. Soft close system features hinges that gently lower the toilet seat and cover to a close when pushed down. The quantity and quality of the support elements also determines the functionality of the toilet seat. Number of supports depends on the hardness of the seat. Toilet seats made of soft plastic with inflexible supports are more susceptible to deformation or fracture. Preferably, the supports are elastic and silencing the sound of the falling cover. Seats and covers with special lifting handles are other interesting examples [9].

The material that is used for the production of modern toilet seats and covers is duroplastic. It is a modern material characterized by high mechanical strength, scratch resistance, surface smoothness and color stability. Contemporary technologies allow to eliminate material micropores, in which penetrate the bacteria and dirt. Duroplastic properties also cause that the toilet seat are not destroyed by the action of detergents and disinfectants. Toilet seats made in the "sandwich" technology are resistant to cracking and breaking. This is a technology based on high-performance composite structure of polypropylene with elastic filling of the toilet cover [9].

4.1 Multifunctional Toilet Seats

Multifunctional toilet seats are another sanitary-hygienic devices that introduce the latest technical standards to the bathroom and another elements which aim to ensure maximum functionality and comfort. In addition to the aforementioned features corresponding to the modern trends in the bathroom, multifunction toilet seats have additional properties affecting the quality of their use [18].

Automaticity and reducing to a minimum manual operation, make use of them is easy and comfortable. Water washing toilet seats indicate not only hygiene and comfort, but their use has a positive impact on the alleviation or elimination of many inconvenient health problems. They are also indispensable in the care of the elderly, the disabled, people after surgery, women in the postpartum period. Properly selected streams of water allow dispense with the need for toilet paper for a more delicate form of hygiene. Nozzles placed on the moving arms are essential elements of multifunctional toilet seats. The first models were equipped with nozzles responsible for the traditional function of a bidet. Systems with duplicate nozzles and shoulders for individual functions have been developed recently [18].

Washing function, or the use of a oscillating water stream having carefully programmed temperature and pressure of the flow is an essential function of the multifunctional toilet seats. Retractable nozzles placed on mobile spray arms are extended only to the working position at the moment of use, otherwise they allow the unfettered traditional use of the toilet seat. The electronic control system is responsible for

maintaining the purity of the individual elements. Automatic cleansing the arms and nozzles takes place before and after use of toilet seat with special disinfectants dispensed by the electronic system. Washing system of multifunctional toilet seats is complemented by drying systems. Electronically controlled dryers significantly increase comfort and hygiene of using the toilet seats and also improve their health benefits. Numerous solutions, including thermostats and thermal safety-valves, ensure safe use (Fig. 13).

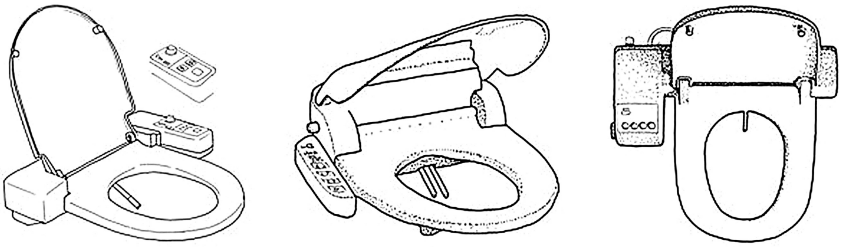

Fig. 13. Examples of the multifunctional "intelligent' toilet seat (Source: own work)

The Japanese toilet company Toto, excels in the production of "intelligent" toilets, in which the most advanced technology is used. Electronic toilet seats with washing and drying systems offer many functions. They feature a heated seats, warm water massage system, warm air drying system, built-in automatic deodorizer and digital thermostat. Automatic opening and closing toilet seat and cover are additional features. Stimulator of toilet flushing sound can mask any unwanted sounds made by the user. Latest toilet devices have additional medical functions, enabling the analysis of urine and blood pressure measurement and data transfer via modem to doctor. The electric raised-seat toilets that provide a lift mechanism to assist the user in getting on and off of the toilet serve as an aid to the elderly or disabled [18].

5 Conclusion

Selected from coexisting in the hygienic and sanitary area and discussed in the article systems and devices, belong to a group of bathroom solutions and equipment, which characteristically and permanently have changed the image of the place - appearance, but in particular its functionality, and significantly have influenced the change in its quality.

The main directions of contemporary designers and manufacturers activities and features of innovative components of bathrooms are:

- multifunctionality - which is a response to the diverse needs of users,
- safety - primarily safety in use, meaning not only comfortable use of the facilities, but also their efficiency, reliability and ease of maintenance,

- ease of use - the possibility of a simple, rapid control method that does not require too much manual dexterity and understanding of complex principles of operation,
- hygiene - ability to keeping cleanliness and easy maintenance and cleaning,
- saving water and energy - allowing for minimal use of the necessary natural resources without the effect of reducing the comfort of using the bathroom,
- aesthetics - application forms and materials that ensure aesthetic appearance of equipment and finishing regardless of the period of use, the so-called technological durability
- freedom in the design and arrangement of bathrooms - mobility of devices, the ability to choose any place of their location and moving them after installation.

These examples are intended to illustrate phenomena and achievements related to the evolution of the bathroom equipment, which until recently were only an idea. It has been implemented as a result of experience, research and creative work on the possibilities of shaping the sanitary-hygienic area. Therefore contemporary user can use the bathroom as it did before, except that it is more readily available, much more comfortable, safer, more pleasant and often more economical.

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