

**MODERN TECHNICAL SOLUTIONS OF FOREIGN BATTERY MOULD**

**KATSIARYNA RAZUYEVA, LUDMILA PARFENOVA**  
**Polotsk State University, Belarus**

*Review of foreign battery mould production Weckenmann (Germany), EBAWE (Germany), Elematic (Finland) is made in the article. It is noted that the use of optimized designs of battery form allows you to get inside the wall panels with precise geometric dimensions, the required category of the concrete surface, which does not require additional processing on the construction site.*

In the long-term production of concrete panels, experience shows that in comparison with other modes of production, tape technology provides higher productivity, requires much smaller production areas, reduces the consumption of electricity and heat, and in steady-state production ensures high stability of product quality, eliminates manual labor. Winter conditions determine the priority role of construction using precast concrete.

Modern building panels established themselves as a technology that can provide the required amount of budget accommodation at a low cost and short construction time. Projects of modern series of panel buildings allow to build facilities of more than 20 floors. Erected housing meets the requirements of quality, comfort and safety. Improved layout of the apartments, a large number of options for the interesting and unusual appearance, a well-developed internal infrastructure of buildings can compete successfully with cast-frame technology. In the Republic of Belarus large-panel construction accounts for 21.5% of total housing [1]. This was made possible by the existing network of concrete plants and their efficiency.

Most of the plants of the Republic of Belarus use tape manufacturing technology of internal wall panels. The following objectives are urgent for the tape technology: the improvement of technological processes of manufacture of precast concrete structures, the improving of their quality, the reduction of the material of construction, the use of cost-effective methods and heat treatment regimes for concrete, the reduction of the vibration of the equipment, as well as the development of chemical-technological processes for obtaining materials with desired properties.

A feature of cassette technology is molding in a vertical position in fixed detachable metal group form-cassettes, i.e. laying, compaction of the concrete mix, as well as the curing is performed in a narrow and high (slit-shaped) cavity working compartments. Depending on the material of the dividing walls cassette metal, concrete and armocement are distinguished. According to the construction of cluster dividing walls may be of flexible forms - metal steel sheet 24 mm thick and continuous armocement sheets up to 50 mm thick or rigid - spatial metal boxes or concrete slabs 100–120 mm thick [2].

Hard metal hollow walls are used when they are used for cooking and as a concrete wall when pulling force reinforcement, and in the case where the molded article has a complicated profile. Hard partition walls require significant consumption of metal. Noted [2] that the flexible dividing wall construction must ensure the immutability of geometrical sizes of products and the efficient transmission of vibration from the vibrator to the concrete mix. Since it is practically impossible to apply the concrete mix uniformly in all molding compartments, partition walls experience significant hydrostatic pressure. To prevent the bending of the wall, they set the locking cones which are provided with additional supports and accurate design position of the walls in molding articles.

Battery formwork manufactured by Weckenmann (Germany), are traditional, well-established, but considerably optimized and newly redesigned (Fig. 1). Obvious advantages are filling separate compartments, reliable design with margin of safety with minimal tolerances for flatness; principle of service to the shop floor, providing easy access to the space between the disclosure of the boards and easy stripping using a device with a small lifting height; the use of special vibrators with optimized design to achieve high quality concrete compaction and perfect surface appearance, without unnecessary noise and wear of equipment; heating system using hot water or thermal oil, ensuring minimum uneven temperature distribution in the working surface of formwork; hydraulic coupler formwork with a pressure control system to ensure absolute tightness [3].

The new development of the company Weckenmann is a mobile battery mould that allows you to make concrete wall panels in the vicinity of the construction site. The technical solution includes installation of a cassette formwork on a special vehicle in the form of a semi-trailer, which can be combined with a conventional tractor (Fig. 2) [4]. Trailers are used for transporting the core and the outer formwork. Central formwork and other components of formwork cassette, for example, the control system, the heating elements and the hydraulic

unit are fixedly mounted on the trailer. Additional work platforms, for final assembly of formwork and other small components are delivered to the construction site by conventional trucks [5].

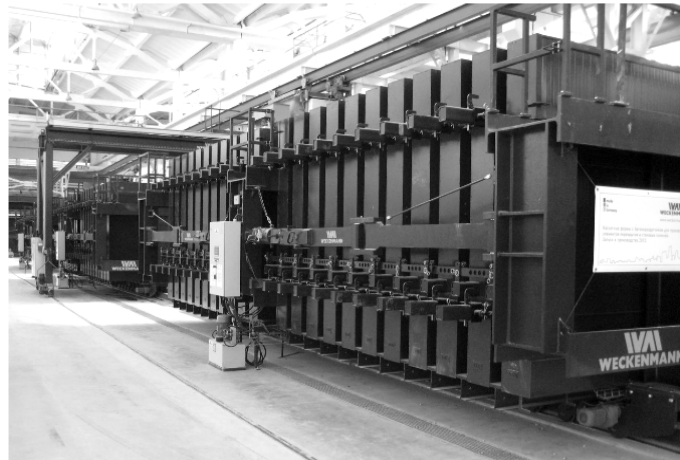


Fig. 1. Weckenmann Anlagentechnik GmbH battery Mould



Fig. 2. The Mobile Battery Mould Weckenmann Anlagentechnik GmbH

Battery mould is composed of:

- rigid central member;
- two mobile external panels with easy-to-service electromechanical drive;
- several (typically – 18 pcs) movable intermediate shuttering panels;
- vertical side and horizontal supporting of formwork panels according to the thickness of the element.

Their position is adjusted according to the size of various elements;

- electric vibrators for compacting the concrete mix integrated into the wall of formwork, which are powered by a frequency converter, providing stepless speed control. This allows you to optimize the quality of the sealing and noise emissions;

- a heating element disposed within the formwork to accelerate the hardening of concrete with reduced power consumption;

- hydraulic power unit and two hydraulic cylinders for reliable and hermetical formwork [4].

The first two units were delivered in 2015, to two major construction companies in Singapore. There were [6] prospects of using mobile Battery Mould in a city with a population of nearly 5.5 million people, which is an active construction, and there is little room for the industrial zones for stationary concrete products.

EBAWE Anlagentechnik GmbH (Germany) offers battery mould (Fig. 3), consisting of intermediate walls, between which it is possible to simultaneously mould multiple concrete elements. The number of intermediate walls defines the number of caulking sections - it varies depending on the required performance. Axial wall with built-in hydraulics determine the position of a package of intermediate walls. During manufacture they compress the whole package. Vibrators at the intermediate walls provide effective sealing of fresh concrete. Cassette forms may be of different sizes having different numbers of compartments casting, and be single or double [7].



Fig. 3. Battery mould EBAWE Anlagentechnik GmbH

In The leading supplier of equipment for the manufacture of precast concrete products in the CIS countries, the Baltic States and Western Europe is Elematic (Finland). The company manufactures production lines for the production of large volume and wide range of precast concrete products [8]. Technological lines PRO. and EDGE include cluster systems for manufacturing solid wall panels and slabs. Dispensers can be single- or double-sided. Both sides of the tape can be used independently.

2013, the Finnish company Elematic won the tender for the supply of technological equipment of large-panel house building «Construction and mounting trust №16». The implementation of the investment project "Reconstruction and modernization of large-panel construction «Construction and mounting trust №16» allows the company to issue a series of articles modernized to 100 000 m<sup>2</sup> of housing per year [9]. The introduction of a new technological line allowed the company to increase the production capacity of the plant of large-panel house building, improve product quality and reduce operating costs.

In the current economic conditions panels compete with the framework design scheme due to lower costs and reduced time of construction of buildings. In this regard, the definition of areas of improvement of technological processes of production of cassette panel construction, improve their quality is an urgent task for the plant of concrete products and panel construction.

Analysis of international experience shows that getting the internal wall panels with precise geometric dimensions, the required category of the concrete surface, which does not require additional processing on the construction site allows the use of cluster systems of optimized and customized designs. Modern cluster installations have robust, sealed construction with hydraulic coupler of formwork and special vibrators to ensure high quality sealing of concrete and the perfect appearance of surfaces.

#### REFERENCES

1. Пилипенко, В. Перспективы развития сборного железобетона в Беларуси / В. Пилипенко // Жилищное строительство. Архитектура и строительство. – 2010. – № 1 (212). – С. 45.
2. Мастерская своего дела [Электронный ресурс] / Технология бетонных и железобетонных изделий. – Александрия, 2006. – Режим доступа: <http://msd.com.ua/tehnologiya-betonnyx-i-zhelezobetonnyx-izdelii/obshhaya-karakteristika-kassetnogo-sposoba-proizvodstva/>. – Дата доступа: 25.10.2016.
3. «Еуро'ра» – новое слово в панельном домостроении / Д. Косяков [и др.] // ЖБИ и конструкции. – 2010. – №3. – Р. 52–53.
4. МЖБИ Мобильный завод по производству железобетонных изделий, 2015 : каталог-справочник / сост. В. Шульц. – Кельн, 2015. – 33 с.
5. Transportable precast factories in operation in Singapore // CPI – Concrete Plant International. – 2015. – № 6. – Р. 174–175 .
6. Asian companies choose new production concept with mobile battery formwork // CPI – Concrete Plant International. – 2015. – № 2. – Р. 200–202.
7. Беларусь продолжает инвестировать в будущее – при помощи двух новых производственных линий фирмы Ебауе КУП «Брестжилстрой» построит в будущем новые жилые комплексы / Д. Косяков [и др.] // ЖБИ и конструкции. – 2011. – № 2. – Р. 26–28.
8. Стеновые панели Acotec от Elematic: «антикризисная» технология строительства // Технологии бетонов. – 2016. – № 9–10. – Р. 26–28.
9. Куртова, Н. Не стоять на месте / Куртова, Н.Н. Дубовик // Знамя новостройки. – 2013. – 26 нояб. – С. 1.