Typification in automated workstations for pressurised casting

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Summary
Typification of automated workstations for technologies of pressure castings results in lowering of costs for their realisation, shortening realisation time, making their operation more effective and making the maintenance simplified. Typification also simplifies their integration into higher automation units (operation units, plants).

Key words: operational automation in castings technologies, pressurised casting, automated workstations

1. Introduction
Automation of activities in casting technologies is typical in cases of hard work environment for attendance personnel, as well as health accidents risks occurrence. Substitution of attendance personnel requires beside providing of technological and manipulation devices also providing of the auxiliary devices. That can ensure multiple repeating ability by operation in similar types of operations.

2. Pressurised casting
By pressurised castign process, usage of robots provides advantages related to constant process of machinery utilisation, standard conditions by casts take out, constant form temperature and high casts quality. Because robots are easy to program by using of checking points that are specified for each cast type, use of robots is advantageous mainly in serious production processes. It overcomes the type of automation when casts are only collected directly on pallets without checking their quality. Important is also the availability of programming the robot for lubrication of active areas of matrix form. Another advantage is that by moving the casts under snip mangle, casts have constant orientation. By realisation of pressure casting process, following technological devices are used: machine for pressurised casting, electrical oven with molten material, mangle for slitting of inflow canals, cooling water tank for casts cooling, outlet pallet, ev. outlet conveyor. Technological process of pressurised casting begins with lubrication of mangling matrix form on mangle cylinder. After lubrication of active areas, the moving part is connected with the stable part of matrix form and is secured with locking mechanism. Electrical oven feeds the device reservoir, from which the mangle cylinder pulls out the molten material into mangle form. Pulled material stays in form for current time when form is opened and cast is taken out. After water cooling of the cast, it is transferred under the mangle for snip off the inflow part. From mangle, cast is placed to outlet pallet on outlet conveyor. Form is cleaned with flow of hot air and whole cycle is repeated. Machines for pressurised casting have typised construction that enables to apply simple methods for automation of auxiliary operations. For taking out the molten metal from electrical oven and its transfer to injection casting machine reservoir, as most often are used different types of self-operating devices. Mangle matrix form is cleaned by using of special...
devices, which are part of machine, or special manipulators connected to device are used. Because of relatively simple manipulation by pressurised casting, automated manipulators are used. Their construction proposal and parameters are estimated according to types of devices. By pressurised casting, pilot workstations have dominant position and also their grouping to larger production units with free-wiring workstations. Unification coefficient (standardisation) of devices \( k_\text{u} \) can be estimated according to following formula:

\[
k_\text{u} = \frac{\sum_{i=1}^{n} E_{ui} C_i + \sum_{j=1}^{e} D_{uj} C_j}{\sum_{i=1}^{n} E_i C_i + \sum_{j=1}^{e} D_j C_j}
\]

where: \( E_{ui} \) is number of unified (standardised) units (/ =1, 2, ..., n, k), \( k \) - number of construction units in product, \( D_{uj} \) - number of unified (standardised) parts that doesn’t belong to composition of construction units (/= 1, 2, ..., n, e), \( e \) - quantity of parts, that form compositional parts of product, \( C_i, C_j \) - wholesale price.

Unification coefficient for construction components \( k_{uk} \) can be estimated according to following formula:

\[
k_{uk} = \frac{Q_{uk}}{Q}
\]

where: \( Q_{uk} \) is number of unified types and sizes of constructional element, \( Q \) - number of types and sizes of constructional elements.

Large variability by casting into metal forms lays not only in use of products, but also in use of different alloys. Before all, alluminium alloys are used, mainly in flying and automotive industry. In flying industry are mostly used parts from magnesium alloys and copper alloys. Casts from gray tempered alloy are used in automotive and tractor industry, common mechanical industry and by production of variety of common used articles. Steel casts are used eg. by turbines production. By steel and alloy production is used so called half-mould casting (metal matrix form, sand cores). By casting of alluminium and magnesium alloys are used metal matrix forms and metal cores. Pressurised casting is used in mass production of thin-wall casts from non-iron alloys. It is special way of casting to moulds that is suitable mainly for difficulty shaped parts.

3. Conclusions

Designing and realisation of typified structures for automated workstations for pressurised casting forces their realisation, reduces costs for their realisation, increases effectivity of automation regarding to repeatability of operations and reduces technological risk during operation. Introduced article is part of grant project KEGA č.3/3064/05 Preparation and realisation of multimedral learning ang study materials for field of Production technics with utilisation of virtual reality technologies and tools.

References