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ELEMENT SELECTION ALGORITHM OF MODULAR FIXTURE SYSTEM

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ABSTRACT:
Creating of fixtures is very important work. If the fixture is designed wrongly it started the collision situates that are the source of useless non – operating state. In this day all firms in the manufacturing processes try to eliminate the existent non- operating state. This is a reason to design fixtures with using model of modular fixture systems on the base of the algorithm.
KEYWORDS:
modular system, algorithm, fixturing, model creating

1. REQUIREMENTS OF WORKPIECE POSITIONING

During designing of fixtures are a lot of conditions and with reference to them to does not start the existent non – operating states in manufacturing process. It is necessary to assure that machining surface must be nearest to fixture surface of the machining tool to assure the fixture stability and toughness of technological system. Workpiece surface in fixture must be assured with rigid backstops but no by friction. The fixture must to disable the back putting workpiece. The tool pressure and fixture force pressure have to influence against rigid backstops surfaces to prevent from force influence to no deformate the workpiece. The workpiece must be located to possible enumerate the machined dimensions directly in the fixture.

We can use three types of fixture part completing into one unit:

- screwed,
- pinned,
- moulded.

Screw connection are realised by inbus screw. They are with metric thread with the base twist – M8, M10, M12. Sometimes is connection of the workpiece secured by pin conus.

Mutual moving parts of fixture should to do movable moving or rotary. Mutual rotary workpieces are completing by shank with sliding and rolling leadings. Leadings of movement parts are tabular or dovetail.

2. FIXTURING BY FIXTURE MODULAR SYSTEMS

One kind of workpiece fixturing is modular systems using. In workpiece selection of that modular system is important to assign certain parameters by that

the workpiece part selection are realised. Important is to observe if the base surface is bigger than surfaces clamping and fixturing, because is necessary to choose fixture plate from the base elements. If it is not like that or here is requirement to fixture the workpiece in vertical position necessary is to choose the fixture cuboid.

According to slot width are standard added 4 leading ledges to fixture plate/ cuboid to assign her position to machine tool. These leading ledges are situated to machine tool by screws M6.

If the semi – finished product will be casted or milled for their clamping is necessary to use adjustable supporting steadies with peak. If it is advantageous to set the workpiece to spheric surface, needed is to use the adjustable supporting steady. It is needed to use the supporter L and connected screw M 12 x 40.

There is requirement to machine the large box workpiece (problematic using of supporters and clamps) must be used fixture side. The fixture screw M12 x L and female screw must be added to this fixture side.

For standard kind of fixturing is needed to: supporter L, connecting screw M12 x 40, and adjustable shore. Next fixture screw M12 x L, female screw and someone of clamps (fork clamp, fork clamp with shank, curved clamp, tool bilateral clamp).

- Fork clamp – standard used,
- Curved clamp - for tabular and thin workpieces,
- Fork clamp with shank – if the workpiece has the holes on its surfaces,
- Tool bilateral clamp - if the dimension of other clamps is not suitable.

When the workpiece has holes or threads on its base surface, they are fixtured with fixture solid. To own fixturing are used the fixture screws M12 x L, connecting screw M12 x 40, and female screws. If the holes and their spacing dimensions are toleranced, we choose the the base solid instead of fixture solid that is supported to slot by distance insert and stiffering plate key. The workpiece is fixtured by clamping – fixturing screw M12 x L in this case.

If it is necessary to press the workpiece from the next side during clamping, we use thrust clamp (or during pressing it is on rotary surface) for this. Own thrust force is deduced by screw using.

Fixture accessories:

- yoke – centred the force to certain position with adjustable possibility,
- attachment 20 or attachment 50 are used to workpiece shoulder,
- pressed spring and gate ring are necessary be used when the requirement is that clamp should be in the free position above the workpiece

There are several kinds of the supporters to workpiece clamping into accurate position.

The clamping standard of various elements is using of clamp.

If the existed clamp defends with her position to machining, is possible to change her with right or left clamp or clamp with tab.

Using of radial clamp is necessary if we needed workpiece positioning with certain angle to machine table. That is confirming with the base part with standard elements – distance keys, distance inset.

On this clamp is possible to build the next elements of modular system. If the slots fail we use the clamp solid too.

If here is the requirement to press the workpiece to clamp we use the screw with top point M10 x L. To workpiece positioning to the side surfaces of the base parts are used the stiffering plate.

When is the support surface of the workpiece higher than the base we choose stiffering plate 1210502. If here is requirement to use the stiffering plate along with

clamp and at the same time is necessary release the place for operation on the workpiece than we use the clamp asymmetric.

If is needed to support the workpiece many times or the workpiece has minimum dimensions needed is to use the clamping.

Screws and female matrices are most widely used kind of the fixture. Their advantages are: the achievement of big clamping pressure with small fixture force (large gear), simplicity, universality, self – locking. Fixture screw influences to part directly or by certain beam gear.

Terms of fixturing are a lot of and it is necessary not to forget of them. More digest solution of existed situation is possible create existed terms by algorithm.

3. ALGORITHM

Algorithm is ultimate graduality of defined instruction to realising of particular task. Typical feature of algorithm is that several steps often multiple repeat (iteration), or the next process is depending on actual conditions. (branching). To resolutions of this same task be several resulted algorithms with particular sequences of instructions.

Properties of algorithms:

- *definitiveness,*
- *determinism* – in each situation must be evident, what and how to do and how is resulting of algorithm continues,
- *entry* – usually is doing with some entrances that are defined before starting or during algorithm working and they have data set that are obtained,
- *output* – algorithm has at least one output, parameter that is in asked relation to existed inputs and by that is answer to algorithm problem,
- *effectiveness* – each operation doing by algorithm must by enough simple to transpose at the final time only by paper and pencil,
- *generality* - no result one concrete problem but universal class of similar problems.

Element is a part that belong to concrete class or to group and have defined facilities. We do their selection on the base of belonging to this class/group and their achievement and no achievement of asked factor.

4. KINDS OF ALGORITHM

Information that is necessary to analyse during tasks solving are very important. There are statements or their interpretation and information. Always when we solve the new required tasks, always we need the detailed information about workpiece. Information on the base we solving the task are named ***input*** and obtained are ***output***. According to resolving task part we representative information usually by statements, we say them input and output statements. The solving task means to transformate the input statements to output, sometimes only input to output. In our case input information are workpiece and technological process of production. We have new outputs by combination of obtained information. In our case is output that information about kind of clamp suitable for fixturing of workpiece.

Designed algorithm can by presented graphical in the flow process diagram. In dependence on the input parameters and on asked output the flow process diagram can be described next:

- elementary
- sofistic.

In the Fig. 1 is showed elementary kinds of the designing of process diagram, for selection of elements of SUS.

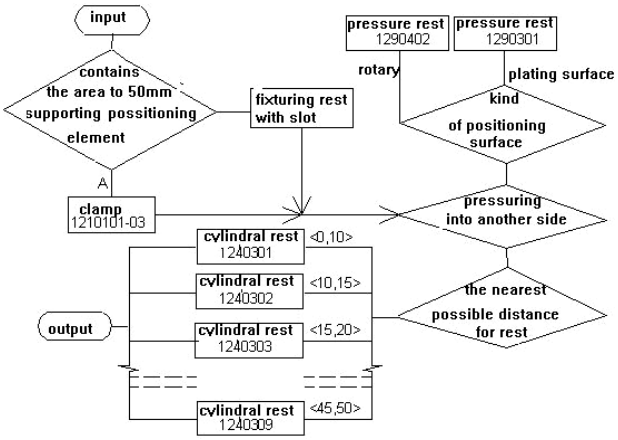

Fig. 1. Clamp selection example according to parameter of side surface clamping

Element selection from modular clamp system according to algorithm is expressing by development diagrams. Selection of concrete clamps is influenced by the fixtured workpiece. His facilities like shape, material, dimension or machined operation, give the way in existed development diagram. Fig.1 The picture shows various input parameters like the clamp selections according to tabular or rotary clamping surface. If the clamping surface is tabular then we select the clamp with number 1290301. And with this number we know to choose the concrete clamp from modular system. Fig.2

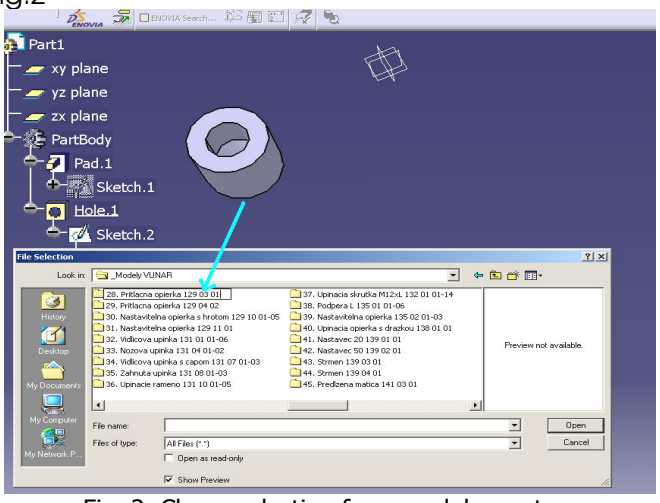

Fig. 2. Clamp selection from modular system

In the Fig.3 is shown the difficult process diagram that described a lot of possible used output elements of SUS.

If the is suitable with dimension to concrete machine workpiece we can use her in software CATIA V5R15 to fixturing and create the mutual relation. This is a kind of clamp selection in some sequence. Usually is needed to solve the situation if the existed clamp is suitable or not and the next to look for the second alternative.

After selecting of all needed clamps become the final fixturing. It means 3D graphical describing of workpiece fixture. The fixture workpiece like that we can use then to machine simulation.

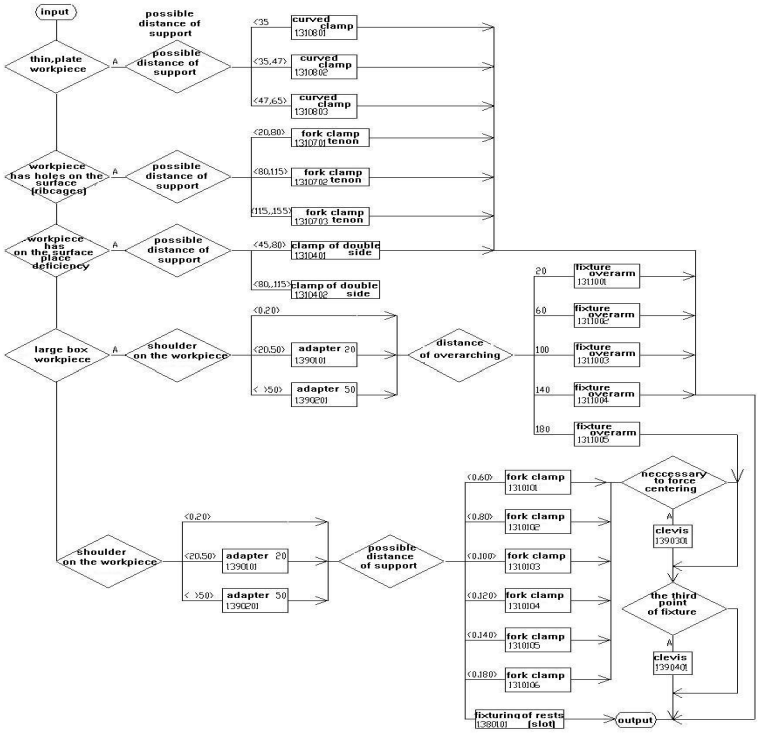

Fig. 3 Process diagram with various alternatives of elements selection

5. CONCLUSION

Development in manufacturing process is directed to flexible increasing in production. In cooperation between constructor and concrete software CATIA V5R15 should become the decreasing of non-operating state in designing of fixtures. These designed fixtures are possible to use to simulating of machining. After fixture design simulation is possible to detect the collision situation in due time.

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