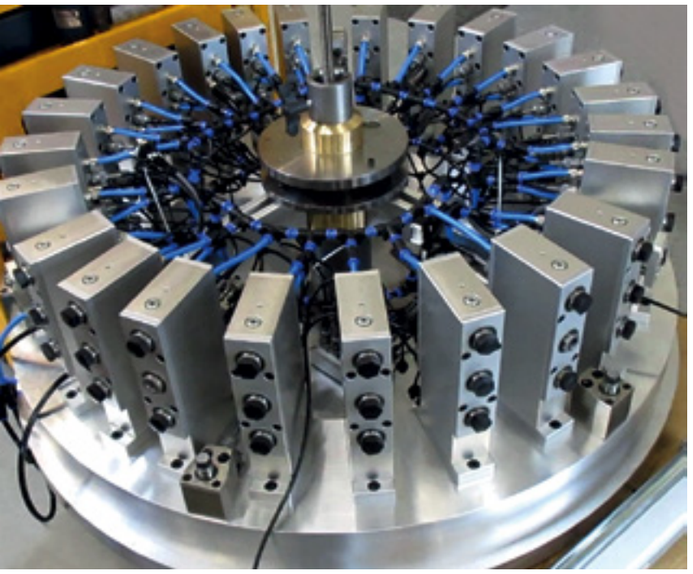
KOSTYRKA

ADAPTIVE CLAMPING

FLEXIBLE FIXTURE FOR JET TURBINE ENGINE AND AEROSTRUCTURE APPLICATIONS AND OTHER EXAMPLES

FLEXIBLE FIXTURE FOR A JET ENGINE RING SHAPED COMPONENT.



Fixture without component.

It is always a considerable challenge when it comes to clamping unstable, thin walled parts on a fixture for precision machining processes. The goal is to support the part as much as possible against the occurring forces caused by the machining process. If the part has free-form surfaces too, the expenditure of time for setting the part on the fixture can be quite long. Depending on the part, this set-up can span several hours or, in some cases like this jet engine ring, in excess of 1 day.

Many composite and un-machined parts usually have deviations concerning the roundness. This is due to the low grade of form stability. The part itself can be deformed by even low forces. Additionally deviations of the part height can occur which have to be compensated by the fixture.

According to these facts, the main goal in designing a new kind of fixture for such parts was to reduce the setup-time from hours or days to minutes. Over and above the manual work should be minimized compared to the already existing solutions.

The base of that new approach are modules with 3 or more axial moveable pins. The pins are guided and hydraulically locked by approved KOSTYRKA© clamping sleeves. The movement of the pins is activated by compressed air, the back stroke by a retaining spring. Because of a special compressed air flow the moving speed of the pins as well as the contact force to the part can be regulated by changing the air pressure.

Furthermore, the pins can be moved at different times. The reason is, that, depending on the shape of the part, a lift or a displacement force to the part can be avoided. For example a pin could create an up- or downwards force directed as a function of the contact point between pin and curved surface.

After all the pins are in contact with the part, they will be locked hydraulically with the Kostyrka© clamping sleeve. Hence the locked pins show the negative shape of the outline of the part. The more pins the more precise the fixture will be. If the hydraulic pressure on the sleeves is released, the pins move back and a new geometry can be molded.

Pin module

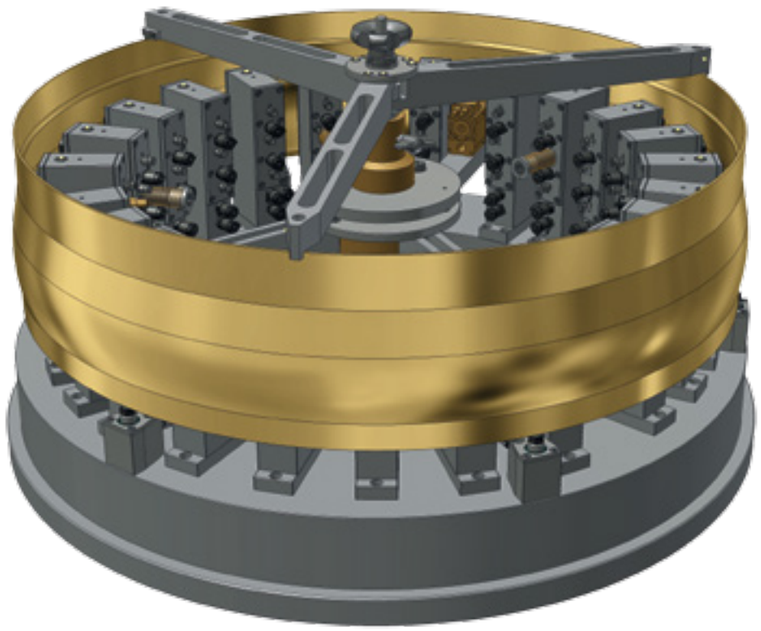
In the case of this fixture, before all these pins move to the outline of the part, the levelling of the correct height will be done with the help of a 3-arm device operating in the middle of the fixture. Therefore this device will be pushed down a guide to a mechanical stop which identifies the correct and repeatable height of the part. In this connection the top rim of the part is the reference for the height setting. Simultaneously the spring loaded support pins the part is rested on will be pushed down to the corresponding height. This process is closed with the hydraulic locking of these support pins. Thus differences in the part height will be compensated and the upper rim of the part is always at the same height.

Also in the case of this fixture, a centering device is also included. This device centers the part relating to the middle axis of the fixture before mov ing out the radial pins. This is effected by 3 linear moving electric actuators, which will move synchronously. The chances are that the part is not exactly round leads to the result, that this centering is an average centering. This will be done also before the radial pins will get in contact with the part.

After all these steps are completed, all the hy-draulic lines can be disconnected. A special fitting allows us to uncouple the lines without losing the pressure. So all hydraulic activated sleeves (in the case of this example, 72 for the radial pins and 6 for the supports) will be pressurized even if the lines are disconnected. After the pneumatical power line is also disconnected, both internal de-vices, centering and levelling device, will be lifted out of the fixture to provide clearance for machining.

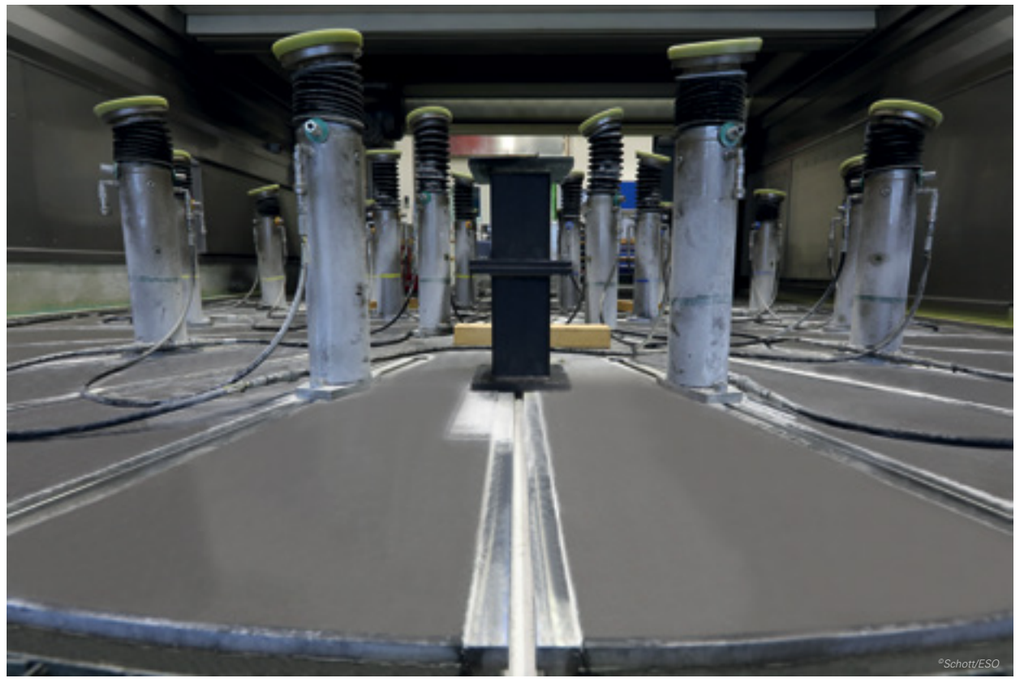
The fixture with the part is now completely self-sufficient and can be forwarded to the machine. In this example, the indexing inside the machine will be done with a zero-point-system which is installed beneath the baseplate of the fixture.

Bringing the ring onto the fixture and doing all the required steps takes merely a couple of minutes. So it is significantly faster than the original manually adjusted glue pin method. The same modules and the same functionality can be used to clamp a part from the outside. Therefore only a larger baseplate is required. So the machining of the internal shape of the ring shaped part is also possible. This shows the extreme flexibility of this new approach.



Fixture with jet engine ring shaped component.

ADJUSTABLE FIXTURE FOR WORLD'S LARGEST CONVEX MIRROR BLANK.



Fixture without blank,

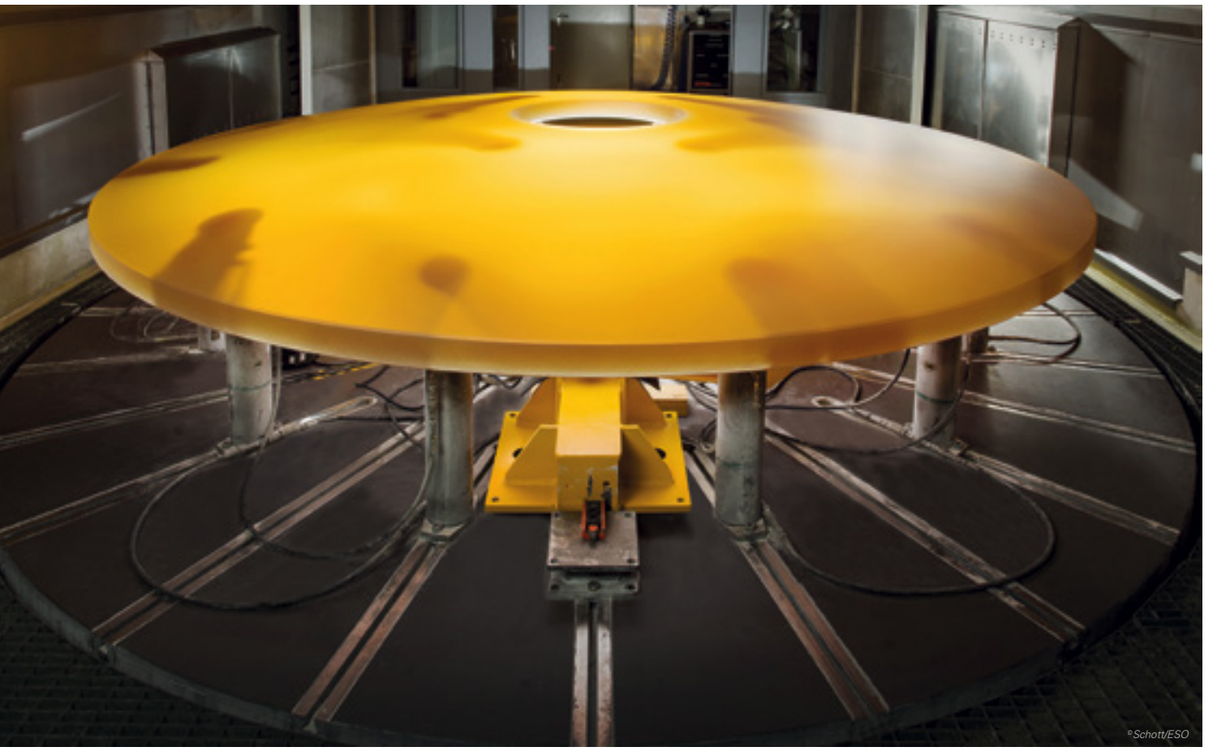
This fixture was designed for a massive 10-ton blank for the E-ELT's – European Extremely Large Telescope – second mirror. This mirror will finally being placed upside-down above the 39-metre (128 feet) primary mirror of the telescope, which will be built on Cerro Armazones, a 3060-metre (10000 feet) mountaintop in Chile's Atacama Desert.

Fixture without blank Within one year, the original 10-ton blank was grinded to its final convex aspherical shape with a thickness of only 10cm (~4") and a final mass of 3 tons.

The basic design of the fixture, which will keep the part in position during the complete process, is based on three groups of posts, each with 6 hydraulic adjustable and lockable support elements.

Each of these three groups acting like communi-cating pipes. Besides a hydraulic power unit, the posts also have manual adjustable screw pumps, which allow to feed very little amount of oil into the system. So the posts can be moved up and down very precisely and therefore the blank can be leveled with the help of additional measuring equipment.

After setting the correct height and level all posts will be hydraulically locked by KOSTYRKA© clamping sleeves. These sleeves are able to hold the adjusted posts in the correct position for the required time of manufacturing – without any displacement and over a long periods of time - even under the load of several tons



Fixture with mirror blank inside the grinding machine.

Single post

One of the major requirements is to protect the complete system against the abrasive dust of the grinding process. All moveable parts, especially the rods, are covered by bellows and wiper rings, which withstand these working conditions. For this reason the fixture is working very precise even in this rough working environment. In case of different blank sizes and weights all posts are movable along rails inside the machine to adapt the fixture to the required size. To define the correct position for the posts, FEM-analyses are used to find the best position for minimum de-flection of the blank.

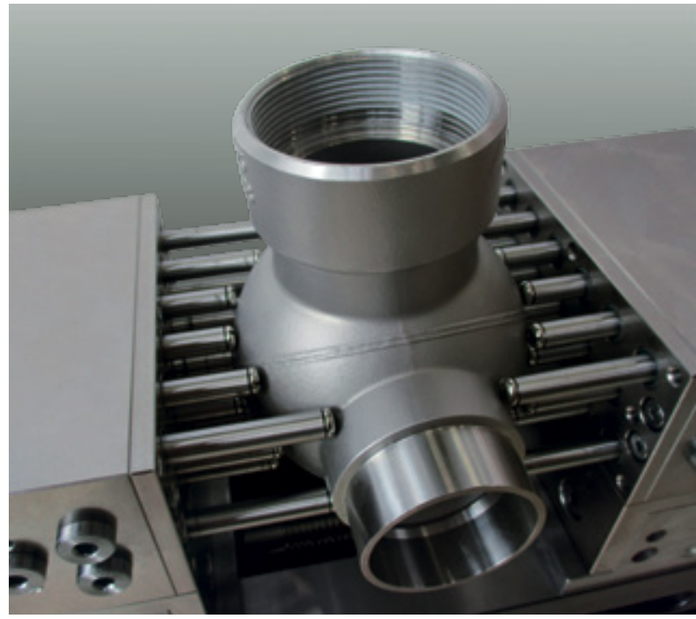
FLEXIBLE PIN JAWS CLAMPING ANY GEOMETRY.

These jaws provide the possibility for fast and precise adapting the outline of a part into the clamping element. Within seconds, part specific jaws are being created. Therefore, axial movable pins get in contact with the part and generate a form fit between the jaw and the part. The movement of the pins is actuated either by compressed air or by spring tension. Once in position, the pins will be locked hydraulically using approved KOSTYRKA© clamping sleeves. The pin jaws made by KOSTYRKA are especially designed to cooperate with regular vices, but other solutions like support elements or grippers for handling devices are also realisable. Side effect of this part spe-cific element is a reduction of the required clamp-ing force due to the form fit.

In case of air actuated pins (back and forth), the complete system is automatable. For this reason the jaws can also being used in combination with a gripper and a handling device as an adaptable interface between gripper and part. So highly effi-cient and flexible handling processes can be realised.

Pros

- No axial or radial displacement while locking the pins
- Completely sealed design
- Completely automatable
- Nearly unlimited size of pin field
- Customized solution (diameter, stroke, number of pins, etc.)



KOSTYRKA© pin jaws on a vice.

KOSTYRKA

Extract from the customer list

ABB Robotics GmbH
Boeing Company, USA
Carl Zeiss Gruppe
Daimler AG
Deckel Maho Pfronten GmbH
Dörries Scharmann Technologie GmbH
Dr. Ing. h.c. F. Porsche AG
F. Zimmermann GmbH
FIBRO GmbH
Gebr. Heller Maschinenfabrik GmbH
General Electric Canada Inc., Kanada
GKN Aerospace GmbH
Hilti Aktiengesellschaft, Liechtenstein
Hyundai Motor Company, Süd Korea
INA Tooling Technique Pvt. Ltd., Indien
INDEX-Werke GmbH & Co. KG Hahn & Tessky
Israel Aerospace Industries Ltd., Israel
Japan Machinery Company Ltd., Japan
Lindauer DORNIER GmbH
MAN Nutzfahrzeuge Vertrieb GmbH
Maschinenfabrik Berthold Hermle AG
Robert Bosch GmbH
Romheld Automation Pty. Ltd., Australien
Schott AG
Siemens AG
StarragHeckert GmbH
Steinway & Sons Pianoforte-Fabrikanten
Swarovski AG, Österreich
ThyssenKrupp AG
Traub Drehmaschinen GmbH & Co. KG
TRUMPF GmbH + Co. KG
Waldrich Siegen Werkzeugmaschinen GmbH
ZF Friedrichshafen AG

KOSTYRKA GmbH

Dieselstraße 6
70839 Gerlingen
Germany

Phone +49 (0) 71 56 - 1 76 73-0
Fax +49 (0) 71 56 - 1 76 73-30

info@kostyrka.com
www.kostyrka.com