TILTING DIES, THE CONVINCING SOLUTION TO CENTRE AN ANNULAR DIE

Heinz Gross, Rossdorf, Germany

Motivation

Why at all has a die to be centred?

Technical requirements

Actual solutions

New solution to centre a die

Advantages for different extrusion processes

Summary

Motivation

- Help line operators to do a better job
- Reduce thickness tolerances or improve thickness distribution in the products

- Improve the quality of the produced parts
- Reduce material consumption
- Reduce machine downtown times
- Reduce personal expenditure

ACHIEVE A MORE ECONOMIC PRODUCTION

Motivation

There does not exist a convincing solution which really fulfills the technical requirements without constraints which have to be fulfilled by a centring solution although annular dies are used for different extrusion processes since over 50 years.

Why is a centring system necessary?

To bring the die or the mandrel out of the centre!

- **To reduce eccentric thickness variations in the extruded parts**

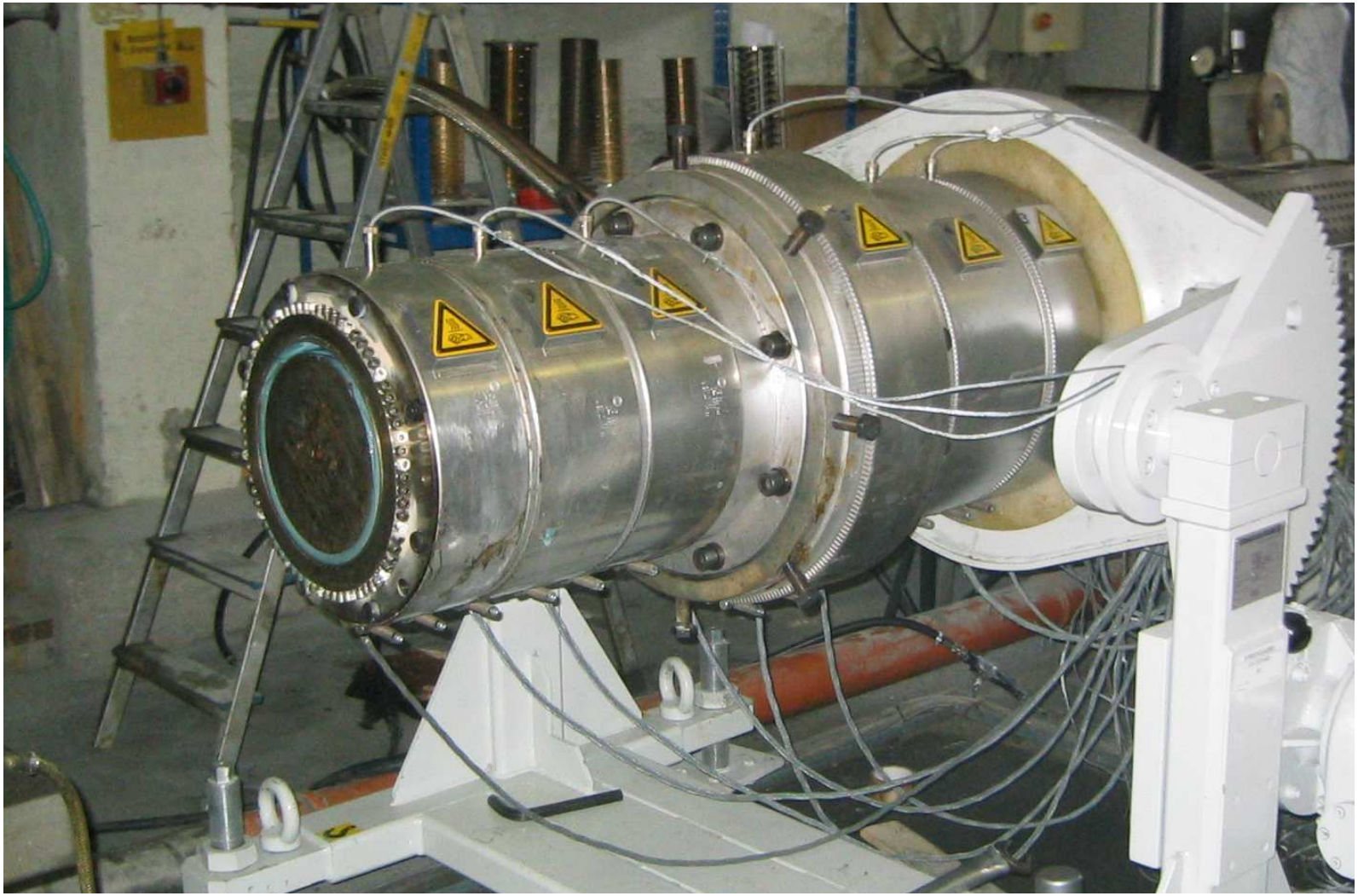
- **To equalize the local exit velocity over the circumference of the die**

Important technical requirements for a centring solution

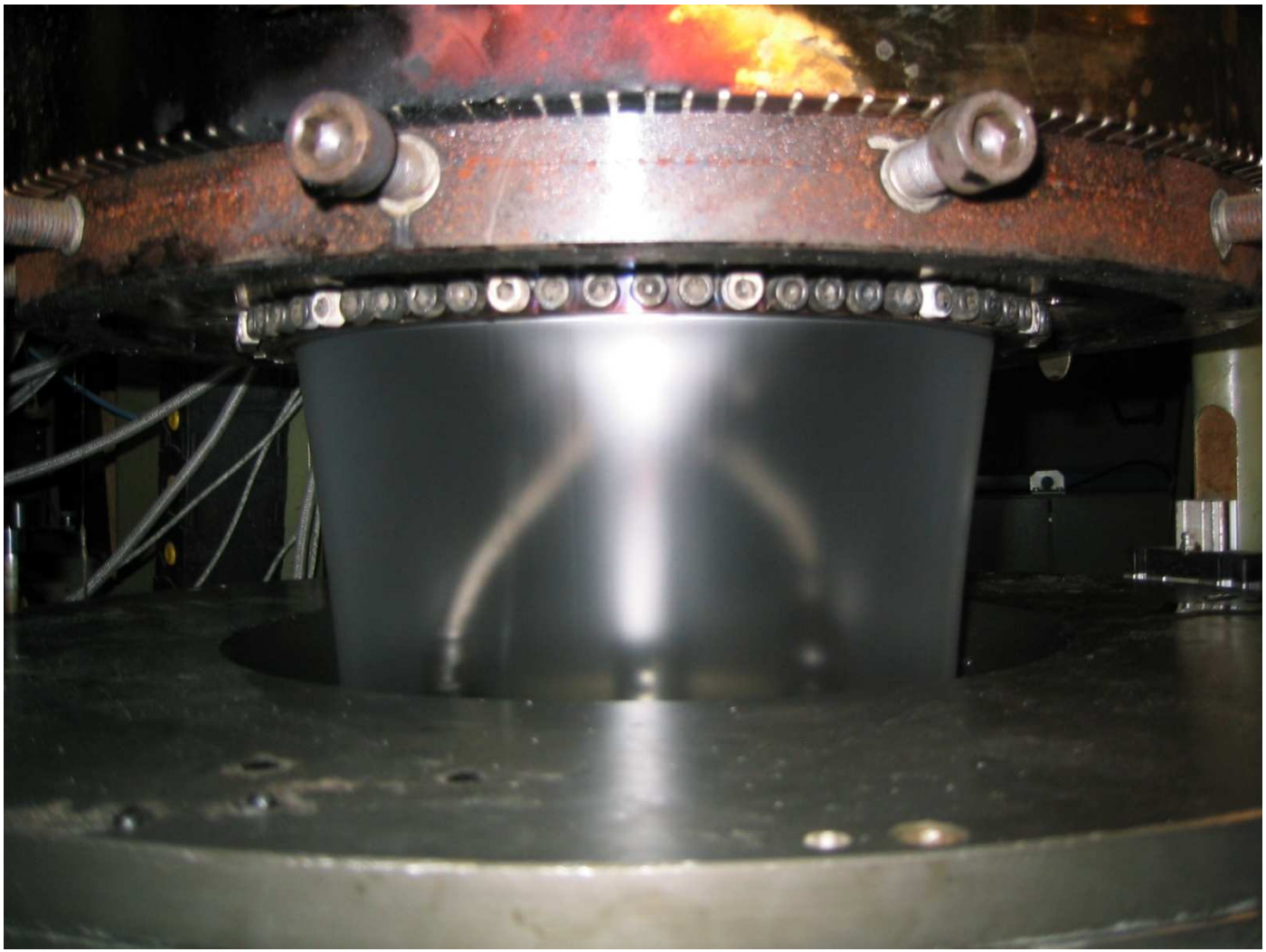
1. **The relative position between the die and the mandrel has to be adjusted extremely sensitively and precisely in a very easy and simple manner .**

2. **It must be possible to exactly reproduce any position that has existed or has been reached at a certain time.**

Example of a conventional centring system used in a pipe die



Double bubble blown film head with a conventional centring system



Actual situation

In all existing solutions metal surfaces exist which have to slide relatively to each other but which in the same time must seal the flow channel against the outside.

This is technically difficult to achieve and causes wear.

Actual situation

- **An extreme sensitive centring is not possible.**
- **A position that once has existed can not be exactly reproduced.**
- **A certain wear of the sealing areas can not totally be avoided.**
- **The fabrication of the conventional centring solutions is rather costly.**
- **The existing systems have to be precentred before the process starts.**
- **It is nearly impossible or affords at least a high technological efford to automatize existing systems.**

Tilting die

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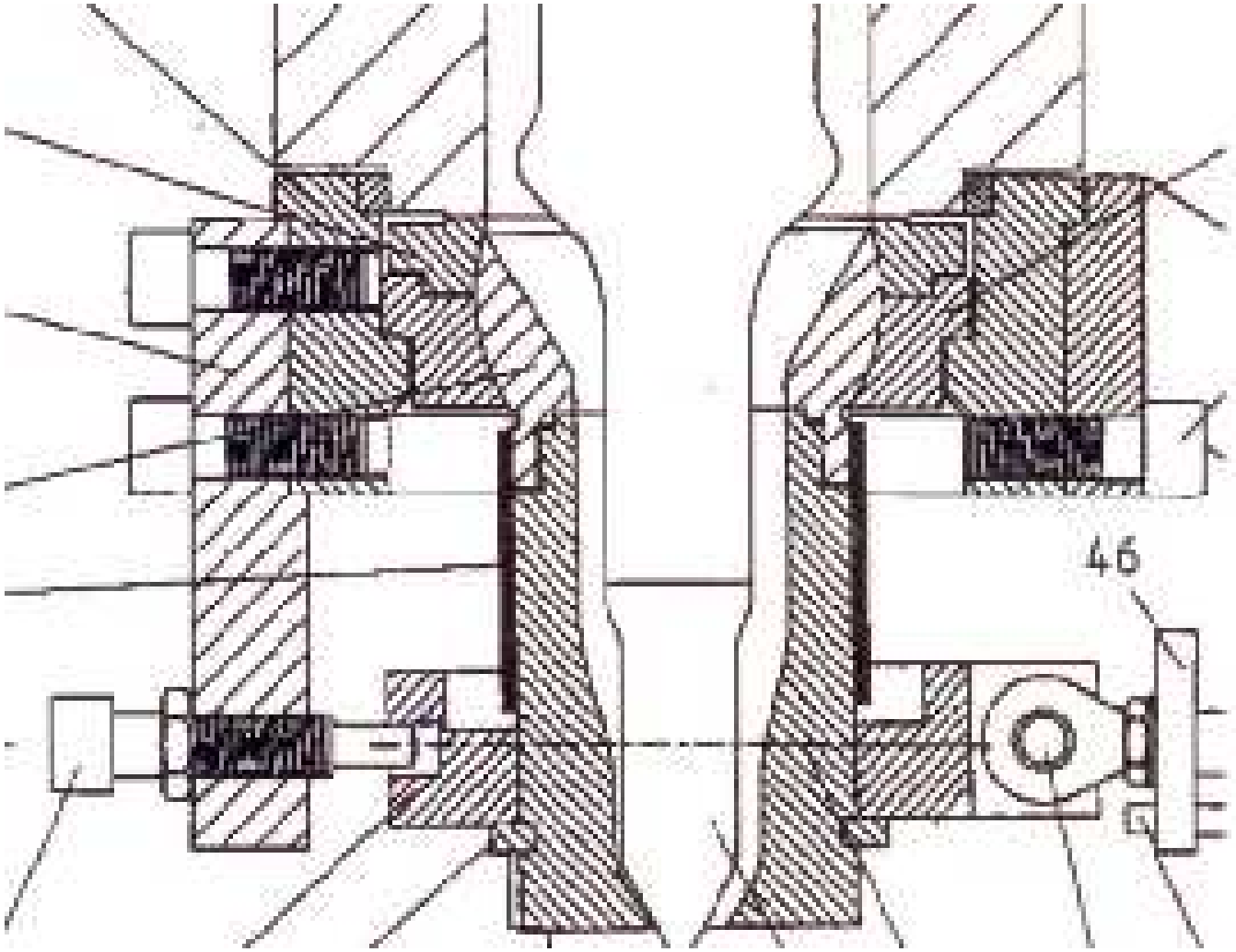


Tilting dies with mechanical tilting joints

The technical requirements are fulfilled:

- A sensitive and precise centring is possible
- Positions can be reproduced

Drawback of such solutions:

- The wear problem is still not solved
- Affords a very precise and costly fabrication
- Is rather sensitive to failures

Demonstration model shown at the K‘2010 show in Düsseldorf

New solution to tilt the die

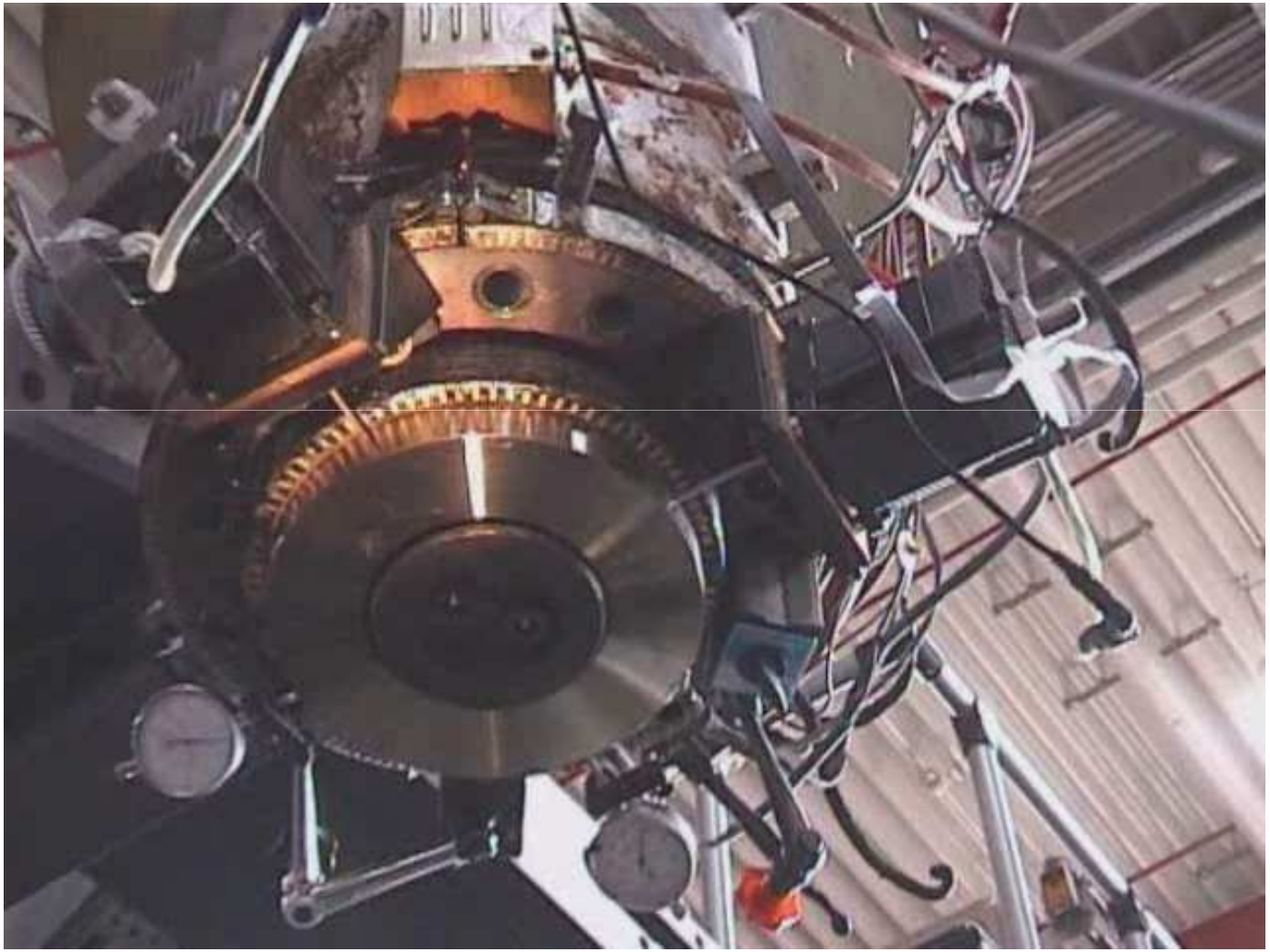
Use a simple elastic tilting joint

The tilting joint fulfills two functions:

Sealing function

Tilting function

Head for extrusion blow molding that has been retrofitted with an elastic tilting joint



Advantages of the elastic tilting solution

The two central technical requirements are fulfilled without any limitation:

- **The die can be centred with an accuracy of a micron**
- **Every position can be reproduced at any time**

This technical functionality is achieved in an extreme simple manner.

Advantages of the elastic tilting solution

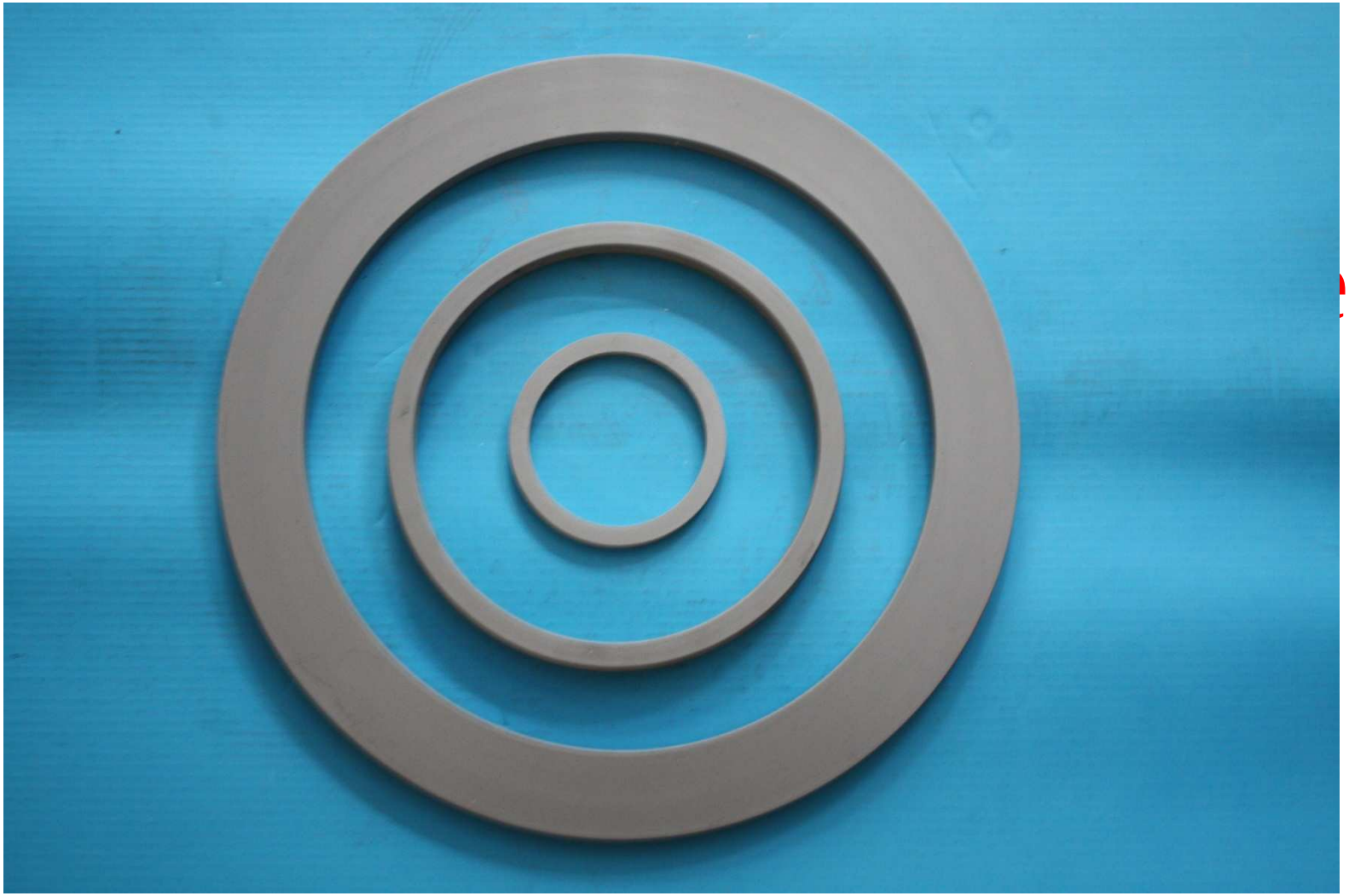
- No precentring is necessary due to a close fit between the head and the die
- Centring to the optimum is possible
- Small forces are sufficient, no elongations are necessary to centre the die
- Die can be changed with one turn, no clamping screws are necessary any longer
- Easy to automatize
- No process stops when operated by drives (extrusion blow moulding)
- Small fabrication costs, less single parts
- Reliable in operation and easy to maintain

Still existing border for the use of elastic tilting joints

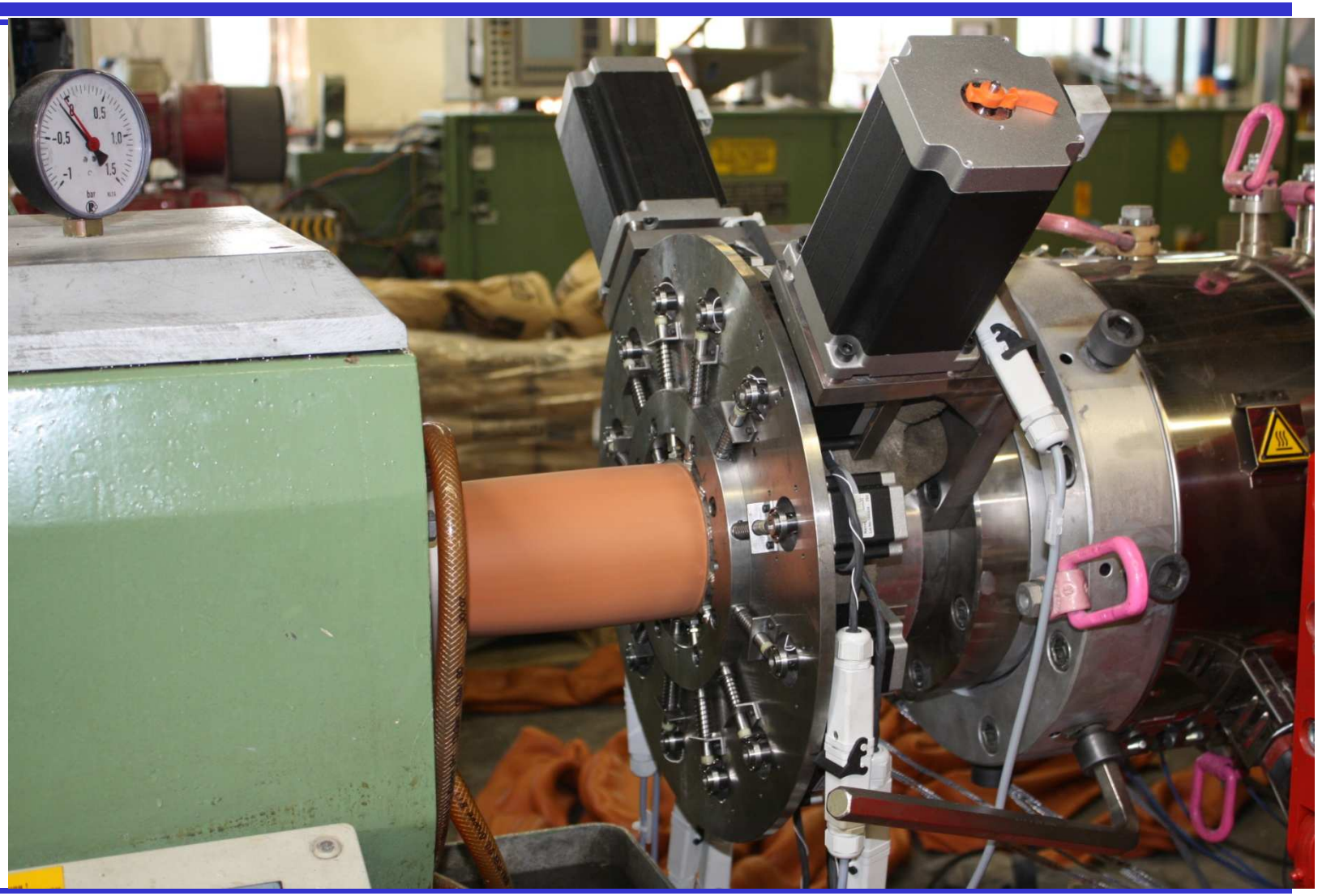
- **Long term heat stability is still limited to 300 °C**
- **At the moment only suitable for melts which do not contain abrasive fillers**

A solution which overcomes these limitations is in the way to be developped

Now how looks an elastic tilting joint like



Pipe die for a closed-loop thickness control



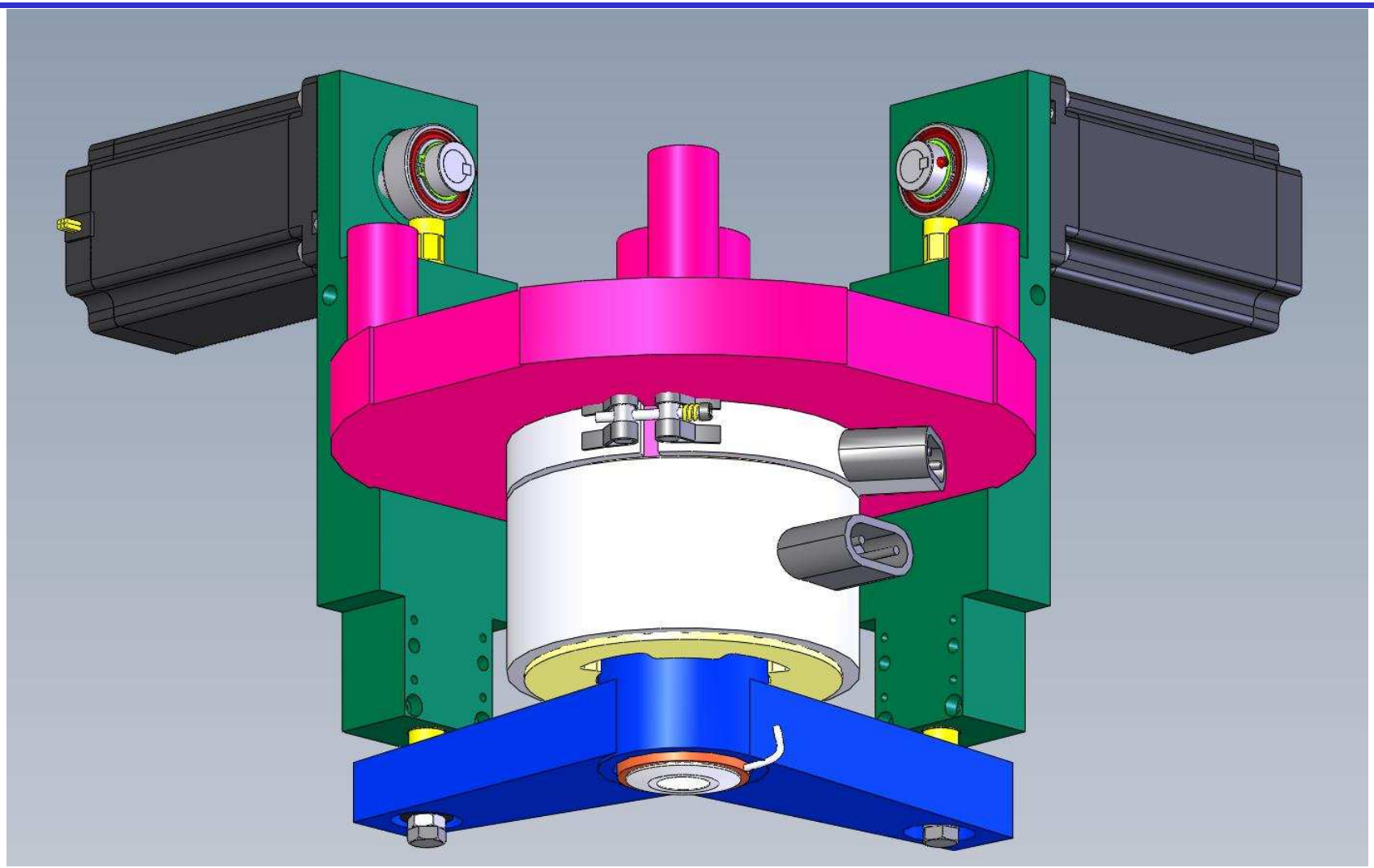
Elastic tilting technology

- **Every existing annular head can be retrofitted with an elastic tilting joint.**
- **The cost to retrofit an existing head are rather small.**
- **The economic benefit depend in a great deal from the specific individual aplication.**

Tilting technology for extrusion blow molding

An additional process variance is achieved by the possibility to dynamically tilt the die during the extraction of the parison to match eccentric differences in the draw ration of the part to be produced. Compared to other existing solution the cost is neglegible.

Tilting die for suction blow molding



Tilting technology for the production of blown films

For the first time a blown film head can be started completely automatically after it has been disassembled in order to clean it as it is no longer necessary to manually precentre the head in front of the restart. Eccentric thickness variations can be eliminated by implementing an additional closed-loop control.

Summery

Every existing annular head can be easily retrofitted with an elastic tilting joint.

Dies having an elastic tilting joint are:

- **Simple in construction and cheap in fabrication**
- **Allow for a very precise and a reproducible centring**
- **Allow for a centring without interrupting the running process in extrusion blow molding**
- **Improve the operating reliability and the ease of maintenance**
- **Help to improve the part quality and to reduce production costs**

Conclusion

Those developments are the best which solve a technical problem and which in the same time reduce the costs and the complexity of the process and by this reduce also the susceptance to failure.

The elastic tilting technology is a good example for that.