

GEAR THRUST COLLARS and SOLID COUPLINGS instead of
highspeed thrust bearings and toothed type couplings.

(See attached drawing No. 4-670 517 and photographs).

The meshing of single helical gears produces an axial thrust $P_{A1} = P_{A2}$ acting in opposite directions on the driving and the driven shaft. In order to balance these axial forces thrust collars on the pinion act against corresponding surfaces of the gear wheel. Collar and wheel shoulder have slightly tapered, hardened and ground surfaces. Due to the low sliding velocities Δu and the full hydrodynamic lubrication the oil film has a considerable carrying capacity with low losses and no wear. This design element, originally developed by Brown Boveri, is working absolutely satisfactory in several hundred gears of large capacity. It has now also been adopted by two leading European gear manufacturers.

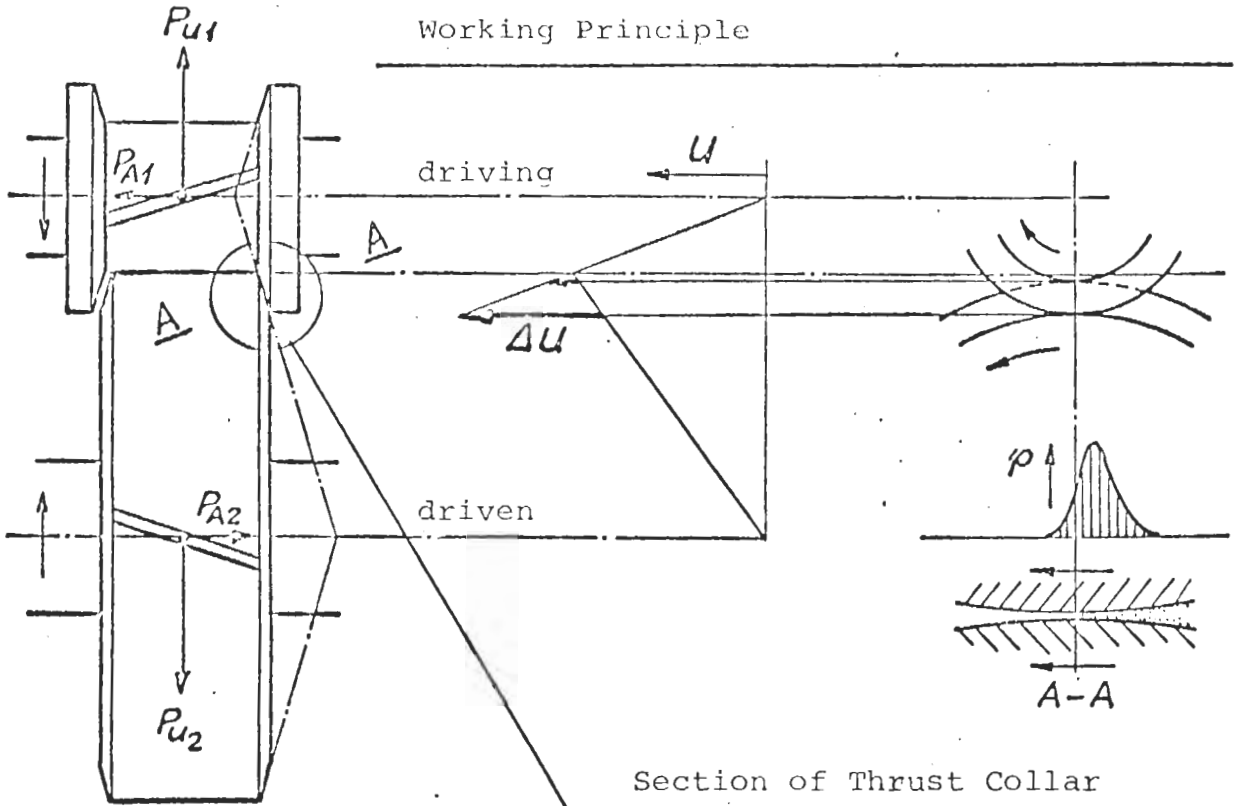
In gears with thrust collars the pinion is axially linked to the gear wheel, the position of the latter being fixed by a normal thrust bearing. Besides the tooth thrust mentioned above a considerable axial thrust acting on the pinion or high speed shaft can be transmitted to the wheel or low speed thrust bearing.

This thrust collar design enables, therefore, to take up the thrust of turbomachines in line with the pinion and coupled solidly together. This solid coupling is an intermediate flexible shaft portion with end flanges bolted tightly to the corresponding flanges of the rotors.

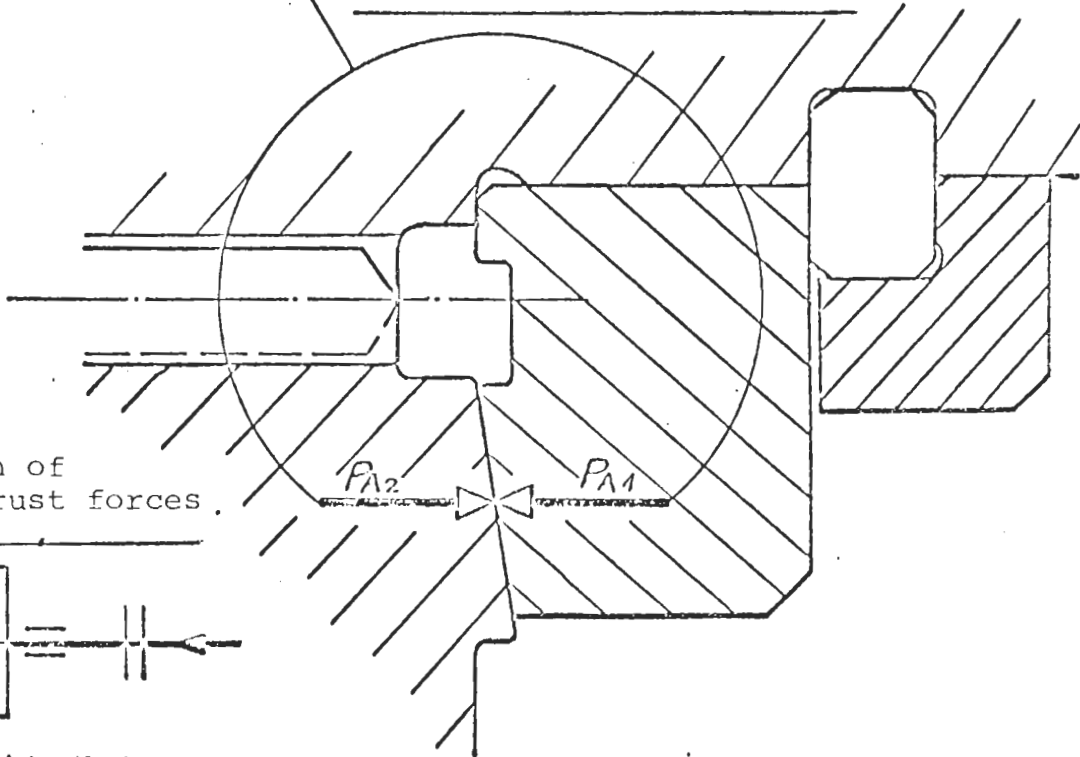
In this manner the residual thrust of a high speed shaft combination is taken up by the thrust collars and transmitted to the low speed thrust bearing of high and non-restricted carrying capacity. High speed thrust bearings and high speed tooth couplings can be avoided which decisively improves the reliability of the plant.

The soundness of this design approach with geared turbo-machines is illustrated not only by the large number of applications in new plants (ranging in power between about 500 kW upto 40'000 kW), but also by quite a few successful modifications of existing plants where, after years of operation, it allowed the elimination of the delicate and troublesome high speed toothed type couplings and thrust bearings.

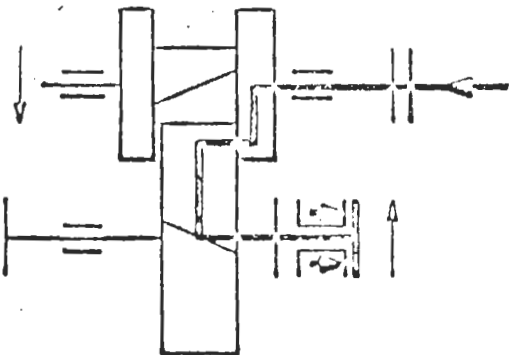
Working Principle



Section of Thrust Collar



Transmission of external thrust forces.

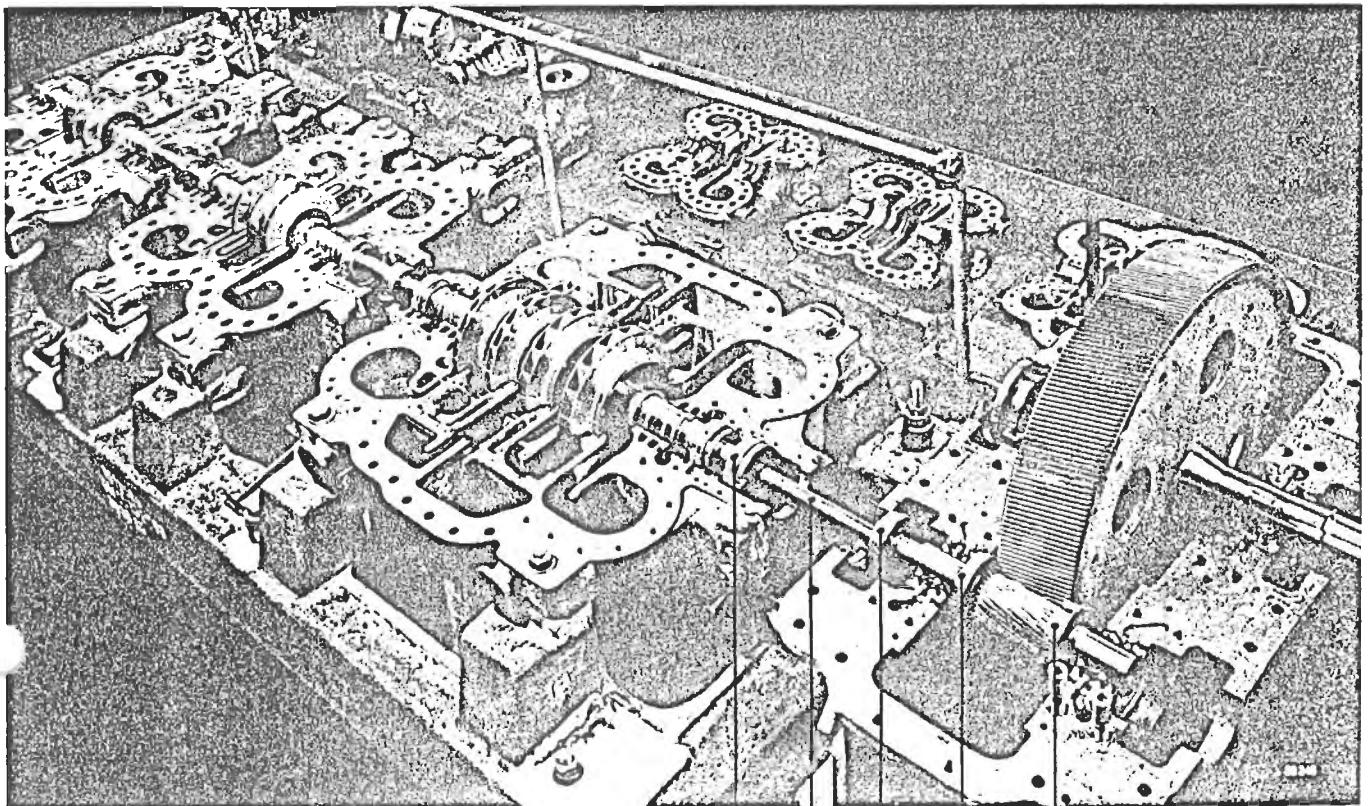
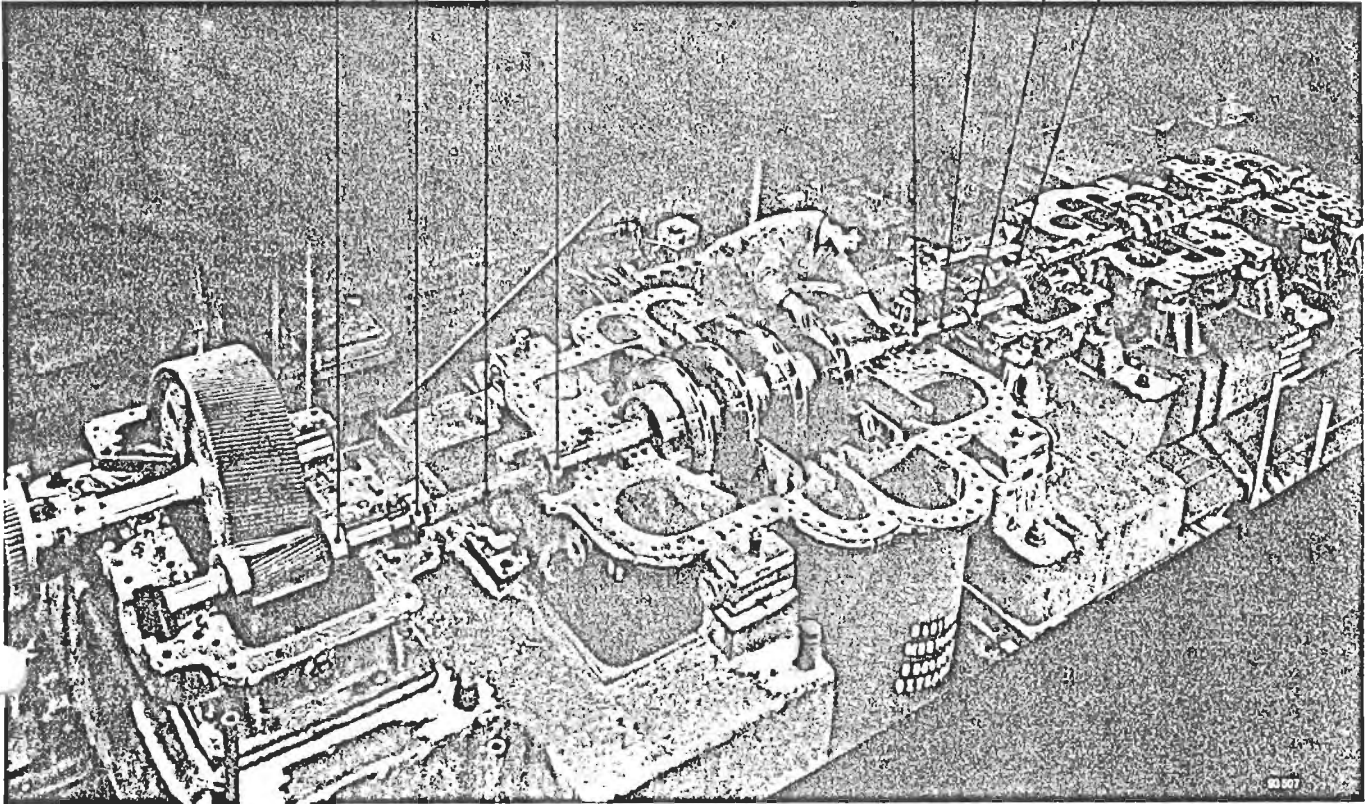


Gears with Thrust Collars (TC)

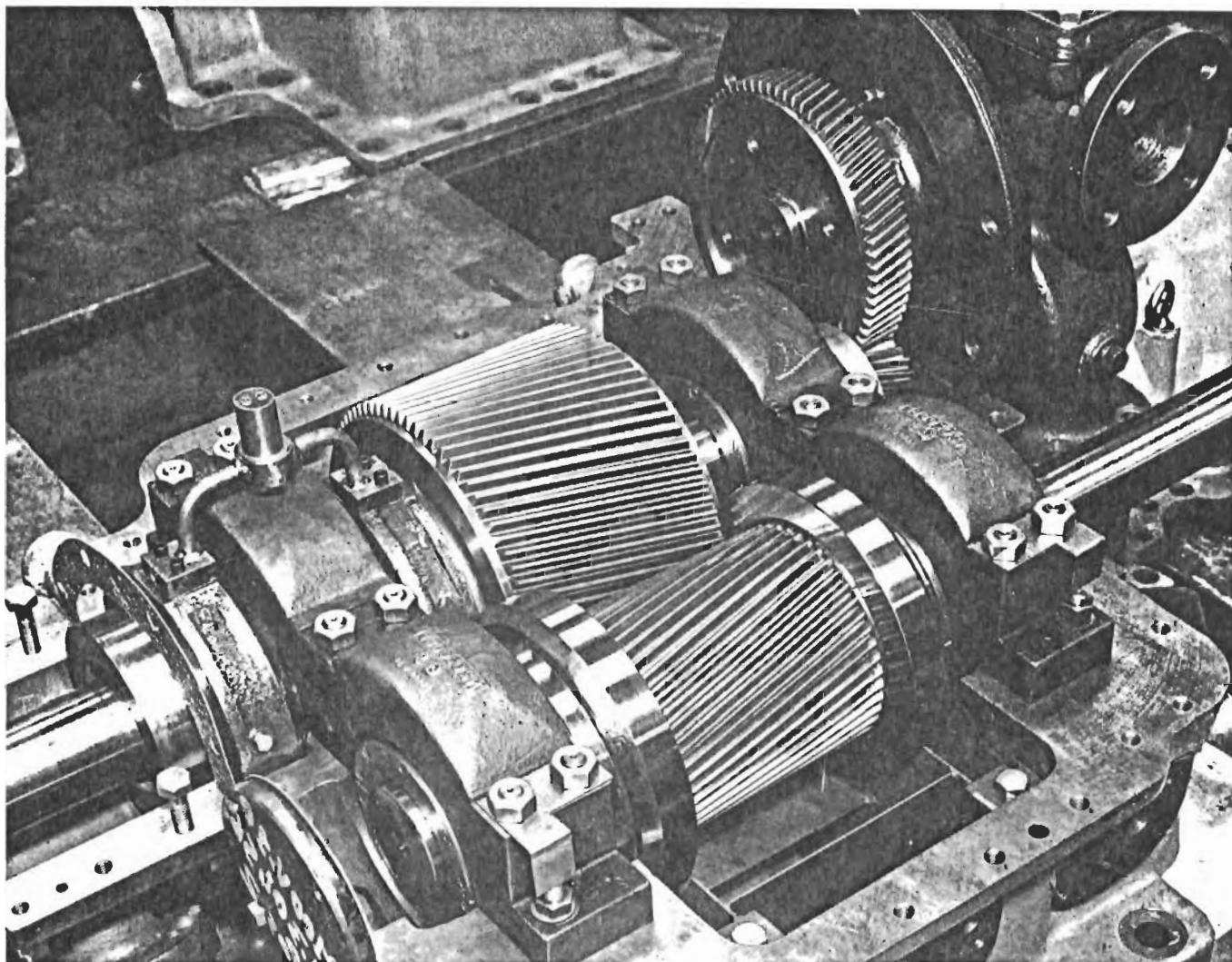
Compressor Shafts and Gear Pinion coupled solidly by means of Intermediate Flexible Shafts (IS) and Bolted Flange Connections (FC).

TC FC IS FC

FC IS FC TC



FC IS FC FC FC



BST single helical precision gear between an LP and an HP compressor shaft. The BST thrust collar on the pinion takes up the axial gear thrust and, in addition, is used to transmit the thrust of the rigidly coupled high speed HP compressor shaft to the low speed wheel-shaft. With this technique, high speed toothed type couplings and high speed thrust bearings can be avoided which helps to improve decisively the reliability of the plant.

Turbo-engrenage BST à denture hélicoïdale simple, entre les arbres BP et HP d'un groupe turbo-compresseur. Denture de précision, nitrurée et rectifiée. L'utilisation du collet de butée BST sur le pignon permet d'absorber la poussée due à la denture oblique et de transmettre, pratiquement sans perte, les efforts axiaux provenant du rotor haute-vitesse du compresseur HP sur l'arbre basse vitesse de la roue. Cette solution augmente la sûreté de marche de l'installation en supprimant les accouplements à dents et les butées axiales haute-vitesse.

BST Turbogetriebe in einfach-schrägverzahnter Bauart, zwischen den ND und HD Rotoren einer Kompressorgruppe. Verzahnung nitriert und nachträglich geschliffen. Durch die Anordnung des BST-Druckkammes auf dem Ritzel ist es möglich, den durch die Schrägverzahnung bedingten Axialschub am Entstehungsort aufzunehmen sowie zusätzliche Restschübe der schnell laufenden HD-Maschine auf die langsam laufende Radwelle praktisch verlustlos zu übertragen. Damit können hochtourige Zahnkupplungen und Kammlager vermieden werden, was die Betriebssicherheit der Gruppe beträchtlich erhöht.