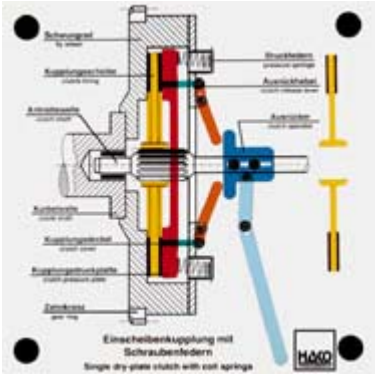
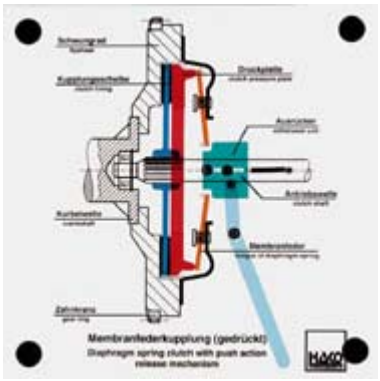
HAKO Overheadmodels - Section 3

Clutches, transmission, synchromesh, automatic transmission



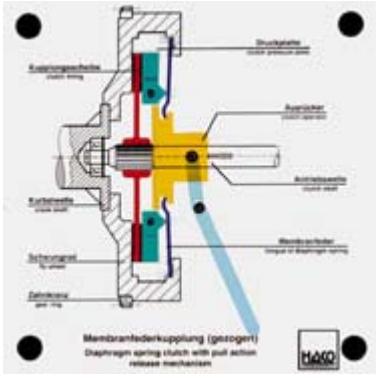
Order no. 115
Coil spring clutch

- motion shown when pressure plate is lifted
- releasing the clutch disk
- the clutch play decreases with lining wear (shown by means of a thin clutch disk)



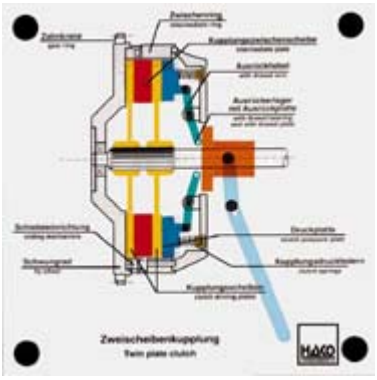
Order no. 116
Diaphragm spring clutch

- motion shown when the pressure plate is lifted
-releasing the clutch disk



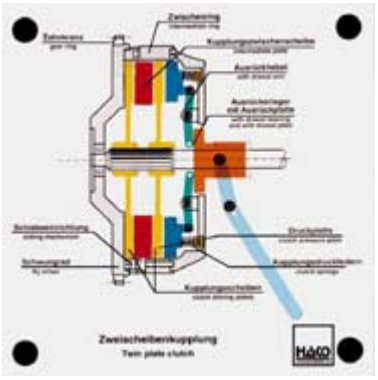
Order no. 117
Clutch with pulled diaphragm spring

- characteristics of a pulled clutch in motion
- releasing the clutch disk



Order no. 207
Double-disk clutch

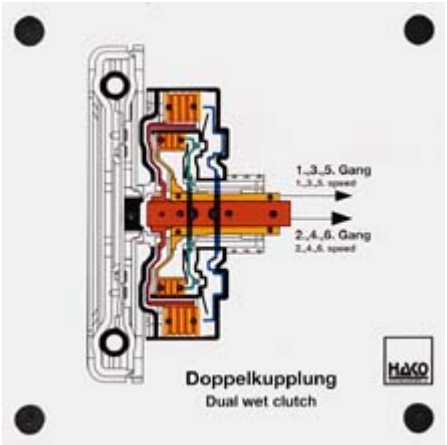
- function of a double-disk clutch
- lifting the pressure plate
- both clutch disks and the intermediate disk can be moved



- while the clutch is engaged, steel springs press the pressure plate

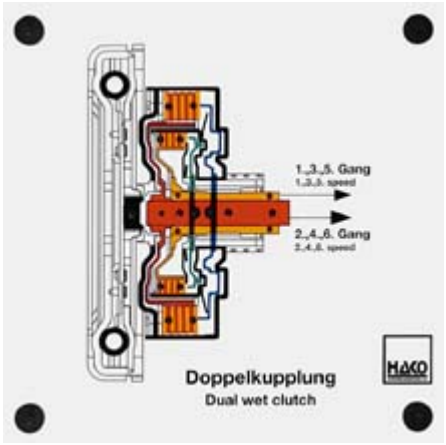
Order no. 293
Multi-disk clutch

- pressing the clutch pressure pin by means of the lever
- lifting the clutch thrust block
- the clutch pressure-plate presses the springs together and releases the discs
- the power flow is now interrupted



Order no. 470
Dual wet clutch

- Function of a dual wet clutch with disks
- the external diameter of the dual wet clutch is only 117mm!



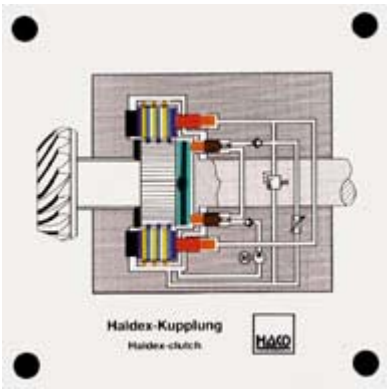
- power flow in first, third and fifth gear via the hollow shaft by operating the small hydraulic plunger and clamping the internal disk package
- Power flow in second, fourth and sixth gear via the solid shaft by operating the large hydraulic plunger and clamping the external disk package

Order no. 447
Clutch disk with torsional absorber

Purpose of the torsion-bar suspension
Task of the torsion springs
Mode of effect of the various torsion springs
Torsion between hub and disk
Function of the stop bolts

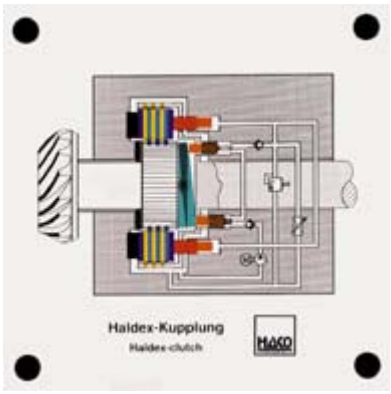
HAKO Overheadmodels - Section 3

Clutches, transmission, synchromesh, automatic transmission

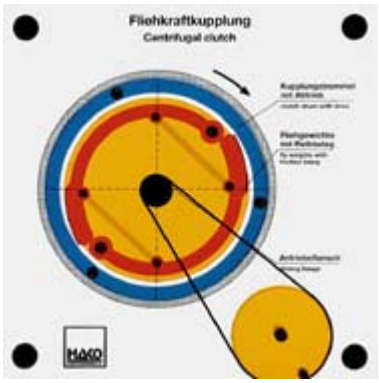


Order no. 429
Haldex clutch

It replaces the viscous clutch in four-wheel drive. As soon as a difference in speed comes about between front and rear axle, the swash plate begins to turn. In this, it operates the pump plunger, which presses hydraulic oil into the plunger of the friction disks.

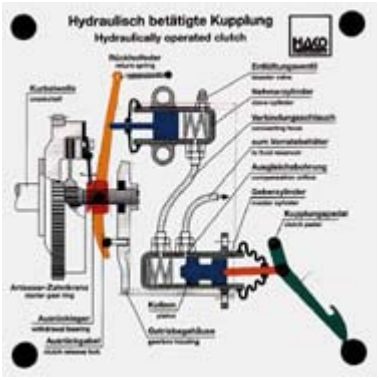


After less than one revolution, adhesion has resulted.
With the help of the electronically operated throttle
valve, the slip can be adapted to the driving situation
in question.



Order no. 295
Centrifugal clutch

- turning the driving crank sets the driving flange into motion
- centrifugal force presses the flyweights with the friction lining against the clutch-drum, thereby driving the clutch-drum



Order no. 279
Hydraulically operated clutch

- interaction of master cylinder and slave cylinder
- actuating the clutch release fork
- function of the compensation orifice and bleeding

Order no. 275
Dual-mass flywheel

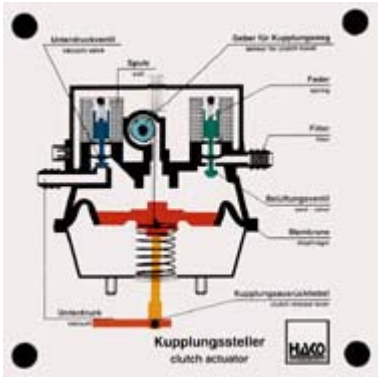
- design of a dual-mass flywheel
- function of the pressure springs when primary flyweight is subject to torsional vibrations

- function of the torsional-vibration da,per between primary and secondary flyweight

Order no. 469
Planetary dual- mass flywheel

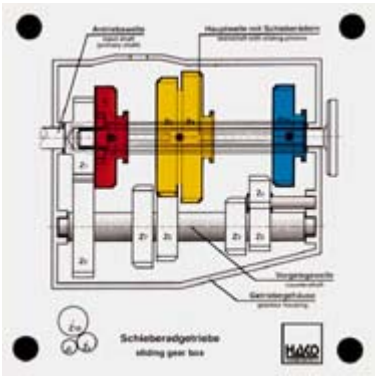
- Rotation of the secondary flywheel mass against the primary flywheel

- acceleration of the planetary wheels, which attenuate the vibrations of the springs thanks to their friction



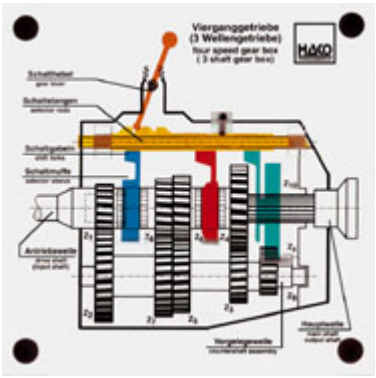
Order no. 324
Clutch actuator

- function of the solenoid valves
- function of the diaphragm and of the retractor spring



Order no. 199
Sliding-gear transmission

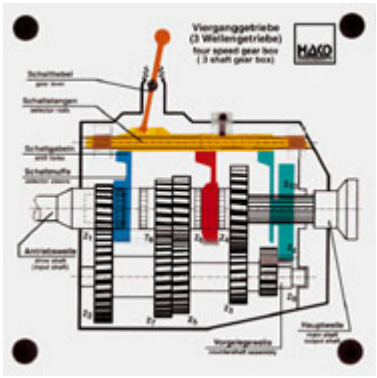
- this model facilitates the understanding of a modern car transmission
- power distribution of four forward gears and one reverse gear can be shown
- all gear wheels can be moved
- functions of the transmission's most important parts are shown



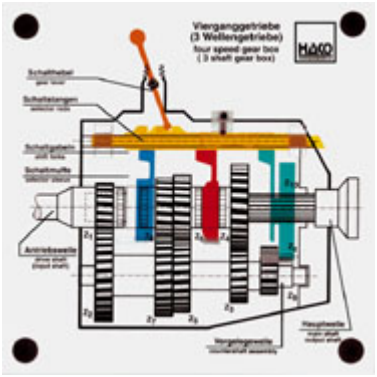
Order no. 201
Four-speed transmission

"reverse gear"

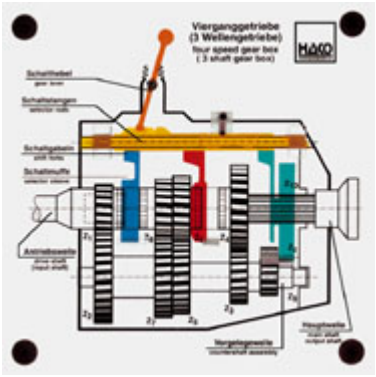
- shifting all gears (four forward and one reverse gear) through gearshift lever, sliding sleeve, synchronizing ring and gear wheel
- power distribution in all gears can be shown



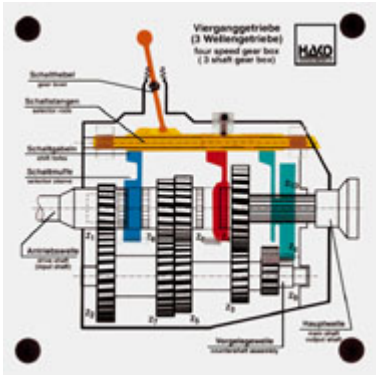
"4th gear"



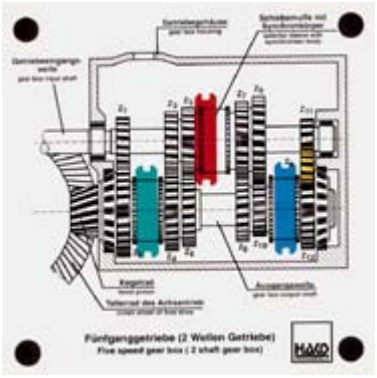
"3rd gear"



"2nd gear"

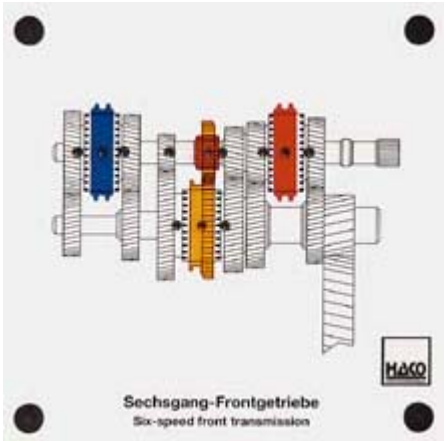


"1st gear"



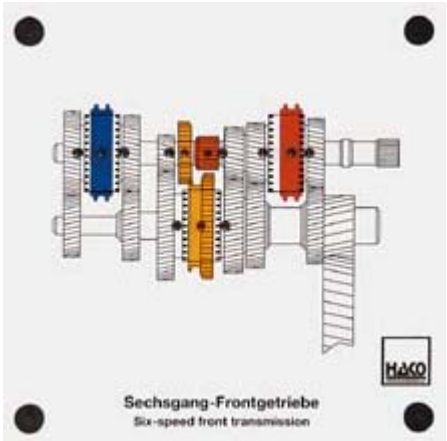
Order no. 202
Five-speed transmission

- power distribution in a five-speed transmission
- all sliding sleeves can be moved
- the reverse gear is synchronized

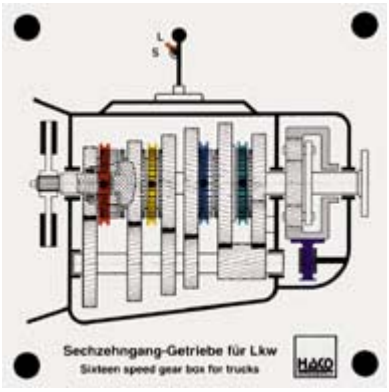


Order no. 466
Six speed front transmission

- shifting the six forward gears by displacing the gearshift sleeves
- shifting the reverse gear by displacing the reverse wheel

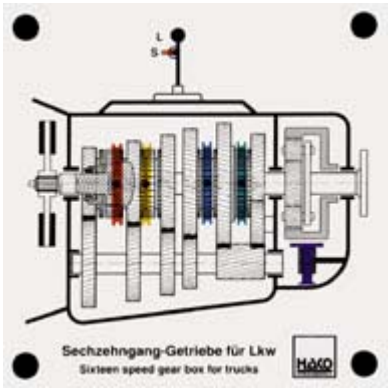


- power flow in the various gears
- recognition of the two overdrive gears

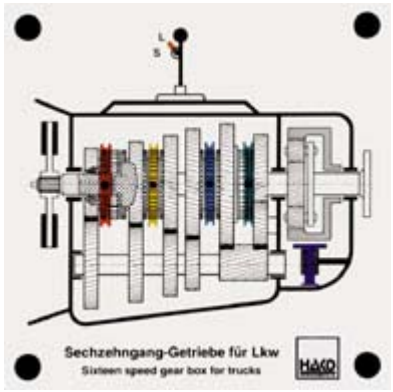


Order no. 438
Sixteen-speed gearbox for trucks

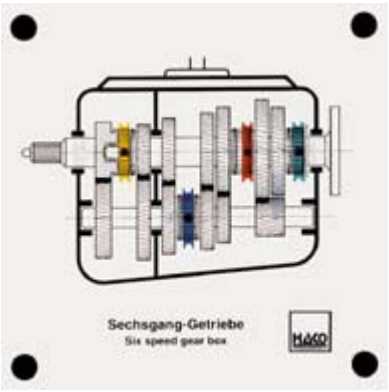
The basic module comprises a gearbox with four gears. By adding a front-mounted and a rear-mounted module, a sixteen-speed gearbox results. With the help of the left-hand sleeve, the



counter shaft can be driven with two transmission ratios. In this way eight forward gears result from four gears. In the rear-mounted group, two transmission ratios of the secondry shaft can be

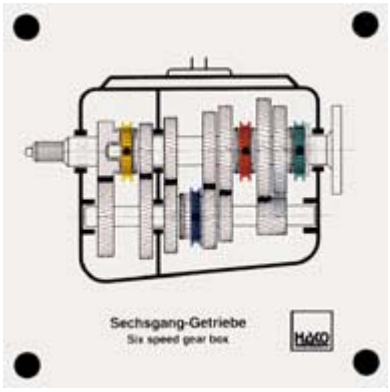


shifted with the help of a simple planteary gear set. Eight gear steps times two results in sixteen speeds.

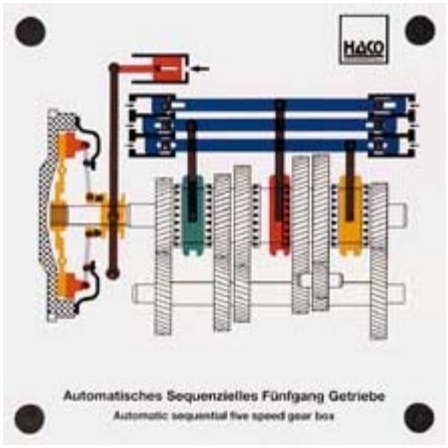


Order no. 433
Six-speed gearbox

This gearbox is ideal for practising the power flow in the individual gears. The shifting sleeves are distributed to both main shafts. A fourth shifting sleeve was required for the synchronised reverse gear.

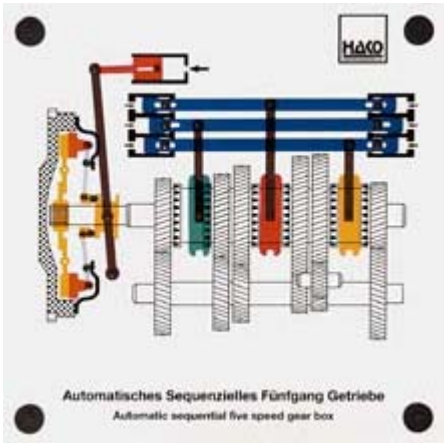


The power flow in the individual gears can be drawn onto a supplied worksheet by the pupils

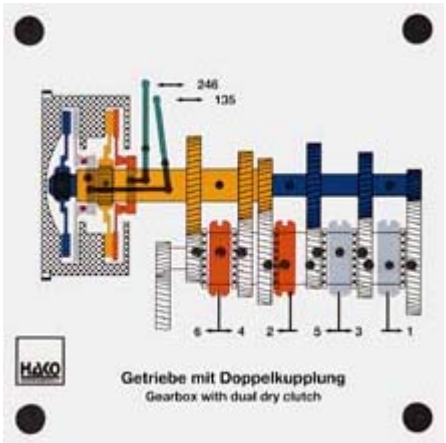


Order no. 467
Automatic sequential five speed transmission

- function of an automatic sequential transmission
- shifting of the gears by hydraulic plungers

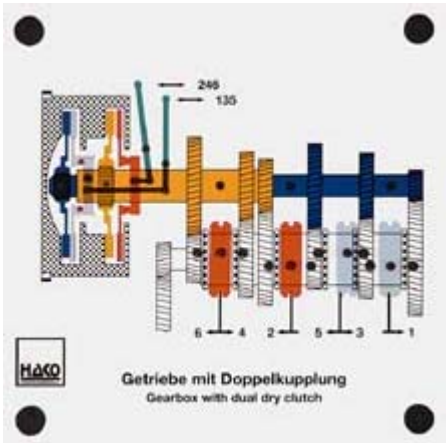


- coupling process by hydraulic operation
- power flow in the various gears

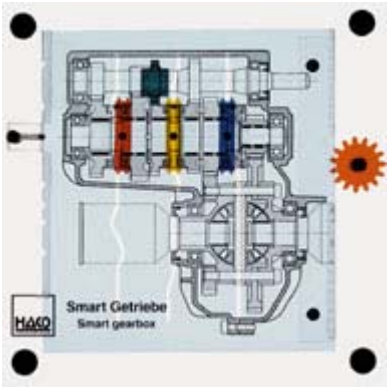


Order no. 465
Gear box with dual dry clutch

- operation and function of both clutches
- power flow 2nd, 4th and 6th gear, 1st 3rd and 5th gear via 2 different transmission input shafts

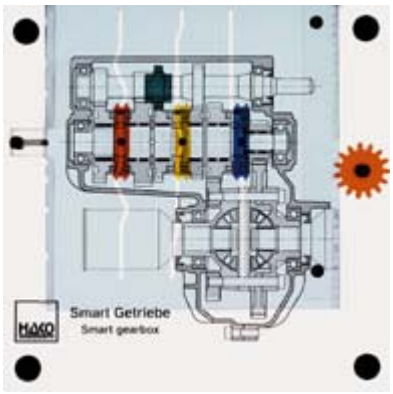


- shifting of all gears by displacing the gearshift sleeves
- change of clutch with 2 gears shifted

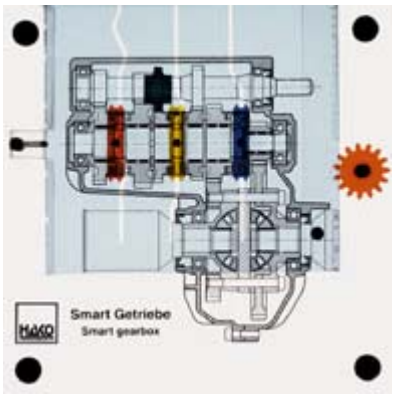


Order no. 432
SMART gearbox

This new construction by the firm of GRETAG shows a mechanical manual transmission with six forward gears and one reverse gear. A gear selector drum driven by an electric motor operates the shifting.



sleeves. For the differential, 2 different transmission ratios can be shifted, which means that 6 forward gears result from the 3 forward gears of the main shaft. An automatic clutch actuator takes over the



clutch engagement and de-clutching in each change of gear. The gearbox can be fitted as a semi-automatic or fully automatic gearbox.

Order no. 270
Draw-key transmission

- function of a draw-key transmission
- moving the draw key
- moving the balls to lock the different gear sets
- balls are released automatically after shifting

Order no. 278
Draw-key transmission (section of side view)

Ideal supplement to model #270

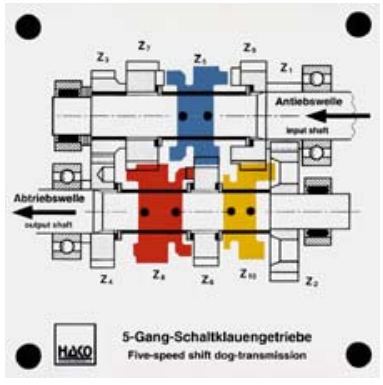
- power transmission: The draw key is pressed down. This causes the balls to role into the tooth space and act as a fitting connection between transmission input/primary shaft and toothed wheel.

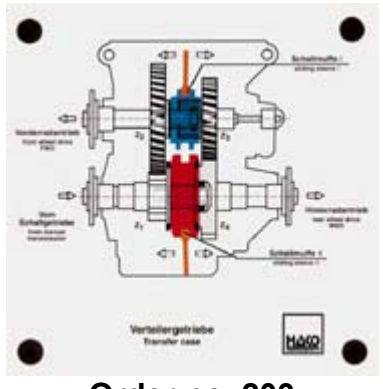
- idle gear: When the draw key is pulled up, the balls are pressed inward by the tooth space. the toothed wheel has no more connection to the transmission input shaft.

Notation: The draw key can easely be moved from the outside by means of a small cam and lever.

Order no. 451
Five-speed shift dog-transmission

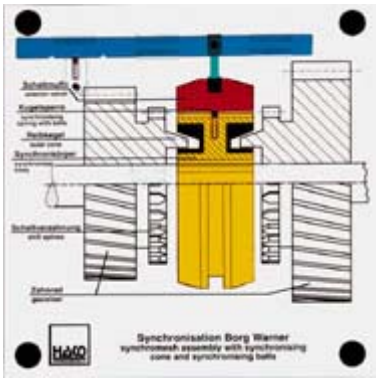
Flow of force in the shift dog transmission
Peculiarity of shift dog transmissions
Shifting of the five gears





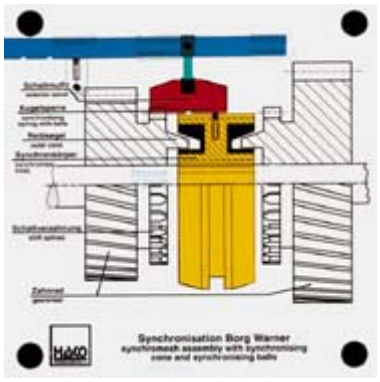
Order no. 203
Transfer case

- power distribution in a transfer case
- shift options: front axle only, rear axle only and both axles (four-wheel drive)

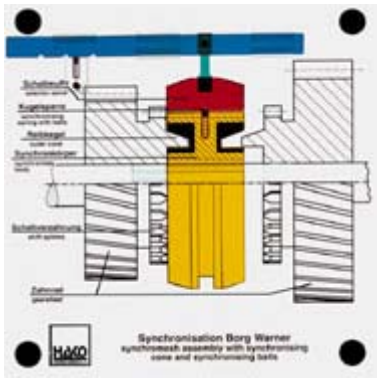


Order no. 144 Synchronization of the transmission

-gearshift rod with gearshift fork in motion
- sliding sleeve moves simulteneously
- synchronization by friction
- meshing of the sliding sleeve
- function of the ball interlock



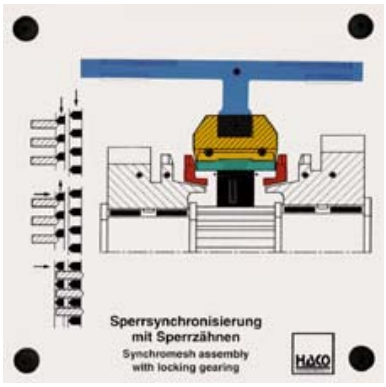
"Synchronise"



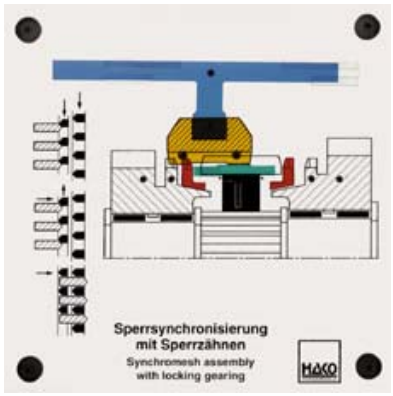
"Put in gear"

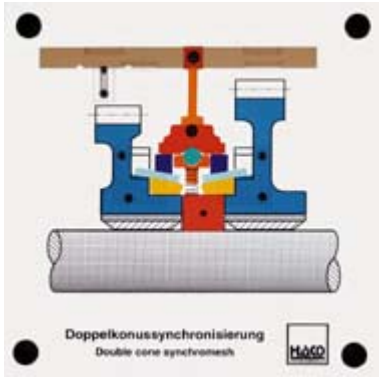
Order no. 439 Synchromesh assembly with locking gearing

Movement of gearshift rod and gearshift fork
Driving of the selector sleeve
Application of the synchroniser rings



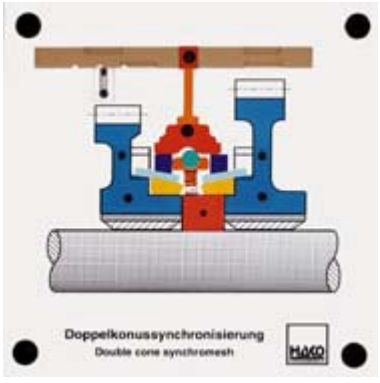
Synchronisation by friction
Shifting of the gear



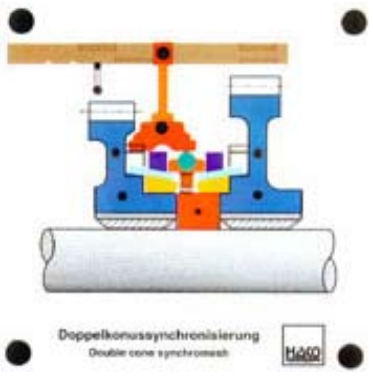


Order no. 400 Double-cone synchronization

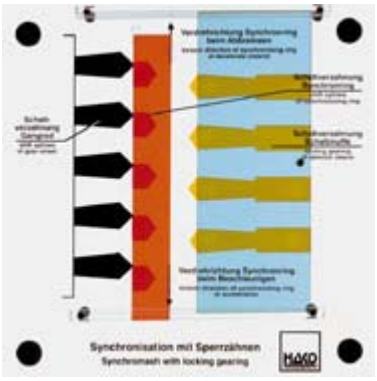
- moving the gearshift fork and sliding sleeve
- function of the shifting lock



- function of the two synchronizer rings with four friction surfaces
- function of the ball synchronising string

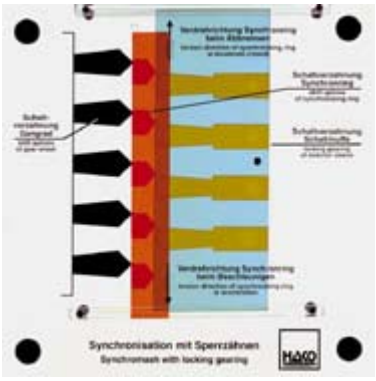


- demonstration of the synchronisation and the shifting of the gear

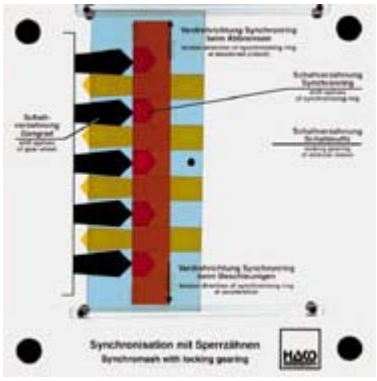


Order no. 186
Locking synchromesh with locking gearing

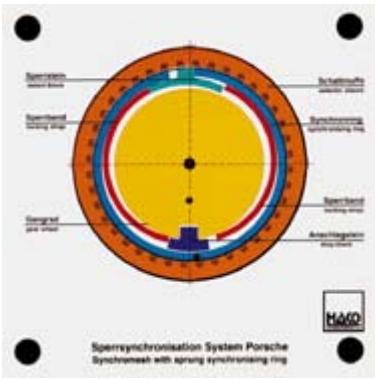
"idle position"



the synchronizing ring can be shifted half a tooth width up and down (slowing down or accelerating) and thus blocks the shift splines of the sliding sleeve

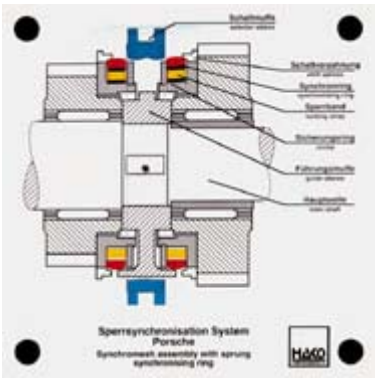


when the constant velocity (CV) is reached, the shift splines of the sliding sleeve move the synchronizing ring. Then, the gear can be shifted



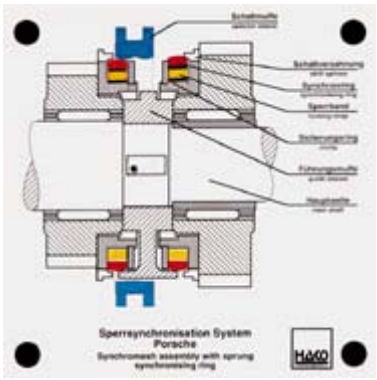
Order no. 164
Locking synchronization System Porsche

- dragging of the split synchronizing ring
- spreading of the locking straps causes syn

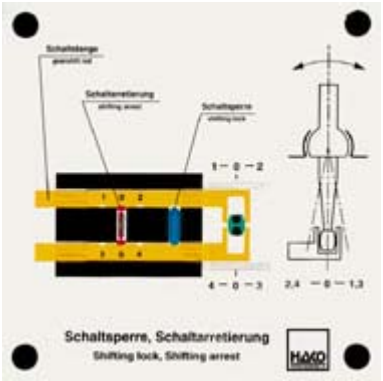


Order no. 204
Locking synchronization System Porsche (longitudinal section)

- this longitudinal section of a locking synchronization facilitates the understanding of model #164

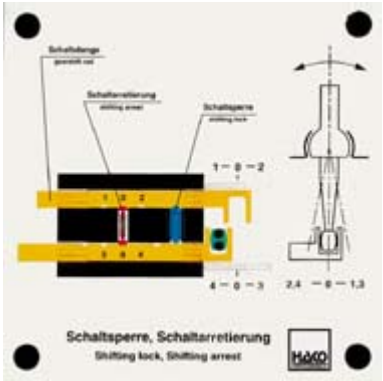


- when moving the sliding sleeve left and right, you can see how the synchronizing ring is squeezed and the locking straps moved
- shift options: neutral, synchronization and gear shifted

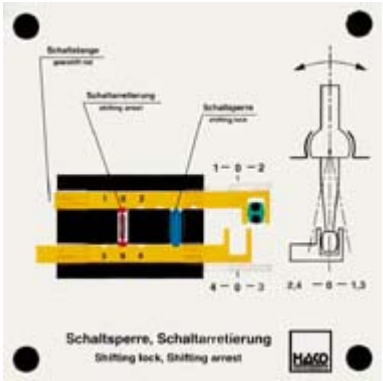


Order no. 371
Shifting lock, shifting arrest

The shifting arrest prevent 2 gears from being selected simulaneously by locking the other gearshift rod. Demonstration: that the simultaneous selection of two gears is not possible.



- The wedgelock mechanism prevents a gear from jumping out once selected and keeps the gears which are not selected in the neutral position. All gears are selectable.



Order no. 430
Torque converter lock-up clutch

Functions:
- Power flow from the converter housing via the pump,
stator and turbine to the inlet shaft of the gearbox with the lock-up switched off.
- The hydraulic piston is pressed onto the friction disks
with the help of the oil pressure
- The power flow now runs from the converter housing
directly to the inlet shaft, the slip is switched off.

Order no. 462
Sequence of flow in a torque converter

The model shows the turbine wheel, the pump wheel and the stator on one level.

1st figure: Starting: In starting, the pump wheel runs, the turbine wheel is still stationary. The flow of oil is guided onto the blades of the pump wheel at a favourable angle by the stator. There is an increase of the engine torque.

2nd figure: Starting up to the coupling point: With an increasing speed of the turbine wheel, the difference in speed between the pump and turbine wheel becomes smaller and smaller. The flow of oil is not deflected much and impacts on the blades of the stator at a lower angle. The stiffening force and thus also the torque reinforcement becomes less.

3rd figure: Coupling area: When the pump and turbine wheel have approximately the same speed, the stator is flowed onto from the back, the free-wheel releases and the stator also turns.

Order no. 239
Simple planetary gear train

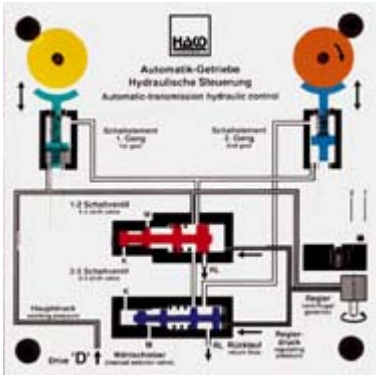
- all transmission ratios of a simple planetary gear train can be shown by driving by driving and locking different parts of the model from the outside

Order no. 240
Planetary gear train: Ravigneaux gear set

- consists of ring gear, planet carriers, two sun wheels and six planetary wheels
- the gear train can be set to the desired transmission ratio from the outside

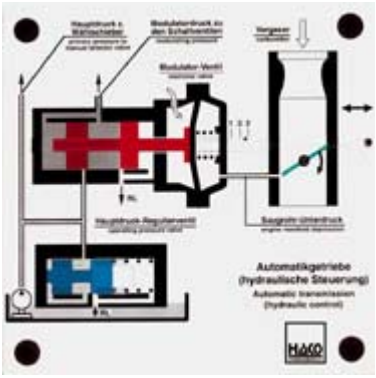
Order no. 385
Planetary gear train: Simpson gear set

- Two simple planetary gear sets are combined to formed a single set. The Simpson gear set has 2 ring gears, 2 planet carriers and two connected sun wheels. Various gears (forwards and reverse) can be selected.



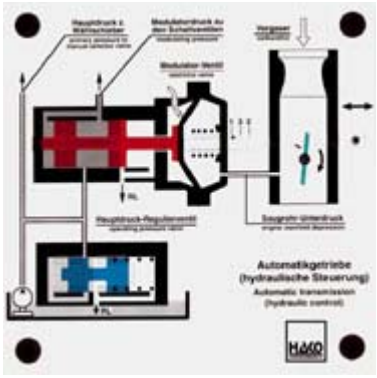
Order no. 215
Control of an automatic transmission

Principles of an automatic transmission
- by actuating one lever in the model, a piston is moved and simultaneously a brake band tightened and another one released



Order no. 227
Automatic transmission (plessure-controlled)

- the model shows how pressure variations in the intake manifold (i.e.load) act on the control piston via a diaphragm. The control piston influences the shift points of the automatic transmission

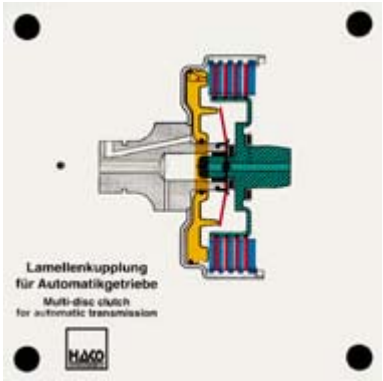


- the control piston is moved by the diaphragm when the throttle blade is turned. (In the model a small, transparent pinion moves the diaphragm via a gear rack)

Order no. 372
Park position

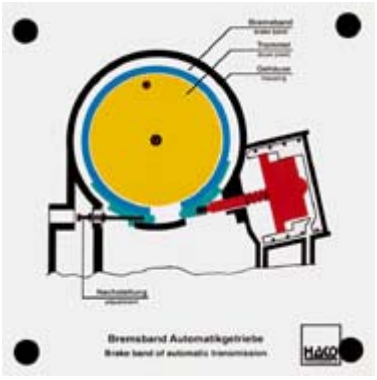
If the selector lever of an automatic transmission is on "P", the park position is engaged and prevents the vehicle from rolling.
Functions: Selection of the park position by means of the control piston valve.

When tooth meets tooth, only the torsion spring is preloaded. When the wheel is wheel is turned further, the locking pawl engages in the next indentation.



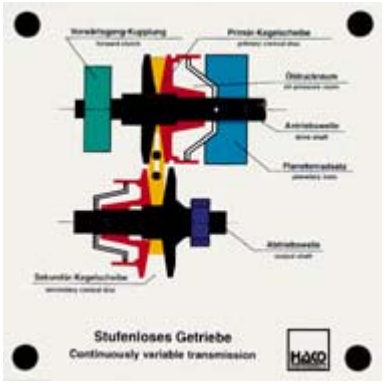
Order no. 373
Multi-disk clutch for automatic transmission

Hydraulic clutches are necessary for shifting theplanetary gear train. Function of the ventilating system. Power flow: the piston presses the discs. Freewheeling: the piston releases the discs. The piston is hydraulically operated.



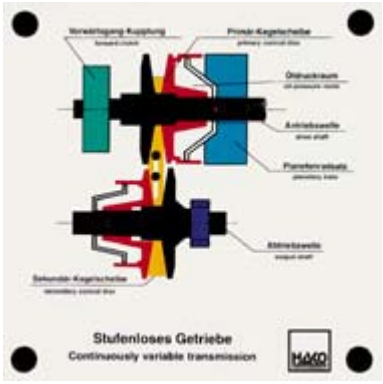
Order no. 179
Brake band of an automatic transmission

- function of the brake-band plunger
- function of the retracting spring
- tensioning the brake band stops the drum
- resetting the brake band



Order no. 384
Infinitely variable PC transmission

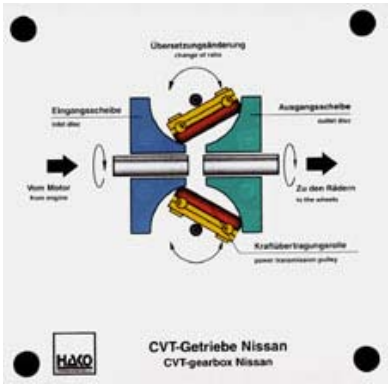
The transfer of power from the primary conical disc to the secondary conical discis made by means of the sliding articulated band. The infinitely variable alteration of the transmission ratio is obtained by means of hydraulic pistons.



This either presses the conical discs together or separates them. This causes the sliding articulated band to run on varying friction radii.

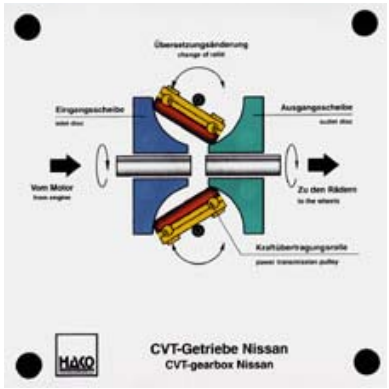
Order no. 229
Gear drive without backlash

The gear drive without backlash, mainly used for motor bikes, has on one shaft a gear wheel with 49 teeth and another gear wheel with 50 teeth. The two are axially preloaded against each other. With every rotation, the gear wheel with 49 teeth is turned one tooth farther than the gear wheel with 50 teeth. This causes a gear drive without backlash.



Order no. 448
CVT-gearbox Nissan

Infinite transmission for rear-wheel driven cars, suitable up to 500 Nm. A roll is used for the force transmission. Pivoting the roll alters the gear ratio infinitely.



Order no. 269
Limited-slip differential with friction plates

Functions:
- displacing the differential spider gear with shaft
- putting the shaft of the differential spider gear against the tapers of the thrust rings

- the thrust rings are spread apart
- pressing the cluth plates together
- locking the differential
- deviding the power flow in the differential