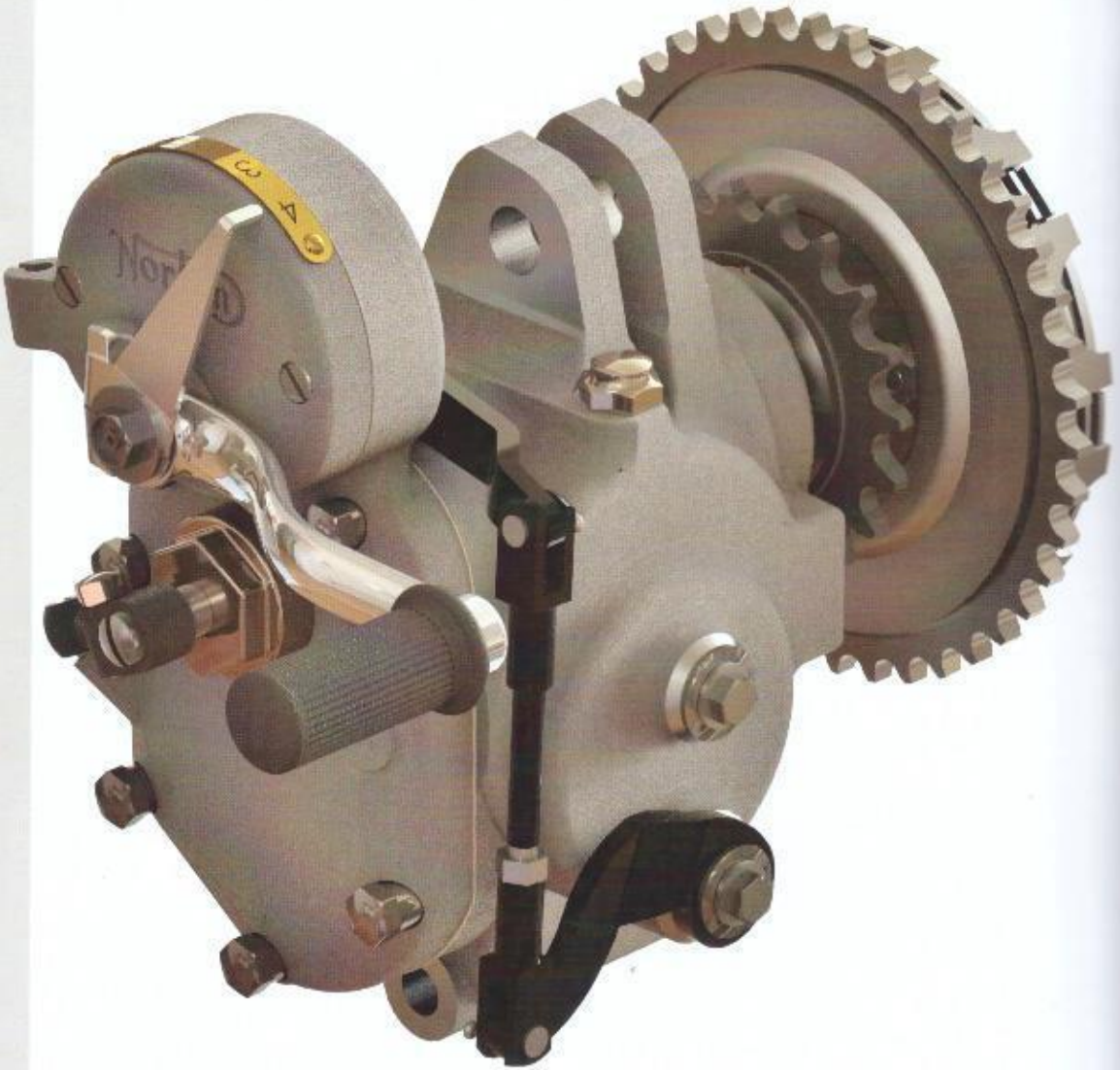
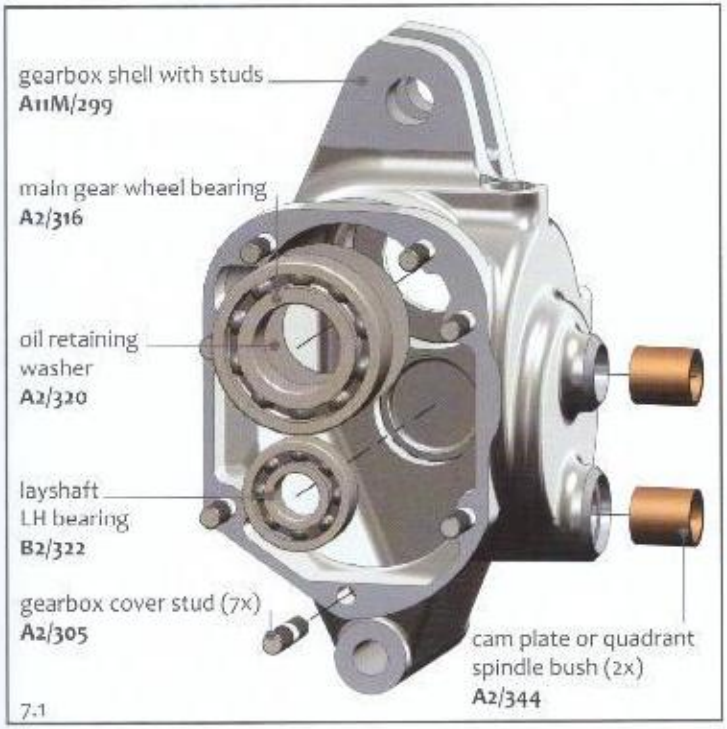
CHAPTER 7 SEVEN

GEARBOX & CLUTCH



This gearbox is a Sturmey Archer by design, but is copied, improved and built by Burman for Norton. The four speed constant mesh close ratio gearbox has the two shafts positioned above each other.

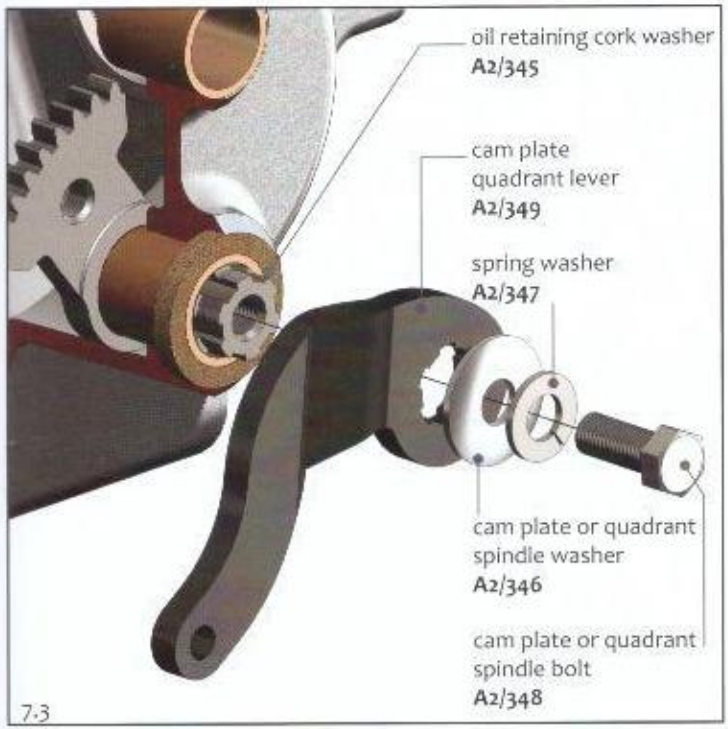
The foot operated gear selection mechanism is at the TS in a separate compartment that gave rise to another nickname; this type is also known as the 'dolls head' gearbox.


gearbox shell with studs
A11M/299
main gear wheel bearing
A2/316
oil retaining washer
A2/320
layshaft LH bearing
B2/322
gearbox cover stud (7x)
A2/305
cam plate or quadrant spindle bush (2x)
A2/344

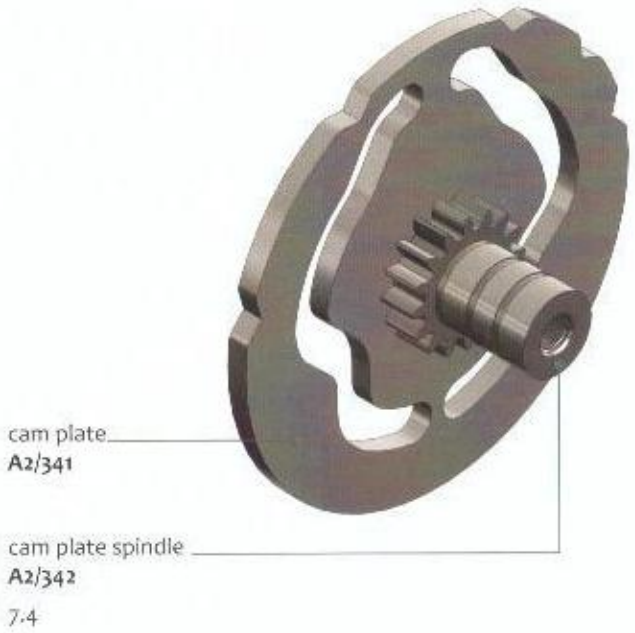
7.1


cam plate quadrant with spindle
A2/343
fibre washer
E5264
oil drain plug
E3336

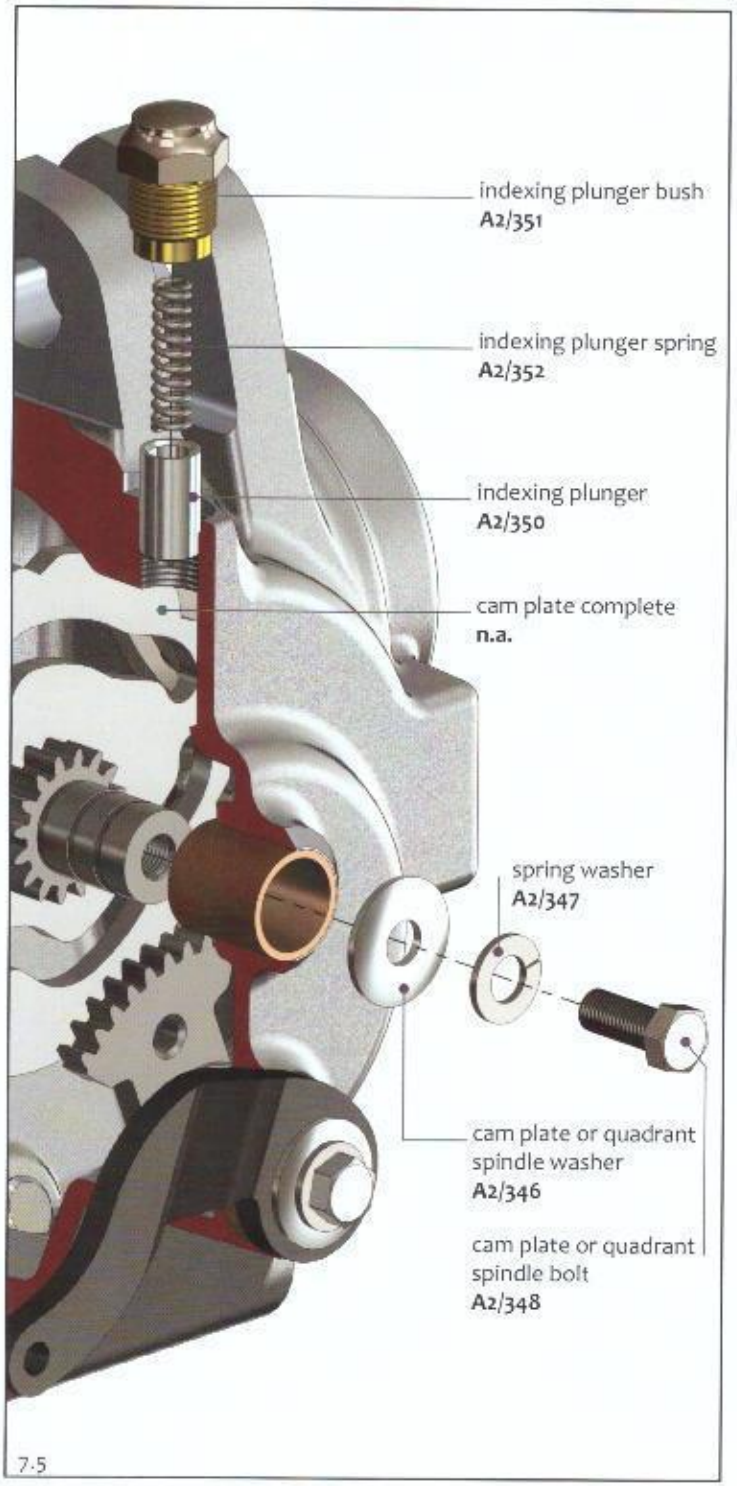
7.2


oil retaining cork washer
A2/345
cam plate quadrant lever
A2/349
spring washer
A2/347
cam plate or quadrant spindle washer
A2/346
cam plate or quadrant spindle bolt
A2/348

7.3


cam plate
A2/341
cam plate spindle
A2/342

7.4

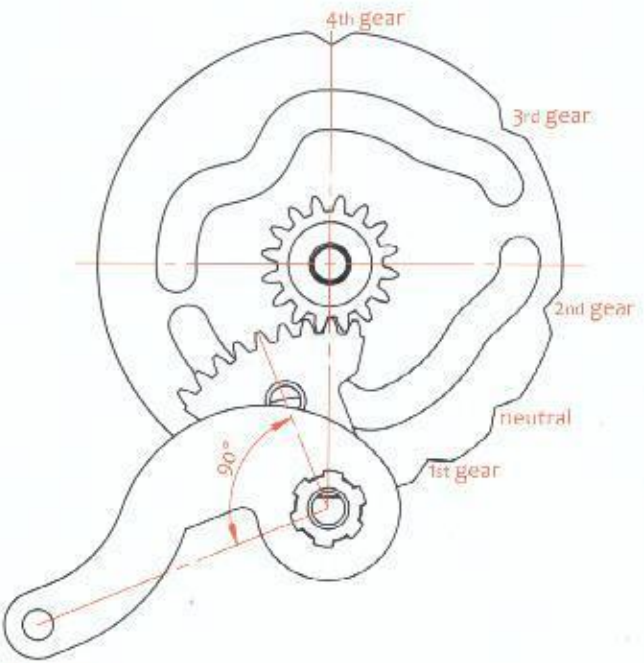


7.5

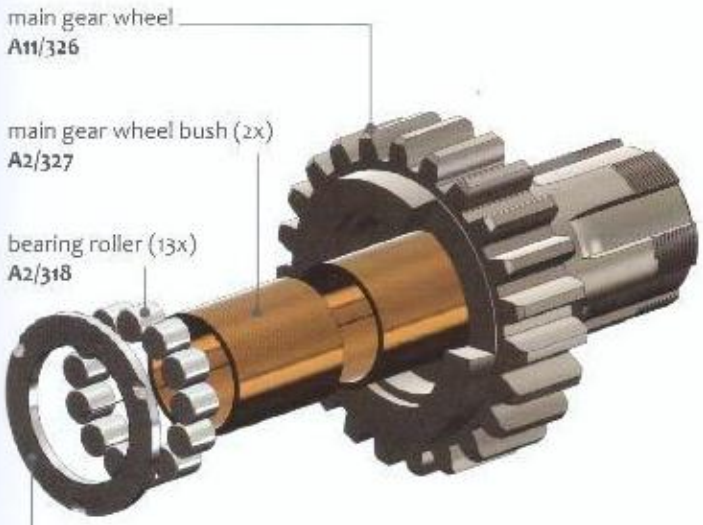
▶ The dogs responsible for the lateral engagement are under cut; when an initial grab is established, it is unlikely that both gears will lose contact.

When the clutch is operated, the reaction force pulls the main axle against the main gear wheel, hence the thrust washer. Wear on this thrust washer will increase axial play and thereupon cause gear shift problems.
More likely to cause problems is an accumulation of play at all the joints between axis and levers that transfer the foot pedal gear motion onto the cam plate inside the gearbox. Too much wear may leave the cam plate unable to reach the next detent.

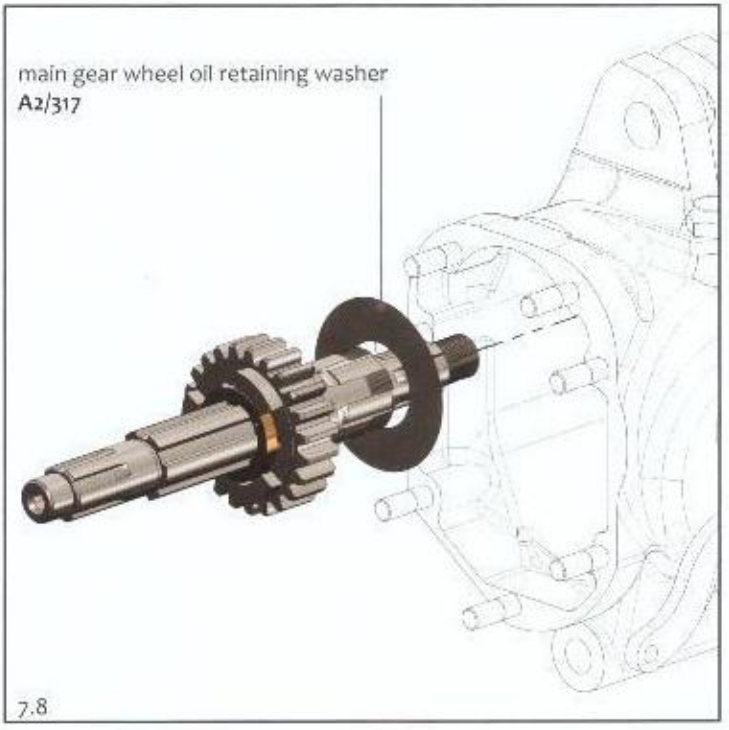
▼ Rotate the cam plate with 4th gear detent on top and mesh the cam plate quadrant with its last but one tooth on the vertical centre line. The cam plate quadrant lever must make a 90° angle with the symmetry plane of the cam plate quadrant.



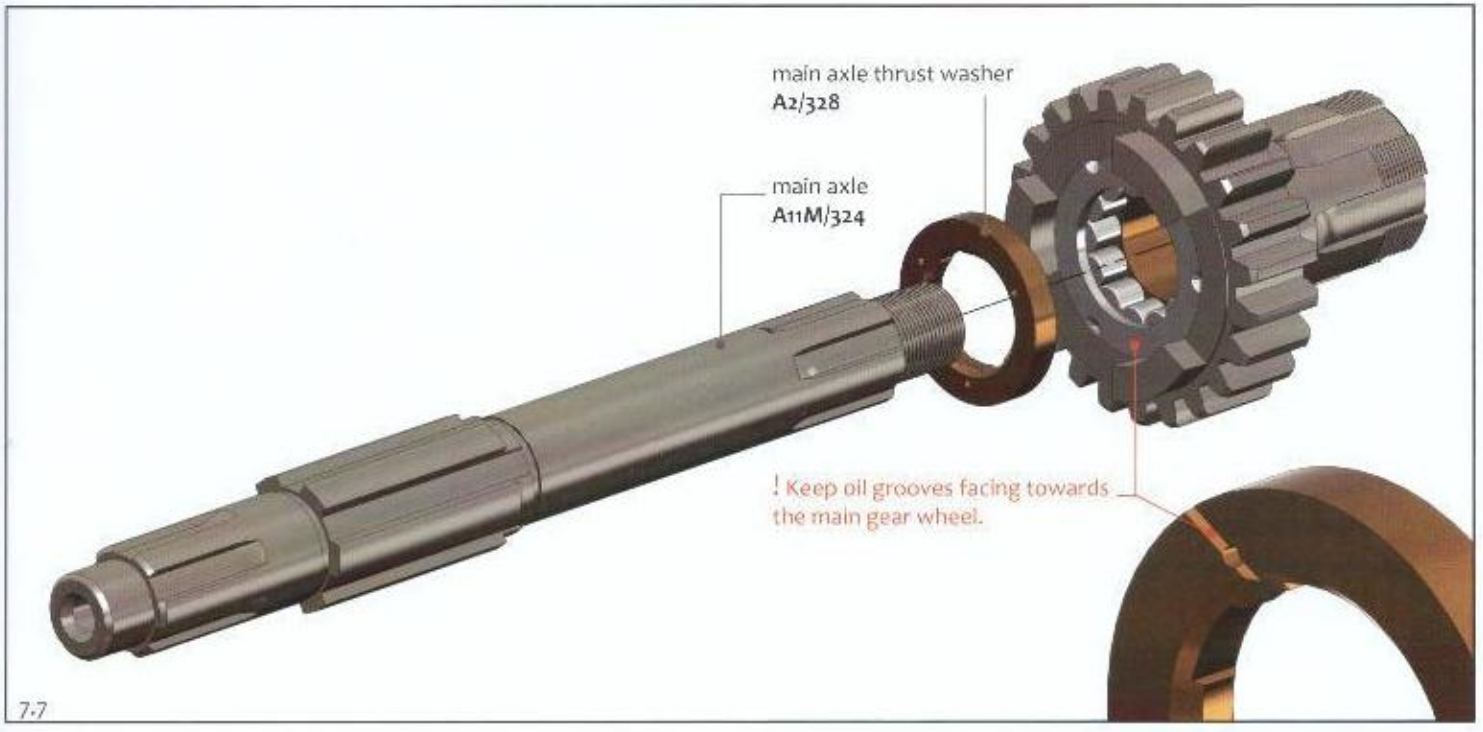
7.3 & 7.5 info


main gear wheel
A11/326
main gear wheel bush (2x)
A2/327
bearing roller (13x)
A2/318
bearing roller retaining washer
A2/319

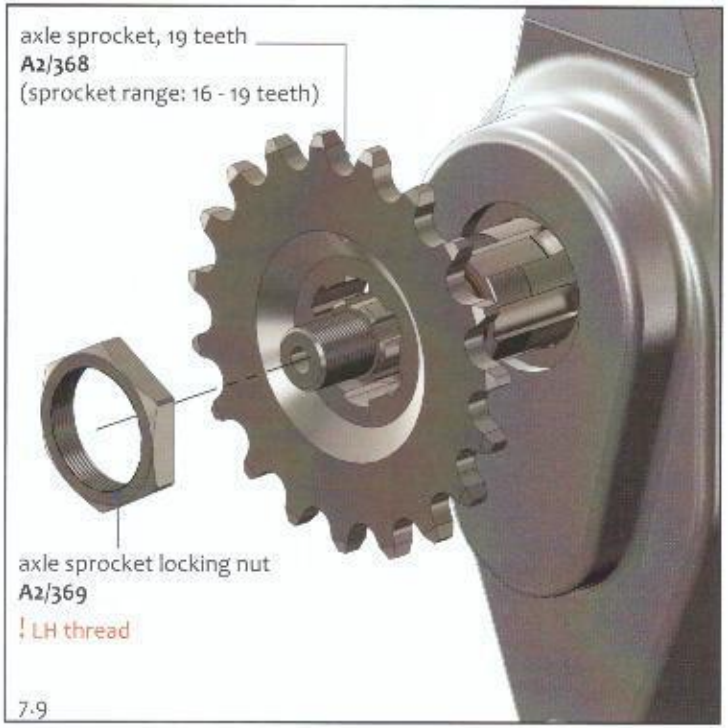
7.6


main gear wheel oil retaining washer
A2/317

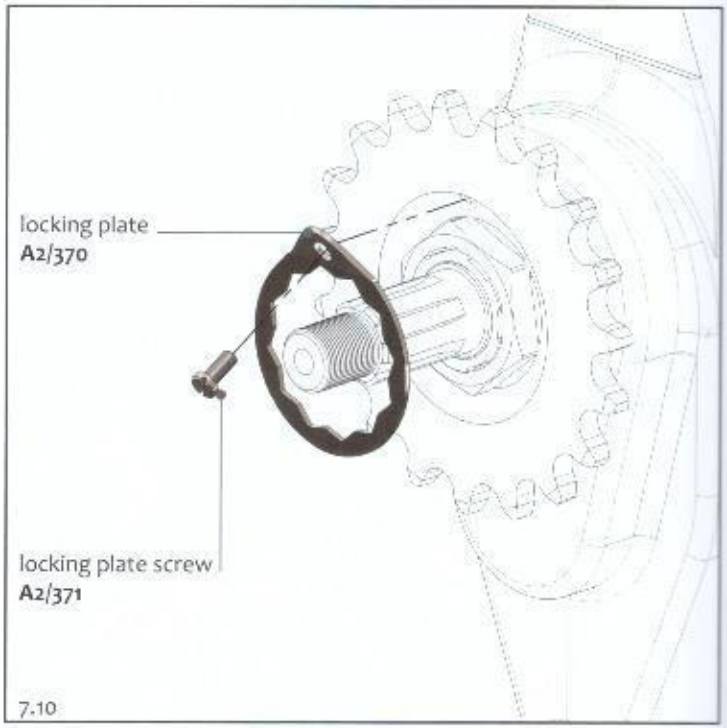
7.8


main axle thrust washer
A2/328
main axle
A11M/324
! Keep oil grooves facing towards the main gear wheel.

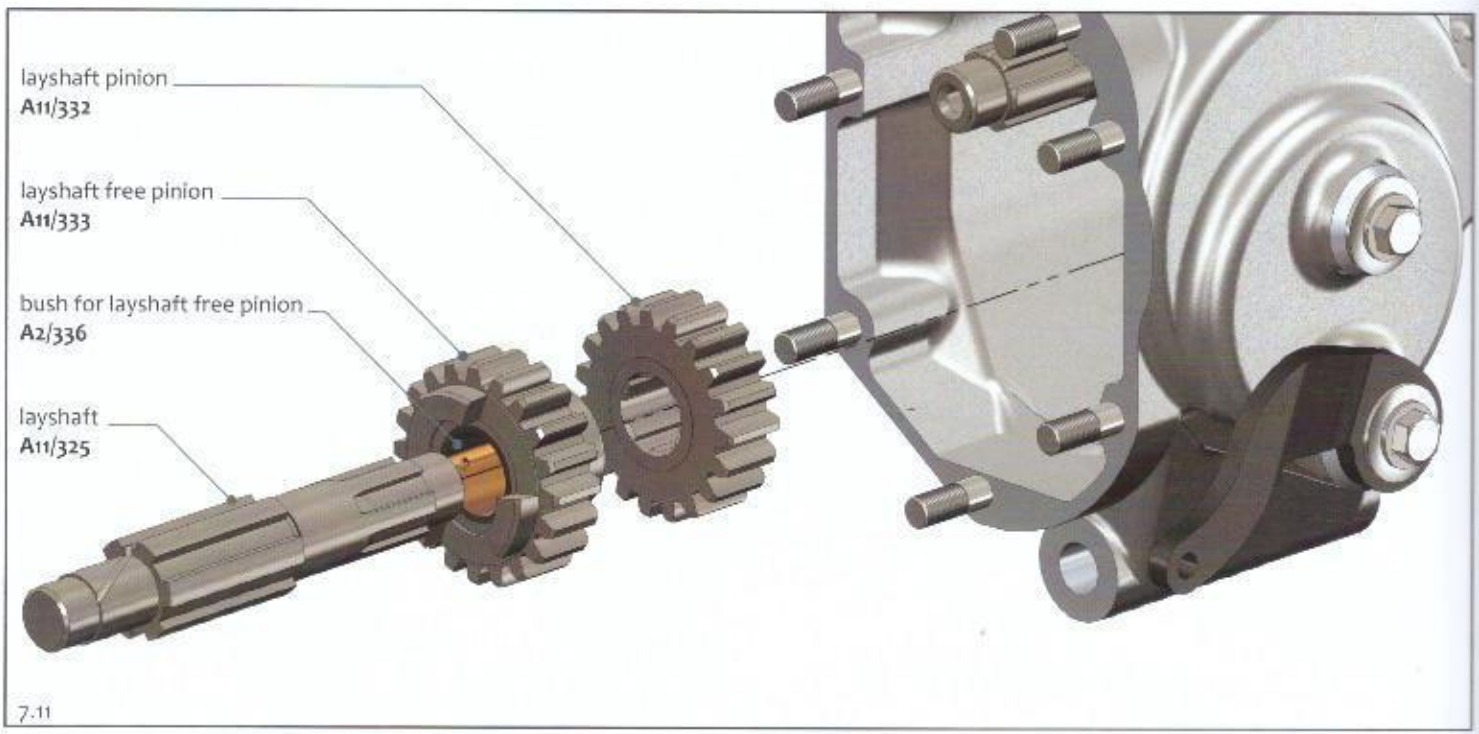
7.7


axle sprocket, 19 teeth
A2/368
(sprocket range: 16 - 19 teeth)
axle sprocket locking nut
A2/369
! LH thread

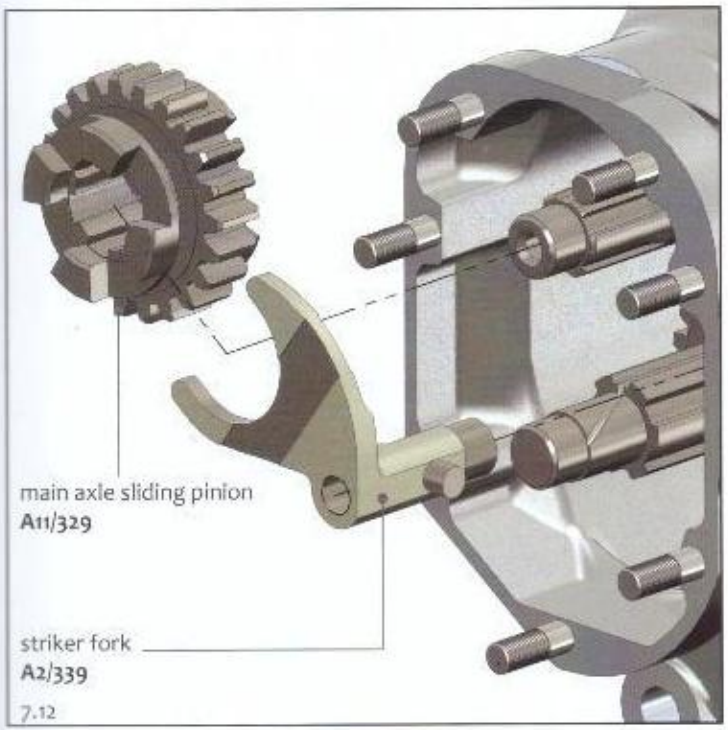
7.9


locking plate
A2/370
locking plate screw
A2/371

7.10


layshaft pinion
A11/332
layshaft free pinion
A11/333
bush for layshaft free pinion
A2/336
layshaft
A11/325

7.11

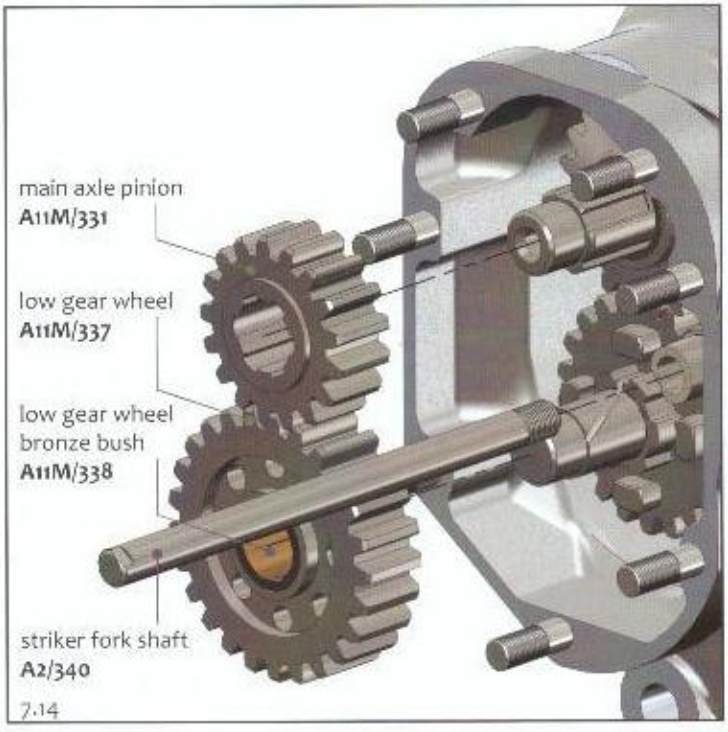


7.12

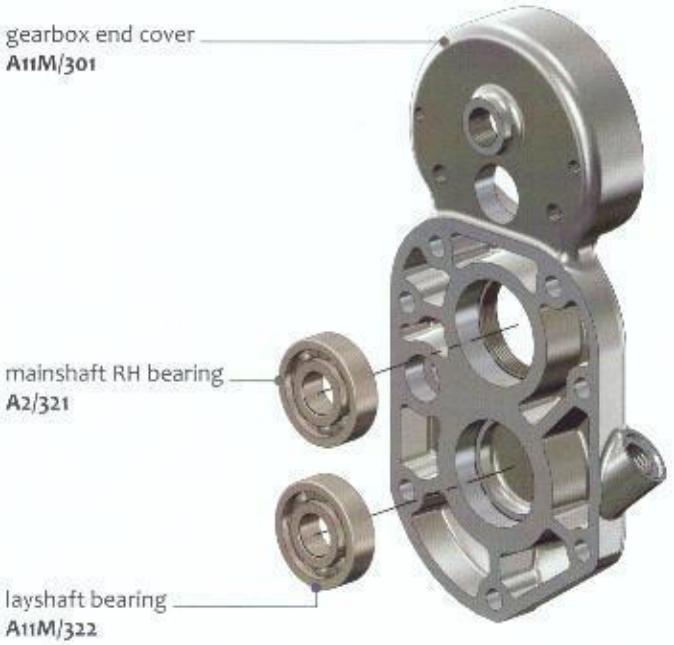
Mesh the striker fork dowels with the curved slots in the cam plate.

7.12 & 7.13 info

7.13

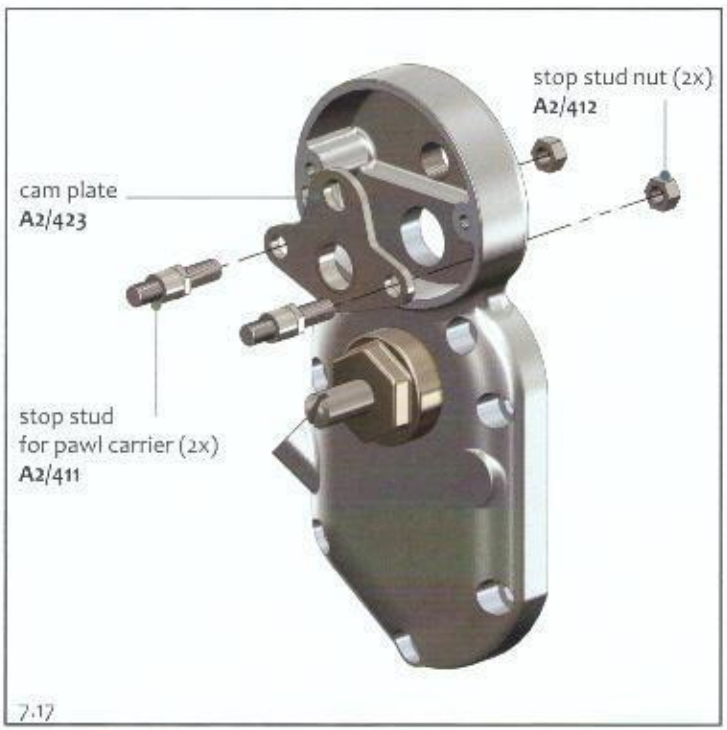


7.14

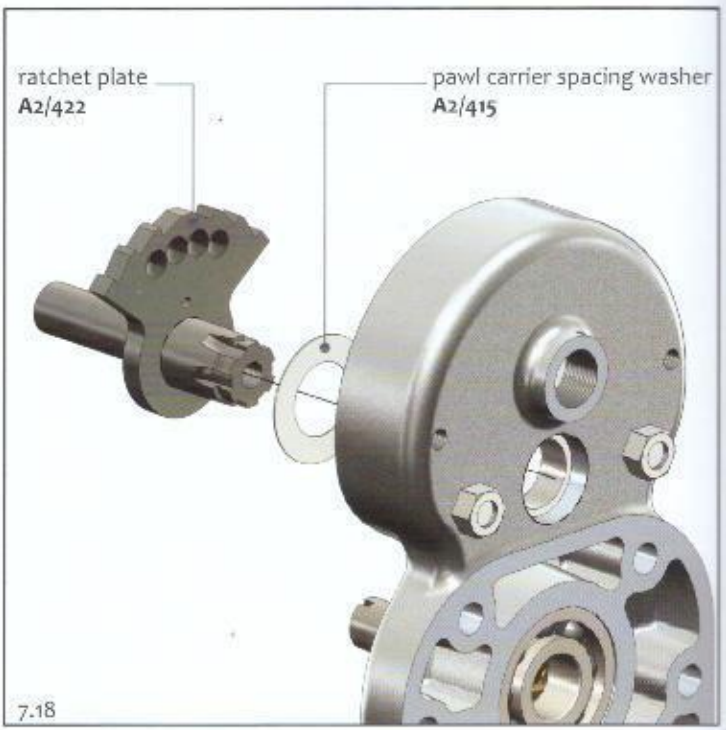


7.15

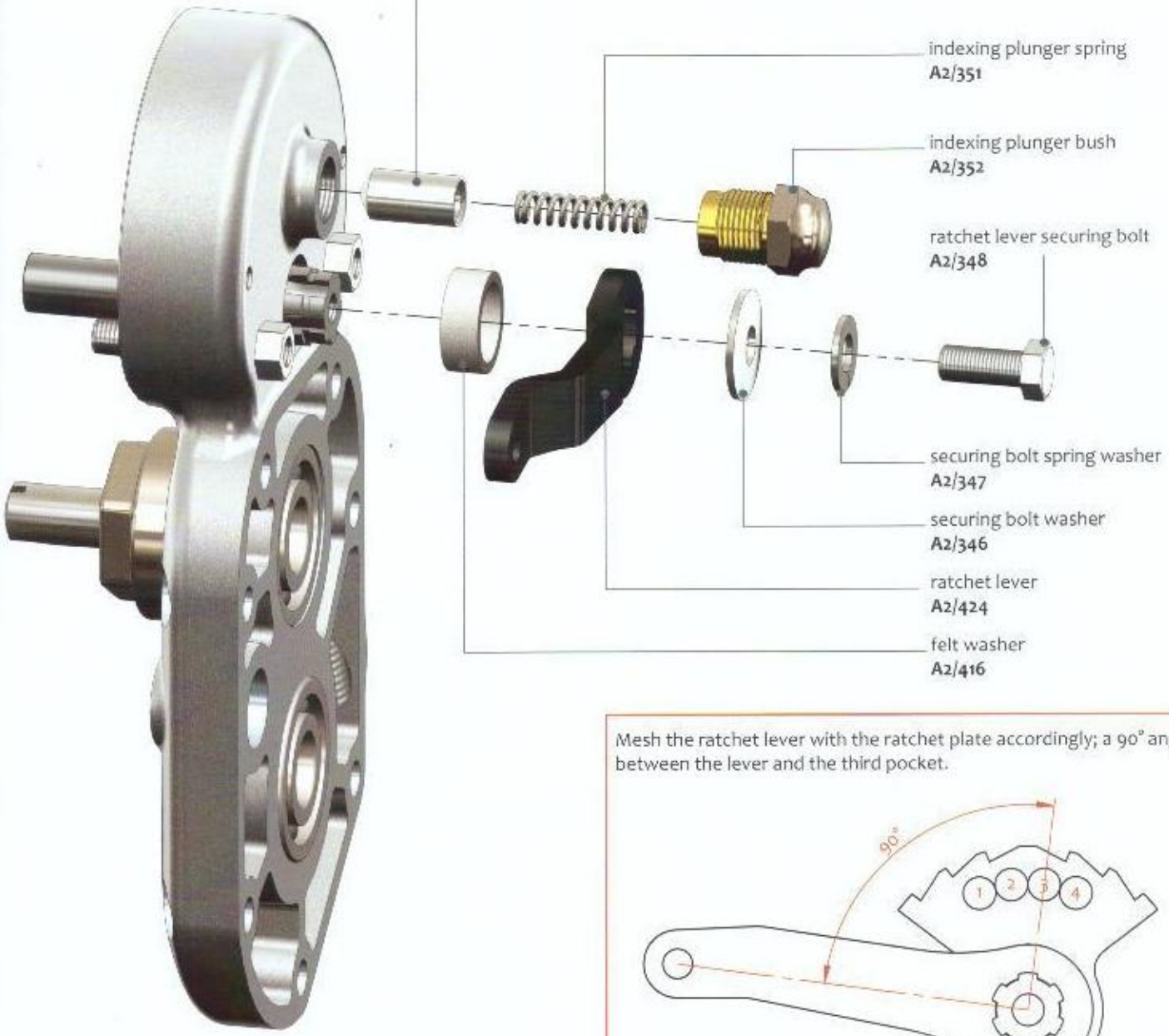
7.16



7.17



7.18

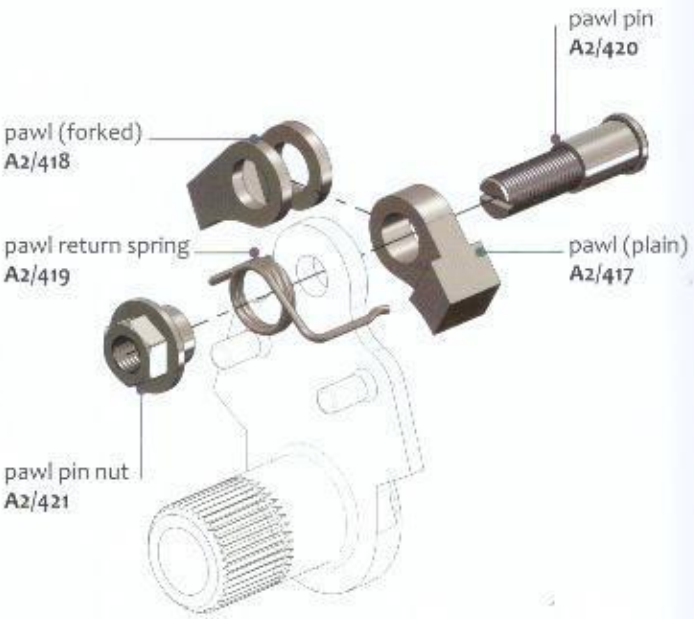


Mesh the ratchet lever with the ratchet plate accordingly; a 90° angle between the lever and the third pocket.

7.19 info

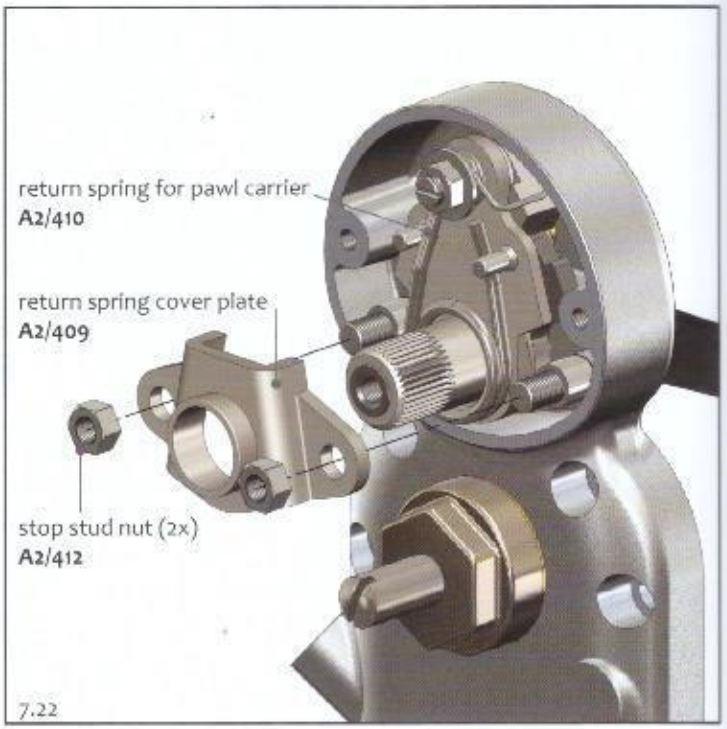
7.19

7.20



7.21

7.21 info



7.22

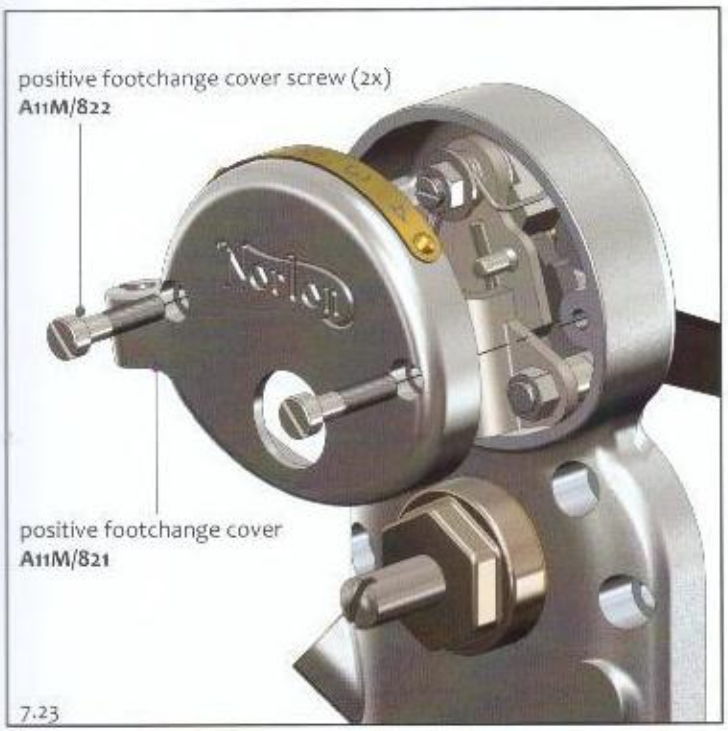
gear lever securing bolt
A2/408

gearbox change speed indicator
A2/404

gear lever
A11M/406

washer
A2/864

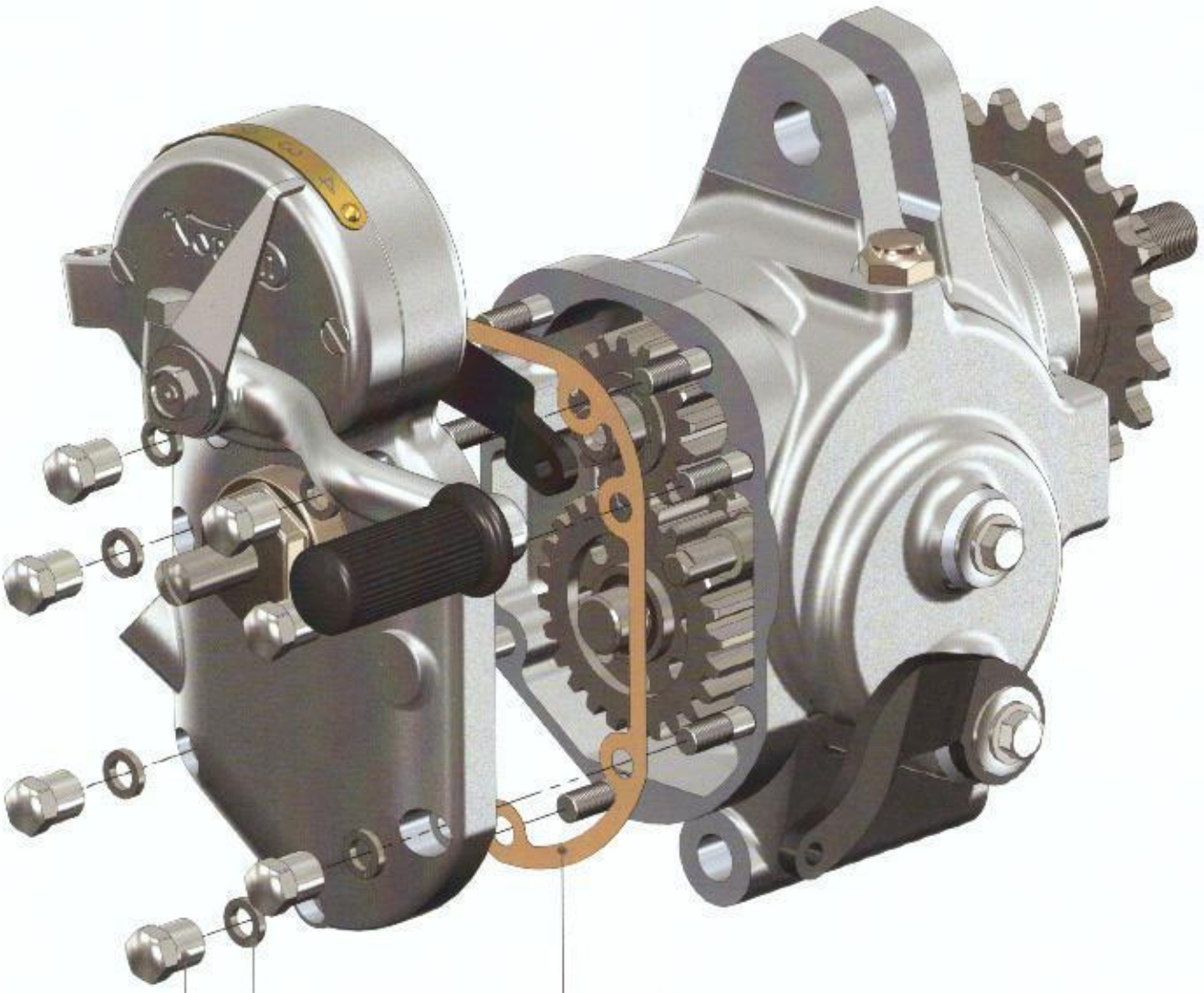
grease nipple bolt
A2/405



7.23

gear lever rubber
A11M/407

7.24



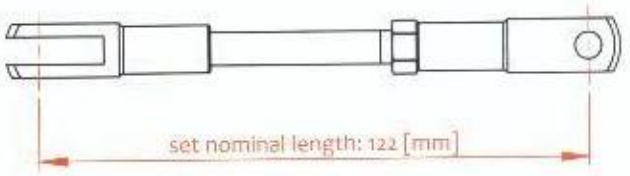
gearbox cover stud nut (7x)
A11M/307

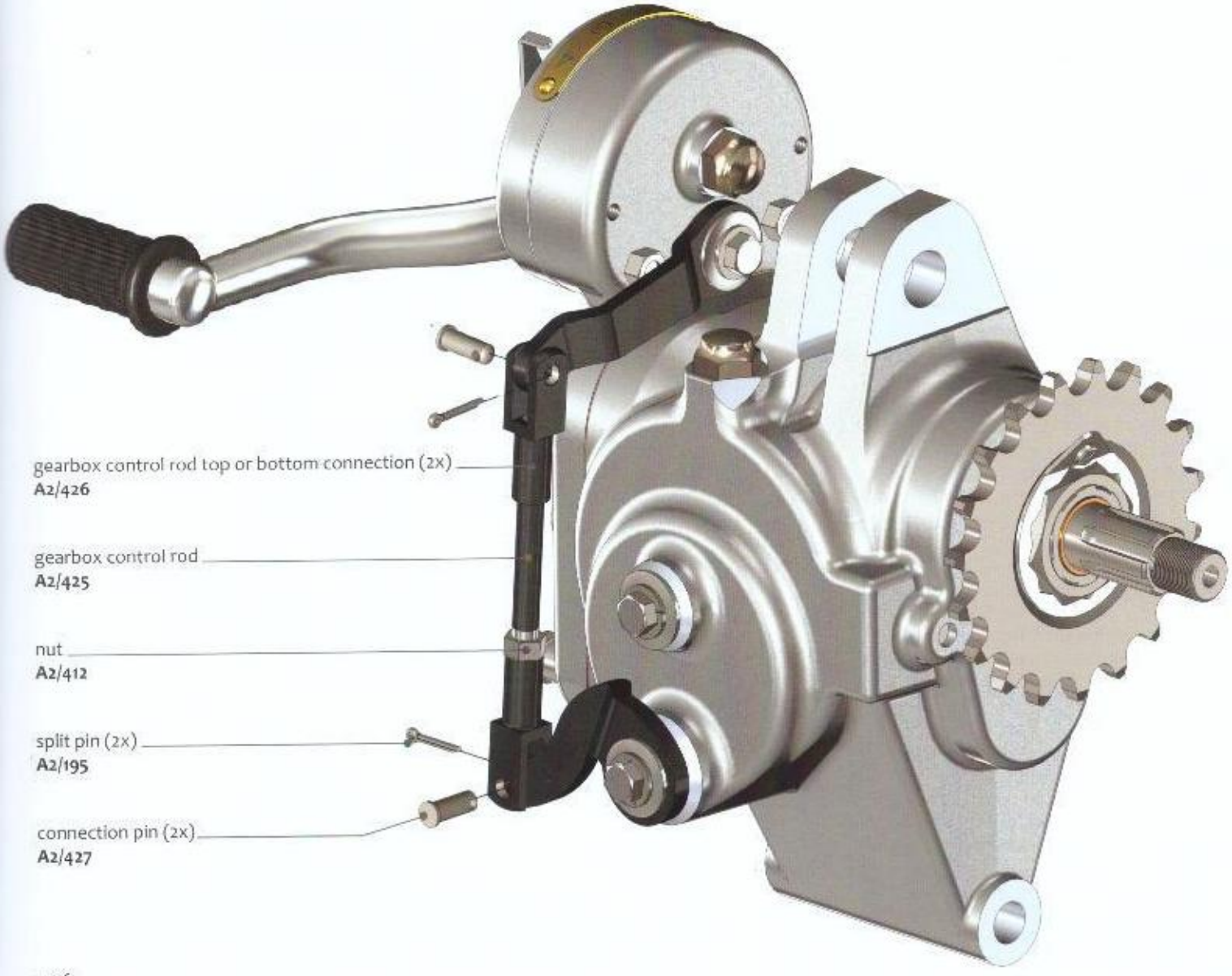
gearbox cover stud spring washer (7x)
A2/308

paper washer
A2/303

7.25

▶ Set the control rod at the nominal length before installing it. Once the rod is in place, proceed by selecting all gears with the gear lever and check each time whether a clear match was felt or heard from the indexing plungers, to ensure that the gears are selected properly.
When gears can only be selected by manipulating the cam plate quadrant lever manually, then adjust the control rod, and check whether play at the joints is too big.





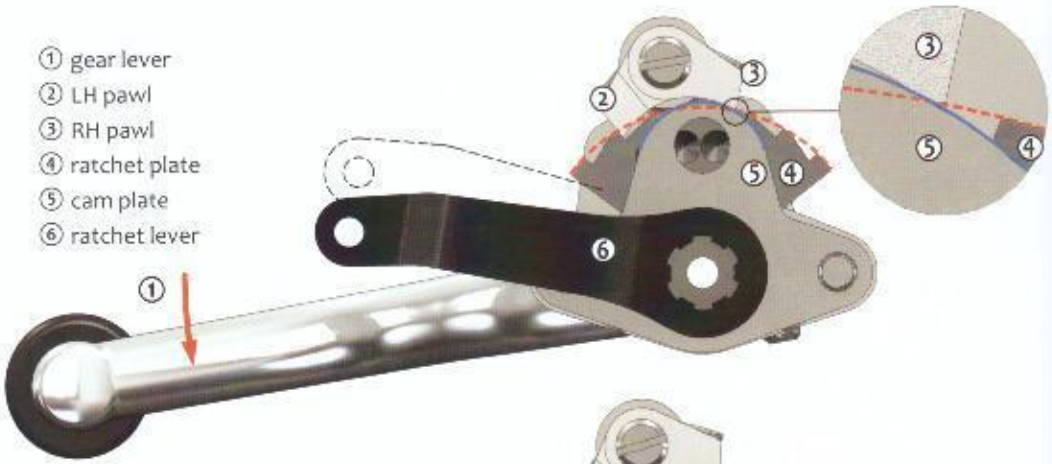
7.26

Before proceeding with the assembly steps that will take us to the clutch, it is good to have a closer look at what we have assembled so far, and see how the entire gearbox works. We start by looking at the positive foot change mechanism and make a random gear shift, in this case a shift upwards from 2nd to 3rd gear.

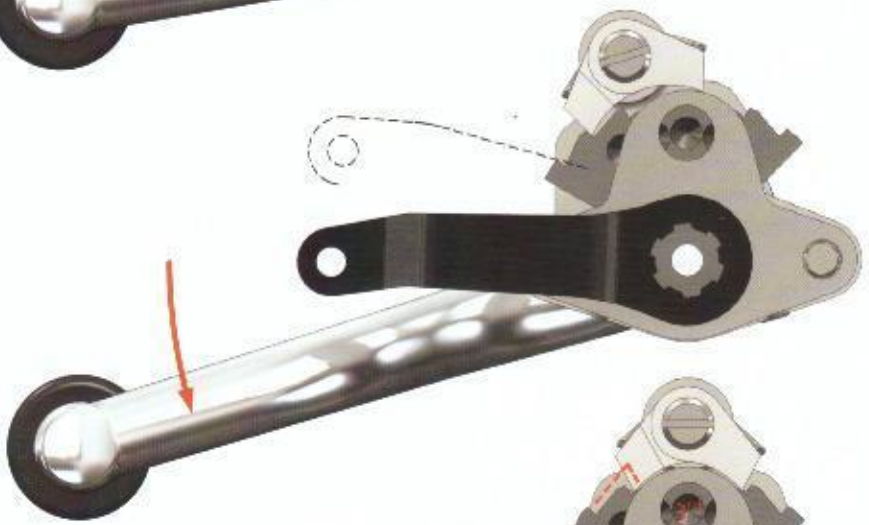
▶ Starting-point in 2nd gear.

▶ The gear lever is brought down by the foot and this makes the LH (plain) pawl catch the ratchet plate and take it along.
At the same time the RH (forked) pawl has a tooth from the ratchet plate about to pass underneath it.
Teeth on the ratchet plate follow the orange dotted trajectory, while the inactive pawl is dragged over the blue contour of the cam plate. Now it is clear that the ratchet plates teeth can overtake an inactive pawl and thus create a new starting-point.

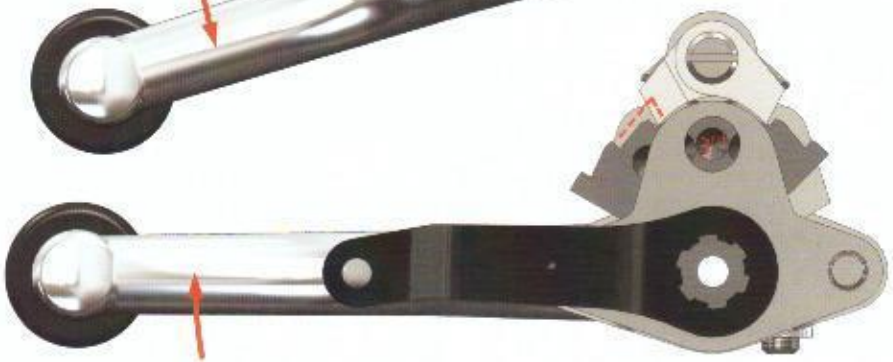
① gear lever
② LH pawl
③ RH pawl
④ ratchet plate
⑤ cam plate
⑥ ratchet lever

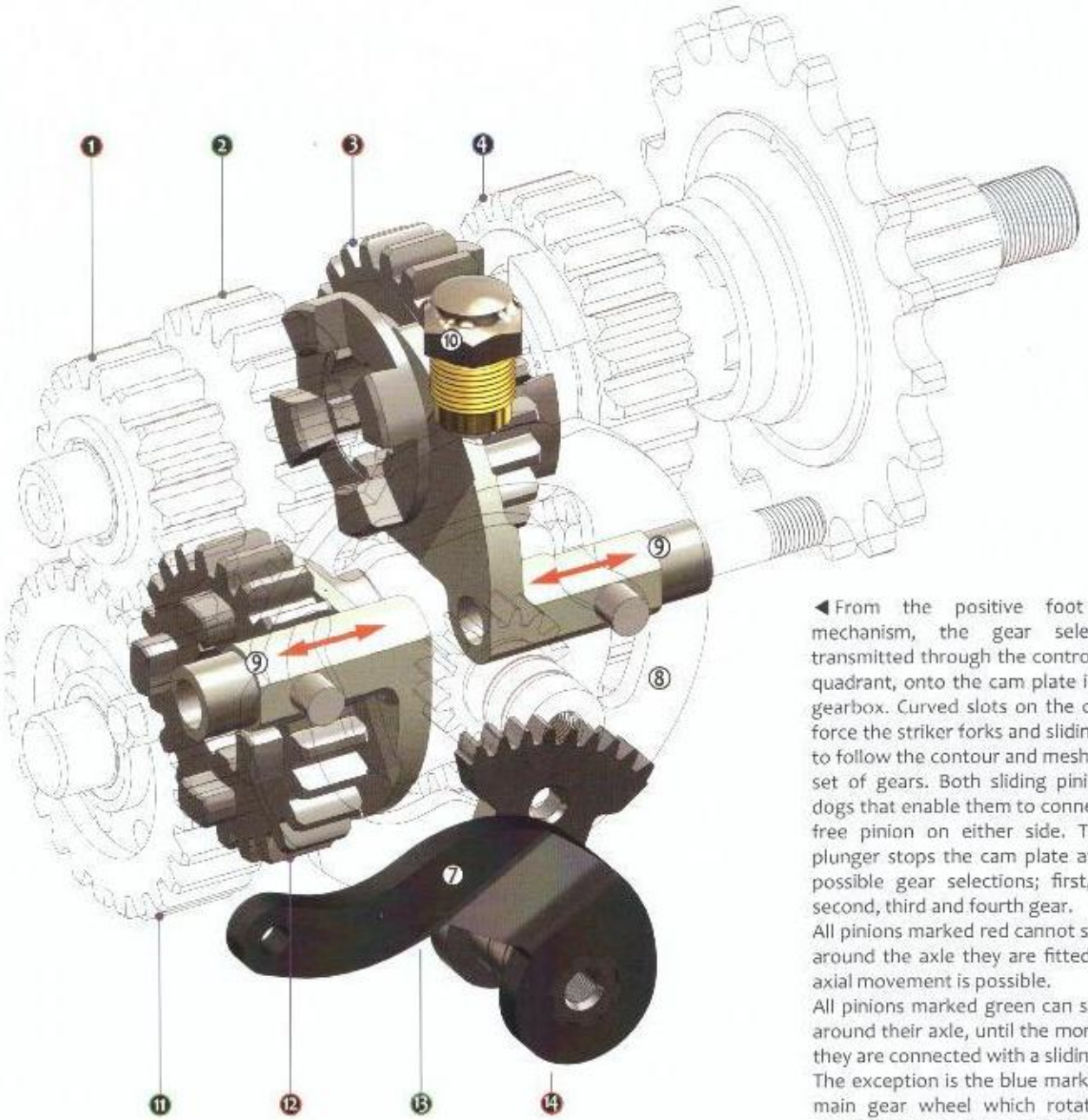


▶ The ratchet lever has now been brought entirely down to the 3rd gear position.
By removing the foot, the gear lever will be brought back up by the pawl carrier return spring, leaving the ratchet leaver as it is.



▶ The RH pawl has already passed a tooth and the LH pawl is about to be dragged over one at the opposite side of the ratchet plate.
After that the gear shift is completed and a new starting-point is created.





◀ From the positive foot change mechanism, the gear selection is transmitted through the control rod and quadrant, onto the cam plate inside the gearbox. Curved slots on the cam plate force the striker forks and sliding pinions to follow the contour and mesh the right set of gears. Both sliding pinions have dogs that enable them to connect with a free pinion on either side. The index plunger stops the cam plate at the five possible gear selections; first, neutral, second, third and fourth gear.

All pinions marked red cannot spin freely around the axle they are fitted on, only axial movement is possible.

All pinions marked green can spin freely around their axle, until the moment that they are connected with a sliding pinion. The exception is the blue marked driven main gear wheel which rotates freely around the main axle, and is meshed at all times with the pinion underneath it, which is fixed at the layshaft.

▶ Pages 88 & 89 show which gears are involved at each of the four speeds available.

⑦ cam plate quadrant lever
⑧ cam plate
⑨ striker fork
⑩ index plunger

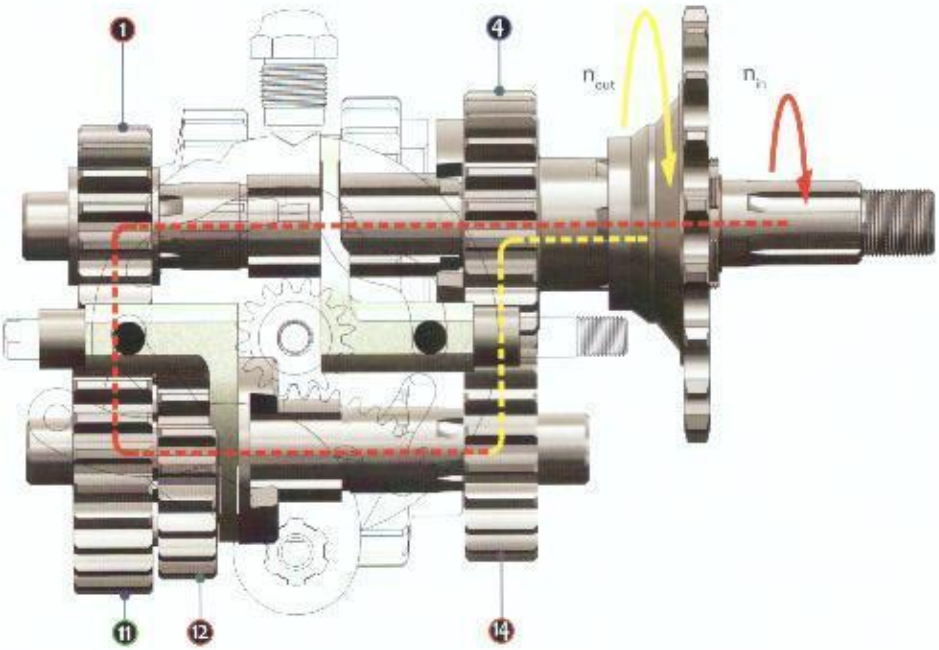
❶ main axle pinion, 17 teeth
❷ main axle free pinion, 20 teeth
❸ main axle sliding pinion, 22 teeth
❹ main gear wheel, 23 teeth

⓫ low gear wheel, 25 teeth
⓬ layshaft sliding pinion, 22 teeth
⓭ layshaft free pinion, 20 teeth
⓮ layshaft pinion, 19 teeth

First gear

Layshaft sliding pinion ⑫ meshes with the low gear wheel ⑪.
The number of revolutions is now reduced with; ① / ⑪ x ⑭ / ④

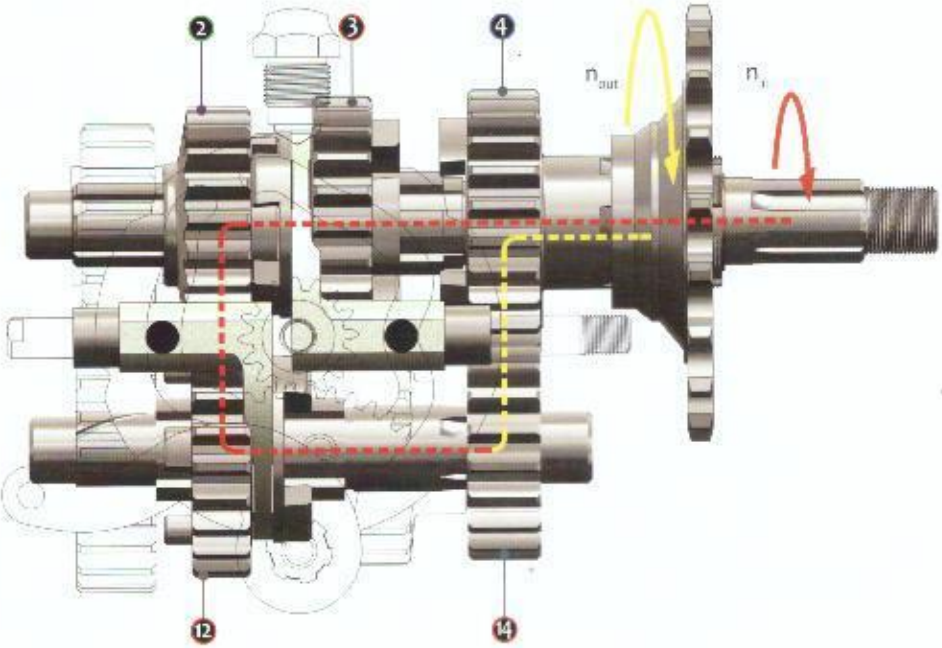
$n_{out} = (17 / 25 \times 19 / 23) \times n_{in} = 0{,}56\ n_{in}$



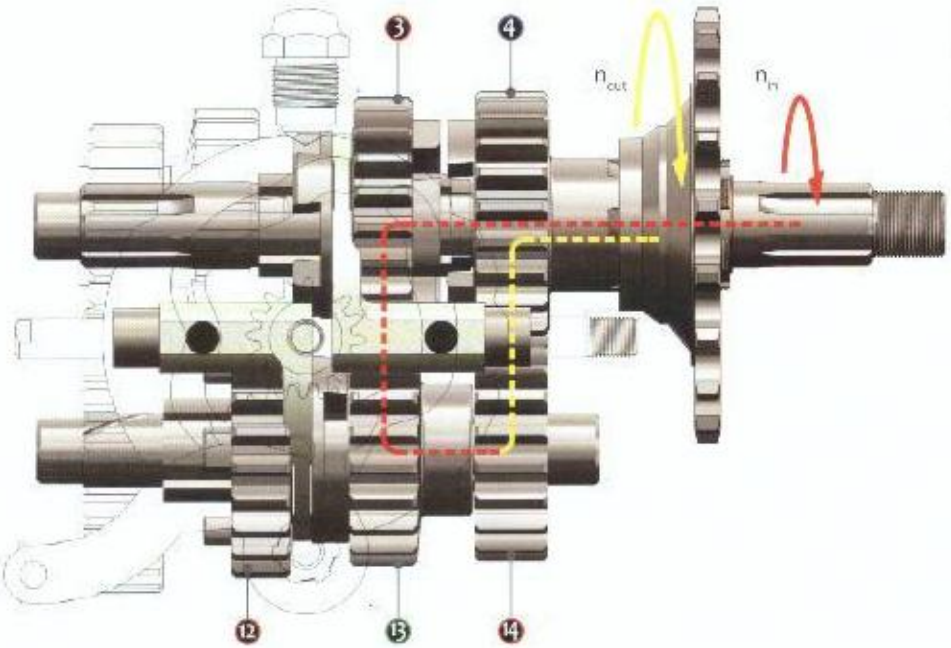
Second gear

Main axle sliding pinion ③ meshes with free pinion ②.
The number of revolutions is now reduced with; ② / ⑫ x ⑭ / ④

$n_{out} = (20 / 22 \times 19 / 23) \times n_{in} = 0{,}75\ n_{in}$



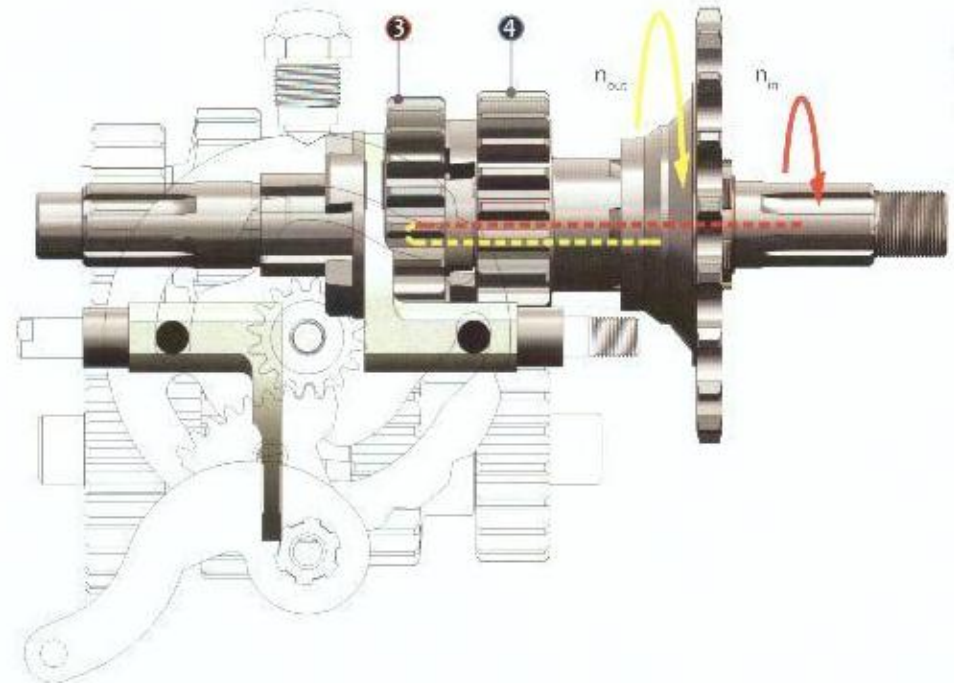
Third gear



Layshaft sliding pinion ⑫ meshes with free pinion ⑬.
The number of revolutions is now reduced with; ③/⑬ x ⑭/④

$n_{out} = (22 / 20 \times 19 / 23) \times n_{in} = 0{,}91\ n_{in}$

Fourth gear



Main axle sliding pinion ③ meshes with the main gear wheel ④.
There is no reduction due to direct linking.

$n_{out} = n_{in}$