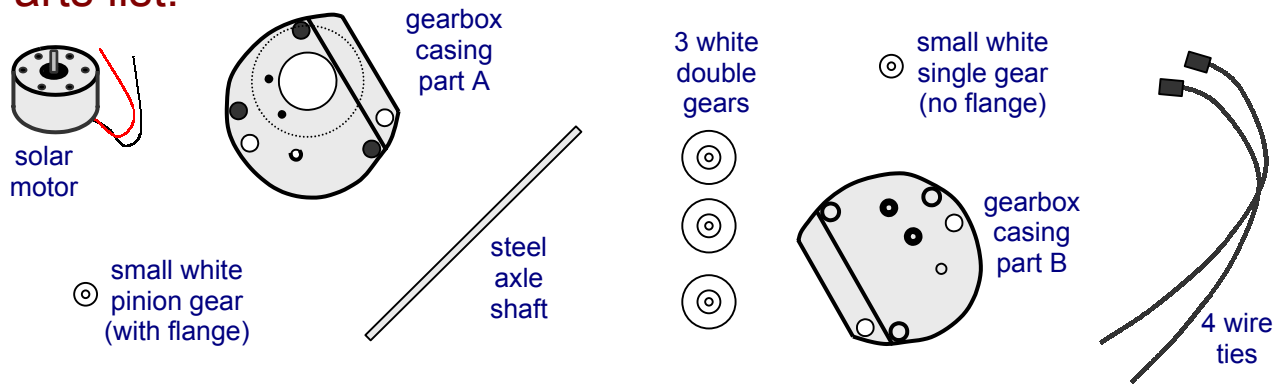
Solar Motor & 3-Speed Gearbox
ASSEMBLY GUIDE

Parts list:



SAFETY: Please note that this product contains small parts not suitable for infants.

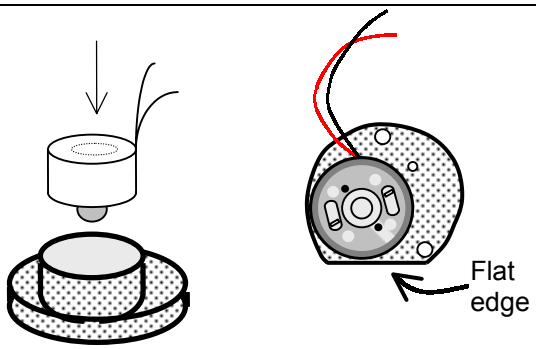
TIP: The motor wires are delicate - do not suspend motor by wires

TIP: Gears will drive each other in the order shown by small arrows in diagrams below. Pinion gear and single gear have 8 teeth. Double gears have 8 teeth & 24 teeth.

PRE-ASSEMBLY.

1. Fitting solar motor

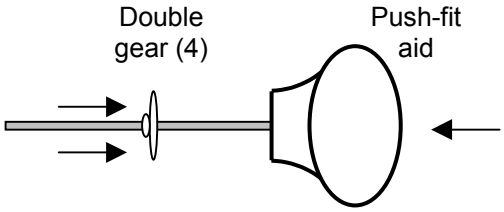
⊙ Push motor [with small pinion gear (1) on shaft going first] into casing part A. Motor wires must extend away from flat edge of casing.



Test the solar motor. Connect the two motor plugs to the two PV cell terminals. Direct the collector side of PV cell towards a bright light source and check that the motor spins. Disconnect motor from PV cell.

2. Fixing gear to axle

SAFETY: Do not push the shaft towards the palm of your hand at any time. The steel shaft is thin so take care when push fitting double gear (4) onto the shaft because it could potentially pierce the skin.



TIP: A small piece of wood with a hole to fit the shaft makes effective push-fit tool. Many wooden doorknobs already have a suitable drilled hole.

⊙ Push gear (4) about half way along the axle.

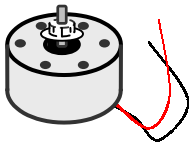
CHOOSING DIFFERENT GEAR RATIOS.

Consult the table to help decide which gear to select then move on to the appropriate section.

Possible transmission ratios:	Name:	Characteristics:	Solar Car Performance
27:1	1st gear	Slowest axle-speed and the most torque (turning force).	The car will climb steeper gradients in this gear.
9:1	2nd gear	Medium axle-speed and medium torque.	A good 'all round' gear ratio.
3:1 [3 motor revs. per 1 axle rev.]	3rd gear	Fastest axle-speed and the least torque.	Under favourable conditions the car will go fastest in this gear.

If you are not sure which gear ratio to use then jump ahead and assemble 2nd gear.

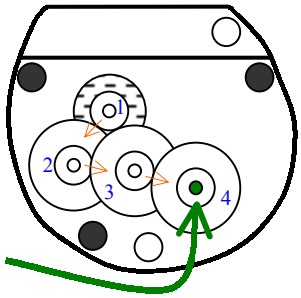
1st gear - Assembling transmission ratio 27:1



⊙ Leave motor in casing and adjust position of pinion gear (1) on motor shaft (with your fingers or a small flat-blade screwdriver) so it sits about half-way down shaft.

⊙ Insert double gears (2), (3)
[note: when sliding double gears onto spindles, gear with 8 teeth is visible at top of spindle and flat side of double gear is at bottom of spindle.]

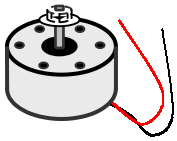
⊙ Gear (1) on motor shaft should mesh with gear (2) but not gear (3).



Axle passes through casing and holds double gear (4) here

NOW GO TO >> Closing gearbox

2nd gear - Assembling transmission ratio 9:1

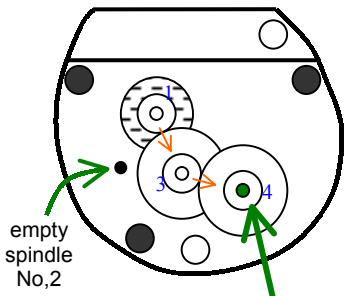


⊙ Leave motor in casing and adjust position of pinion gear (1) on motor shaft (with your fingers or a small flat-blade screwdriver) so it sits near top of shaft.

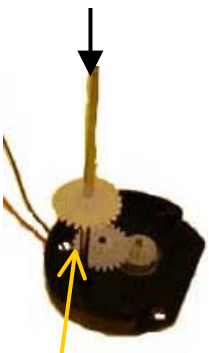
⊙ Slide double gear (3) onto casing spindle 3.

[note: when sliding double gears onto spindles, gear with 8 teeth is visible at top of spindle and flat side of double gear is at bottom of spindle.]

[note: do not insert gear (2)]

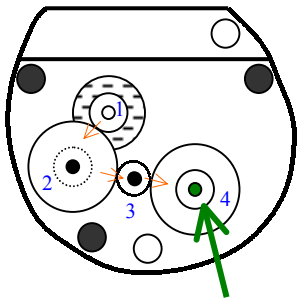


Axle passes through casing and holds double gear (4) here



NOW GO TO >> Closing gearbox

3rd gear - Assembling transmission ratio 3:1

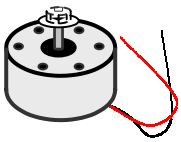


Axle passes through casing and holds double gear (4) here

⊙ Leave motor in casing and adjust position of pinion gear (1) on motor shaft (with your fingers or a small flat-blade screwdriver) so it sits at top of shaft.

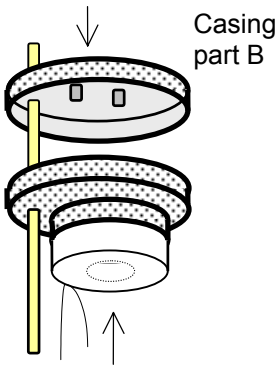
⊙ Insert single gear (3) [with flat side down] on to spindle 3.
⊙ Insert double gear (2) onto spindle 2 with 8 tooth gear towards bottom of spindle and flat side of double gear is at top of spindle.

Double-gear (2) inserted 'wrong way round' with smaller gear towards bottom of spindle
Small gear (3) made from the smaller gear of a large double-gear



NOW GO TO >> Closing gearbox

INSERTING AXLE & CLOSING GEARBOX



⊙ Slide shaft into casing axle hole with flat side down so gear (4) meshes with gear (3).

TIP: Test gearbox by carefully turning axle with your fingers and watching gears meshing together and turning.

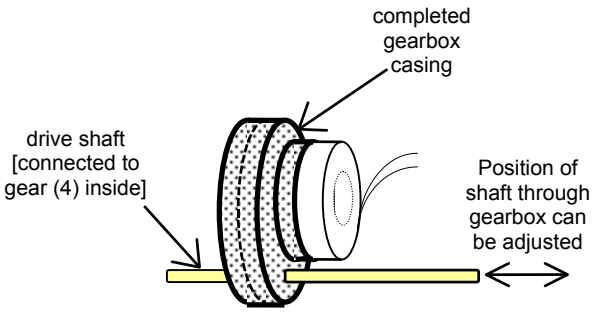
⊙ If necessary make fine adjustment to position of gear (1) on motor shaft so gearbox runs smoothly.

⊙ Thread axle shaft through casing part B and snap together with part A. Don't let gears fall off their spindles when you do this.

TIP: Cable ties make a temporary fixing for the gearbox casing, so you can change gear ratios.

⊙ Thread plastic cable ties through the two outer holes to fix the casing parts A & B together. Trim the ends of plastic ties.

⊙ Test the motor and gearbox assembly by connecting motor wires to the PV cell.



CHANGING GEAR

- Consult section Choosing different gear ratios
- Disconnect motor from PV cell.
- Remove cable-ties that hold gearbox together, and carefully open gearbox.
- Remove axle and all gears except pinion

NOW GO TO >> 1st gear OR 2nd gear OR 3rd gear

GEARBOX PROBLEM SOLVING

Problem	Check Items ⇒ Solution
gearbox does not run smoothly	bent axle shaft ⇒ replace shaft gear teeth clogged ⇒ remove obstructions from within gear teeth **ratio 3:1** pinion gear (1) & double gear (2) not meshing smoothly ⇒ adjust position of pinion gear (1) on motor shaft to correct height for gear ratio 3:1 double gear (2) wrong way round ⇒ insert double gear (2) with 8 tooth gear towards bottom of spindle single gear (3) wrong way round ⇒ insert with flat side towards bottom of spindle **ratio 9:1** pinion gear (1) & double gear (3) not meshing smoothly ⇒ adjust position of pinion gear (1) on motor shaft to correct height for gear ratio 9:1 double gear (2) fitted in error ⇒ remove large gear (2), it is not used in ratio 9:1 **ratio 27:1** pinion gear (1) & double gear (2) not meshing smoothly ⇒ adjust position of pinion gear (1) on motor shaft to correct height for gear ratio 27:1 pinion gear (1) may be meshing with gears (2) and (3) - this jams the gearbox ⇒ adjust position of gear (1) to mesh with gear (2) only.