

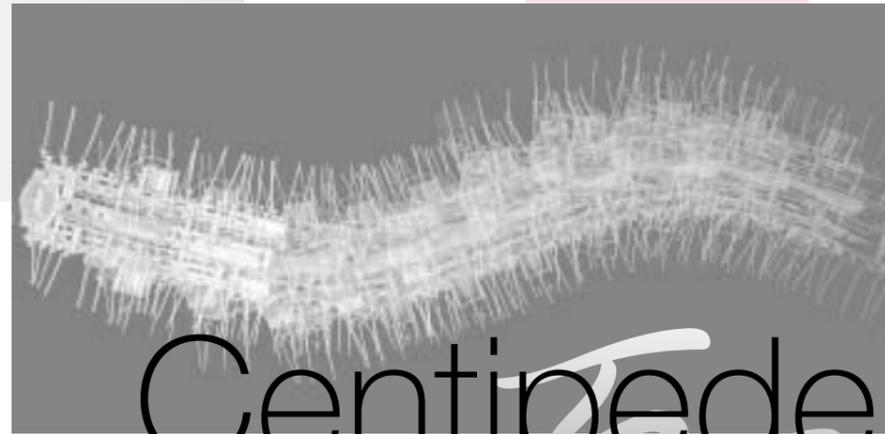
大人の科学 Otona no Kagaku
The Sophisticated Science Kit for Adults

MECHAMO

メカモセンチピード Mechamo Centipede ●●●THEMECHANICALANIMALSERIES

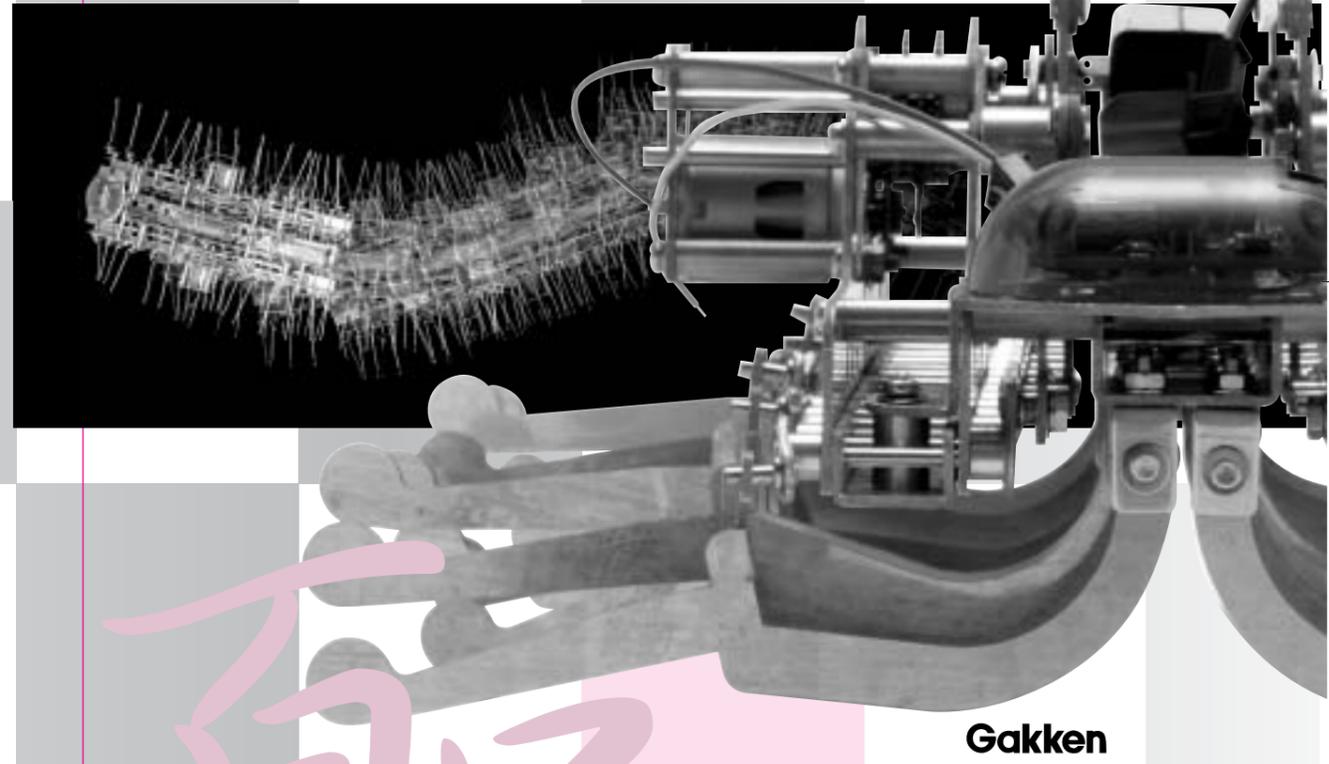
Instructions for Assembling and Operating

The parts list is separately attached.



Centipede

百足



Gakken

Centipede

百足

CONTENTS

Contents and Cautions	2	3. Attaching Links to Leg Bases	10
The Animal-shaped Robot Devised from Mechanical Engineering MECHAMO	3	4. Setting Right and Left Leg Bases to the Body	13
Before Assembling the Kit	4	5. Attaching the Light Sensor and Battery Boxes	15
1. Attaching Motors to Leg Bases	5	6. Attaching Legs to the Body	17
2. Attaching Cranks to Leg Bases	7	Trouble Shooting	19

⚠ CAUTION! Please read the following instructions before using this kit.

Use caution when handling any metallic parts. Improper use may cause injury.
 To avoid the risk of suffocation, do not swallow small parts such as screws.
 To avoid the risk of injury, do not point your hands and eyes with the screwdriver and the like in this kit.
 To avoid the risk of injury, use caution not to get your fingers caught in the machine while it is operating.
 To avoid the risk of traffic accident, do not operate the machine on the road.
 To avoid the risk of electric shock, do not insert the lead wires into an electric socket.

Six size AA batteries are required. Improper use of the batteries may cause the generation of heat, explosions or leaks. The following precautions should be taken:

- Do not use rechargeable batteries, such as nickel cadmium batteries.
- Ensure that the positive and negative terminals on the batteries are facing the right way.
- Do not use used batteries and new batteries together and do not mingle more than two kinds of batteries.
- Do not short-circuit, recharge, break up or put the batteries in a fire.
- Remove the batteries when not using for a long time.

Please read the assembly instructions and cautions in this booklet carefully before using this kit. Do not use any materials that have become damaged or deformed while in use.
 Keep the kit away from small children when not using.

Warning : Do not touch the Mechamo while it is operating. It is very dangerous. Particularly, never let small children touch it.

The metallic materials used in this kit

main body parts : aluminum gear : steel+brass screws : nickel-plated iron

The plastic materials used in this kit

battery box : ABS resin cover of the light sensor : ABS resin remote control : ABS resin

connector : POM screwdriver handle : ABS resin

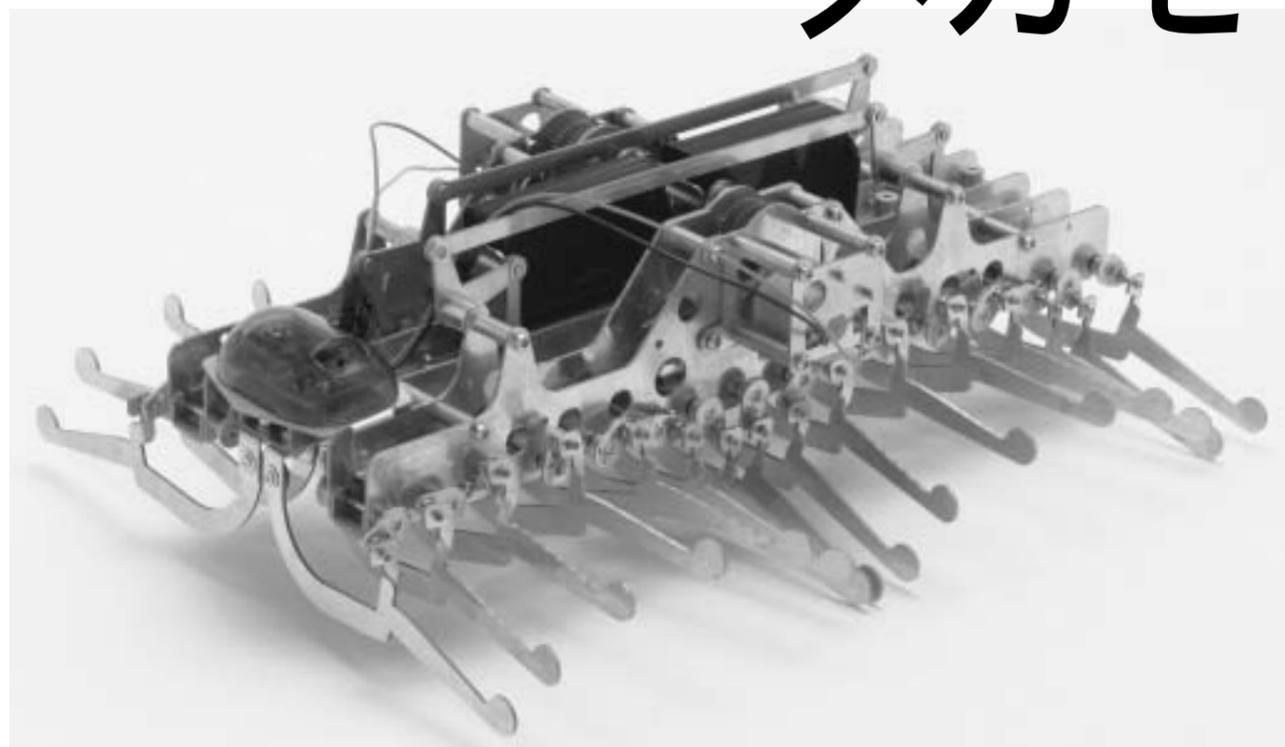
* Vinyl chloride resin is used for the covers of the lead wires.

* When disposing of the kit, please follow the recycling regulations in your area.

大人の科学 Otona no Kagaku

The Animal-shaped Robot Devised from Mechanical Engineering

MECHAMO
 メカモ
 Mechamo Centipede
 THE MECHANICAL ANIMAL SERIES



This Centipede has 32 legs in all. It looks like waves when these legs are moving all at once. This movement is realized by a set of link mechanisms that rotates 32 cranks at once and also keeps their phases different by 45 degrees and thus its legs move one after another to form waves.

Enjoy assembling, examining from where to where the kinetic energy is transmitted through links and where the axis of cranks is located. Then, operating the machine will be more impressive. It takes about two hours to assemble. Please follow this instruction booklet when you assemble.

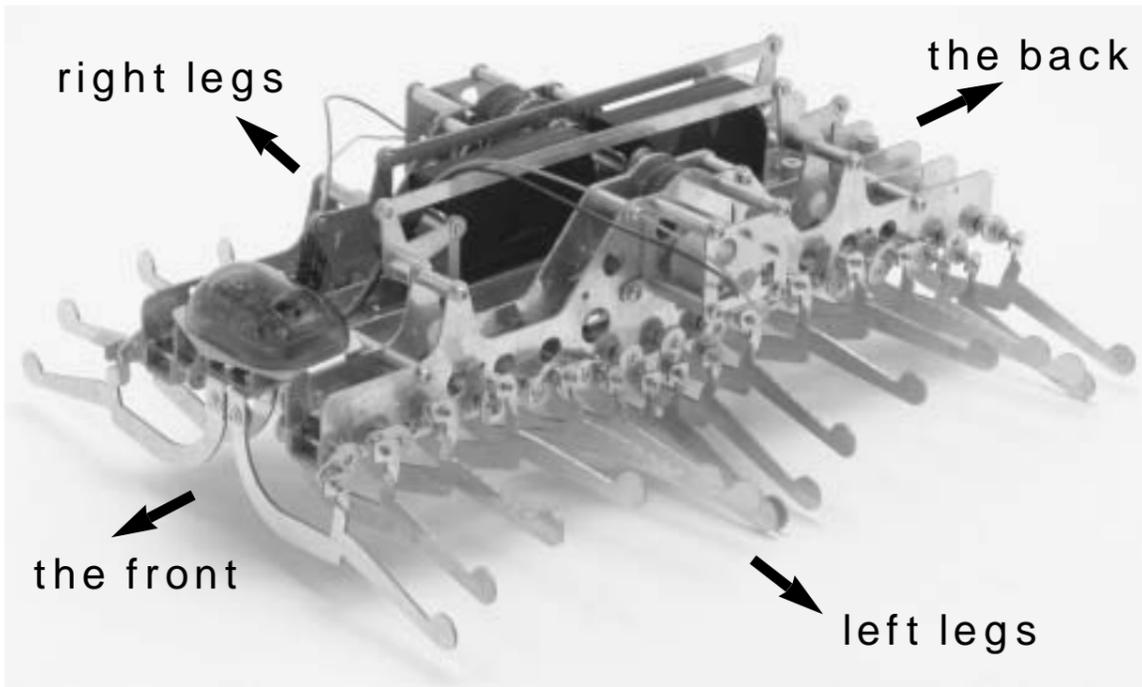
It will be helpful in assembling the kit if you set the parts list aside.

Warning Do not touch the Mechamo while it is operating. It is very dangerous. Particularly, never let small children touch it.

Before Assembling the Kit

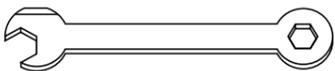
1. Understanding the right direction

The centipede is basically symmetrical but it has the front, the back, the right, and the left. In this booklet, the direction is defined for convenience even if the same parts are used in process of assembling. Check the right direction with the picture below.

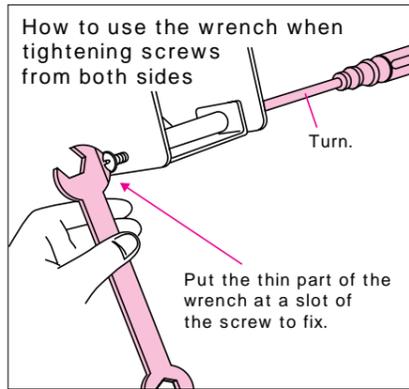


2. How to Use Supplied Tools

wrench



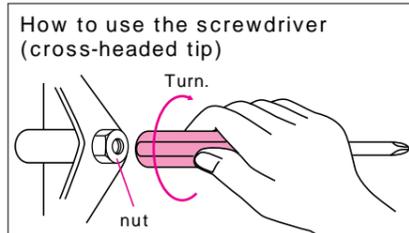
The wrench can be used not only for tightening a nut but also for tightening screws from both sides as shown in the right figure.



screwdriver (cross-headed tip)



The screwdriver can be used not only for tightening a screw but also for tightening a nut as shown in the right figure.



Please note that shapes of materials may appear slightly different from pictures and illustrations in this booklet.

1 Attaching Motors to Leg Bases

There may be more screws, washers, nuts and bushes than actually used for spare.

Parts to be used PARTS A Divide the parts into those for left legs and for right legs beforehand.

parts for left legs

motor A
(with yellow and blue lead wires)

A1 left leg base
the back the front

A2 left leg base
the back the front
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

A3 motor gear retainer

Six 8mm screws
Two 15x6mm A4 threaded pipes
Two nuts
Six washers
Two spring washers

Check the length of screws with this figure.

parts for right legs

motor B
(with green and white lead wires)

A1 right leg base
the front the back
This part is distinguished from the A1 left leg base for convenience though both are the same parts.

A2 right leg base
the front the back
This part is distinguished from the A2 left leg base for convenience though both are the same parts.

A3 motor gear retainer

Six 8mm screws
Two 15x6mm A4 threaded pipes
Two nuts
Six washers
Two spring washers

Check the length of screws with this figure.

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Figure-1
Attach the motor A to the A1 left leg base. Fasten it at two points with screws and nuts.

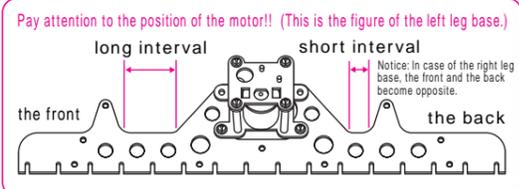
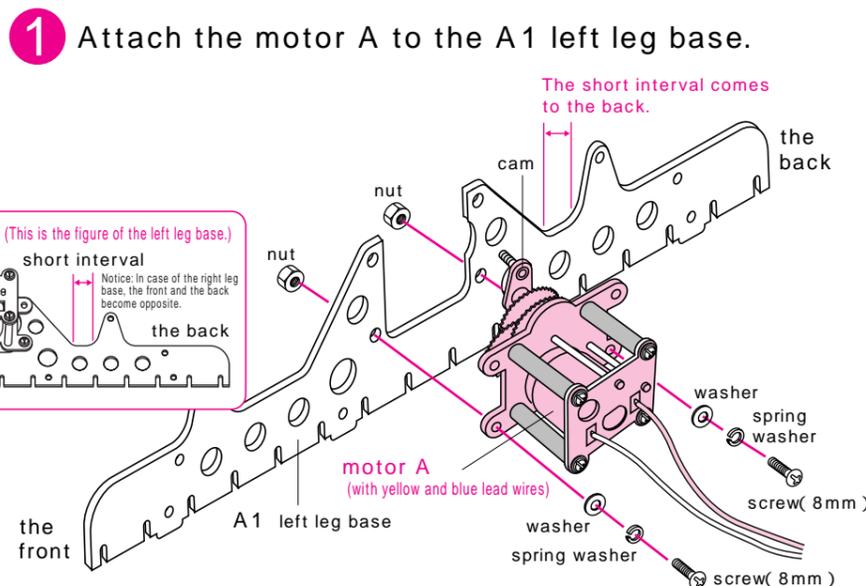


Figure-2
Attach the A2 left leg base to the A1 left leg base with A4 threaded pipes. Put an A3 motor gear retainer between the A2 left leg base and A4 threaded pipes and fasten them.

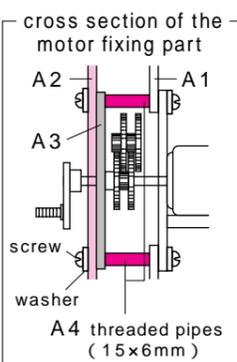
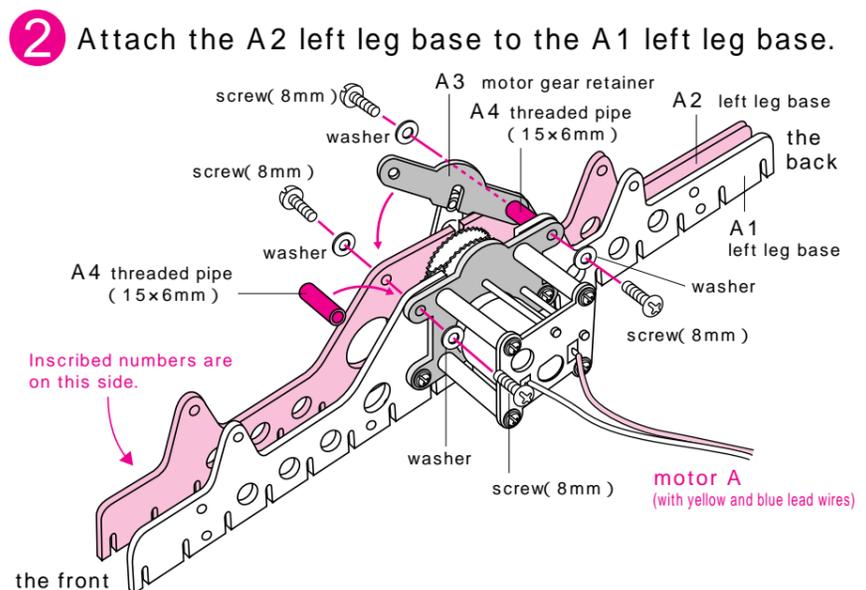
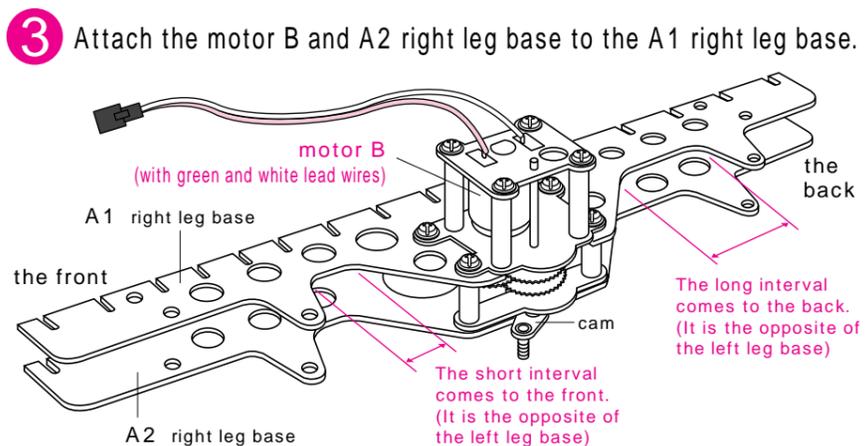


Figure-3
Attach the motor B, the A2 right leg base, an A3 motor gear retainer to the A1 right leg base just like to the left leg base.

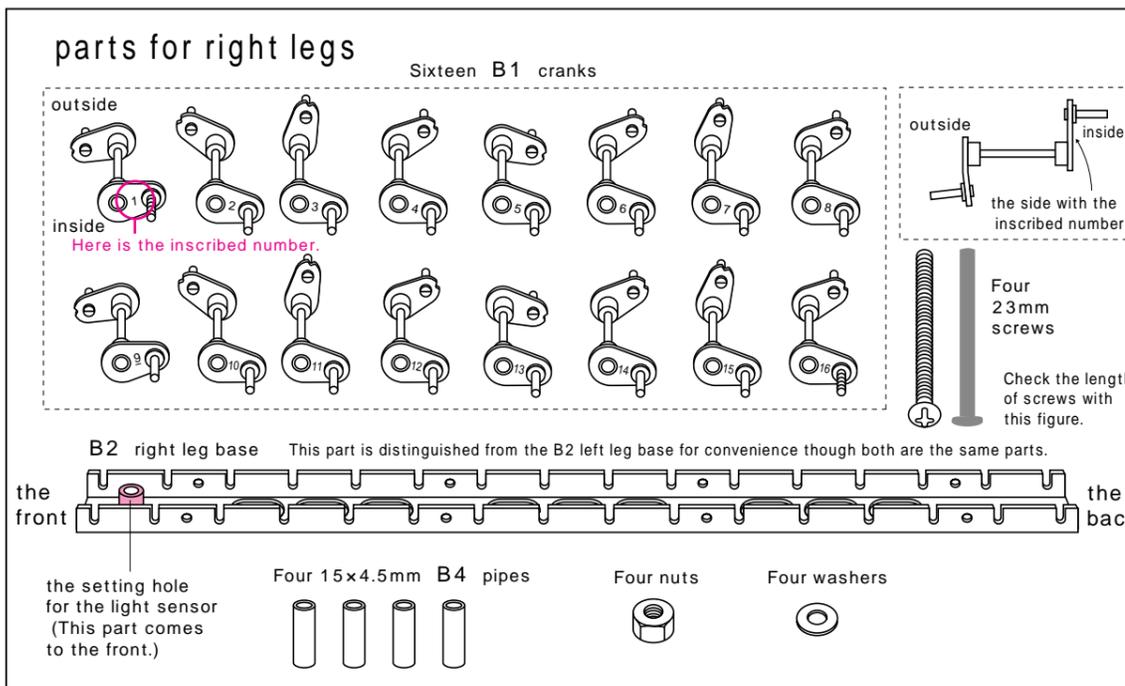
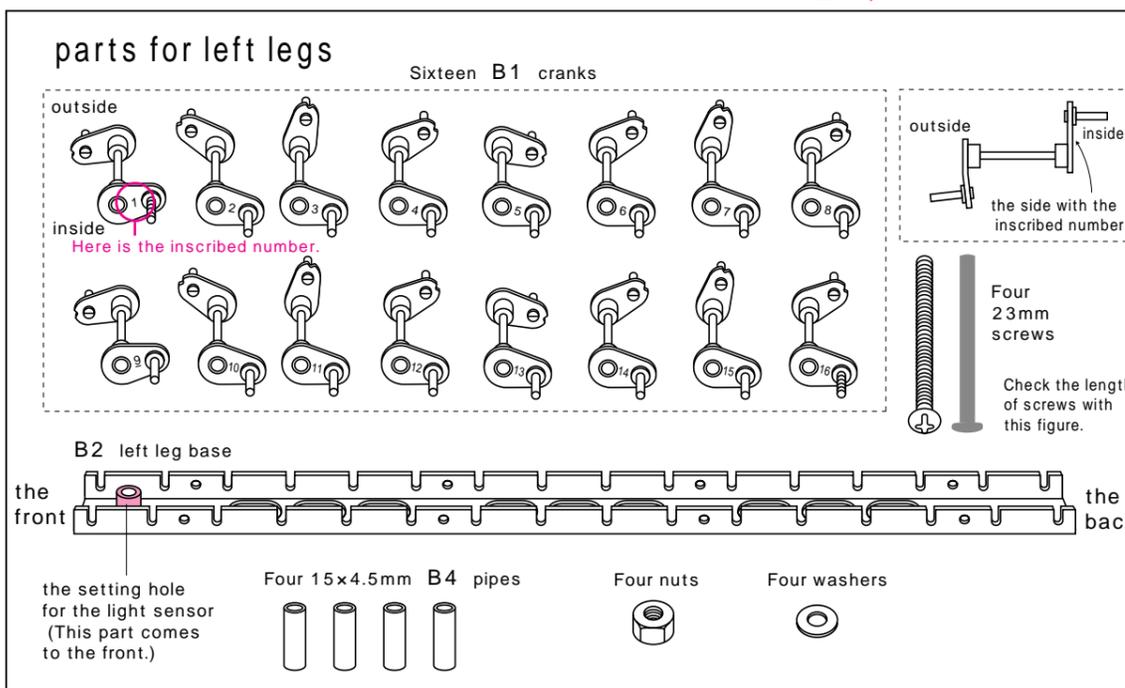


Full-scale Check the size with this.
A4 threaded pipe(15x6mm)

2 Attaching Cranks to Leg Bases

Parts to be used PARTS B

Divide the parts into those for left legs and for right legs beforehand.
Notice: The inside and the outside of the crank have to be distinguished. The bent side is the outside (motor side) 6 is inscribed as "6" and 9 is inscribed as "9". Pay attention not to mistake them.



Warning Do not touch the Mechamo while it is operating. It is very dangerous. Particularly, never let small children touch it.

Figure-4
Set cranks 1 ~ 16 on the left leg base assembled at Figure -2. Attach the B1 cranks in order of inscribed numbers to the same numbers inscribed on the A2 left leg base.

How to distinguish the inside and the outside of a crank

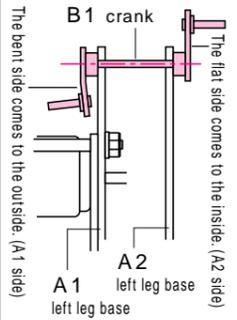
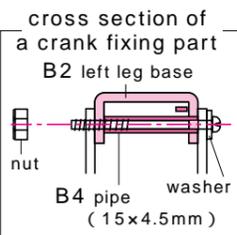
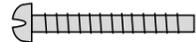


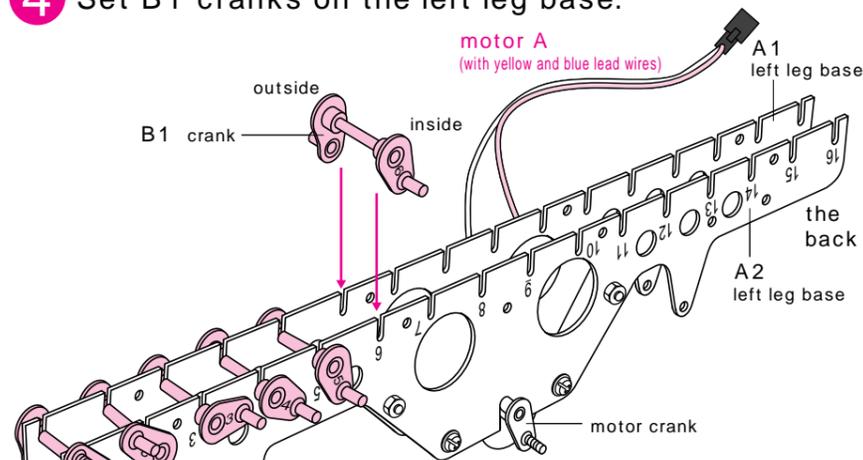
Figure-5
After setting sixteen B1 cranks, fasten them with the B2 left leg base. (Put four B4 pipes through holes in the B2 left leg base beforehand.) Insert B2 left leg base between the A1 left leg base and the A2 left leg base. Put four washers on four screws and put the screws through the leg bases and fasten with nuts from the other side.



Full-scale Check the size with this.
B4 pipe(15x4.5mm)
screw(23mm)

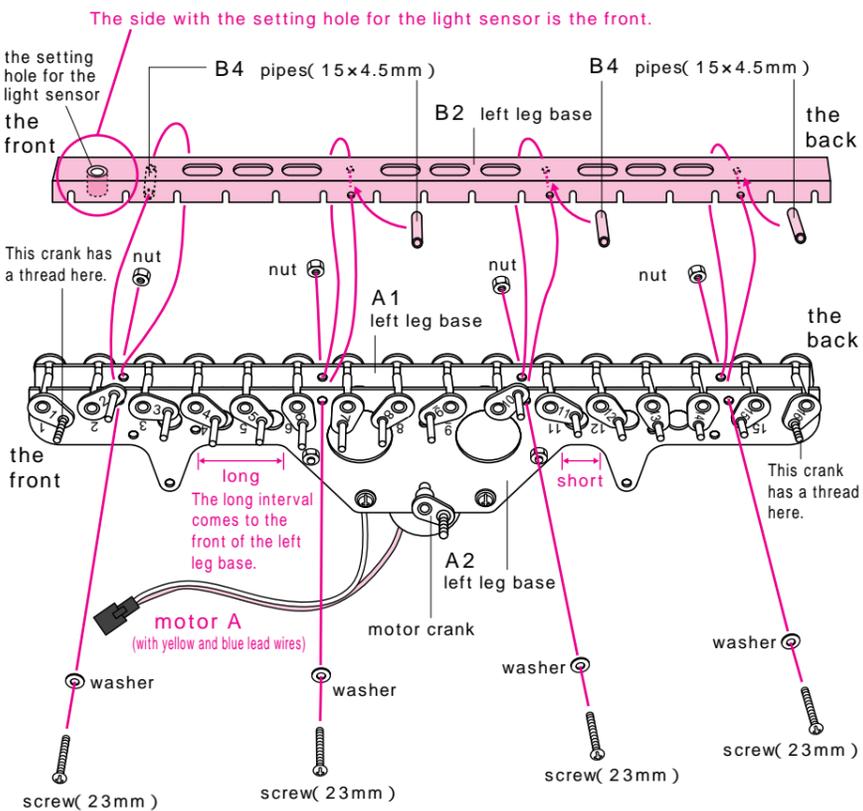


4 Set B1 cranks on the left leg base.



Notice : The inside and the outside of a crank have to be distinguished. **The bent side is the outside (A1 side) and the flat side with a number is the inside (A2 side).** It won't work if the crank is set in the wrong direction. Also, **pay attention not to mistake 6 and 9.**

5 Fasten B1 cranks with the B2 left leg base.



Check if the B1 cranks move smoothly after setting.

Figure-6
Set cranks 1 ~ 16 on the right leg base assembled at Figure -3. Attach the cranks in order of inscribed numbers to the same numbers inscribed on the A2 right leg base.

How to distinguish the inside and the outside of a crank

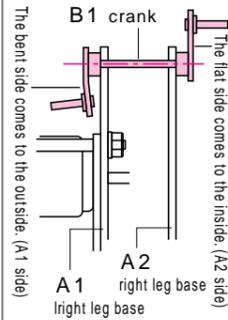
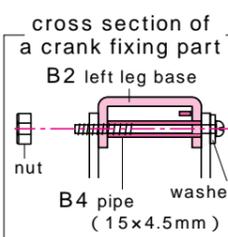


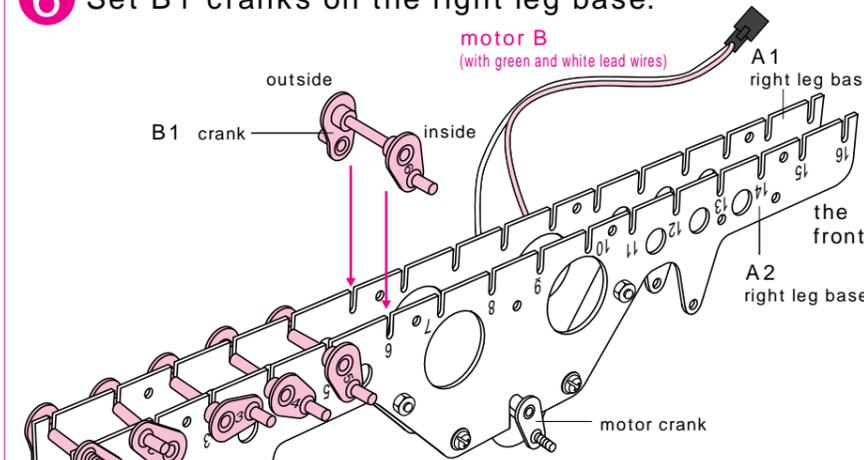
Figure-7
After setting sixteen B1 cranks, fasten them with the B2 right leg base. (Put four B4 pipes through holes in the B2 right leg base beforehand.) Insert B2 right leg base between the A1 right leg base and the A2 right leg base. Put four washers on four screws and put the screws through the leg bases and fasten with nuts from the other side.



Full-scale Check the size with this.
B4 pipe(15x4.5mm)
screw(23mm)



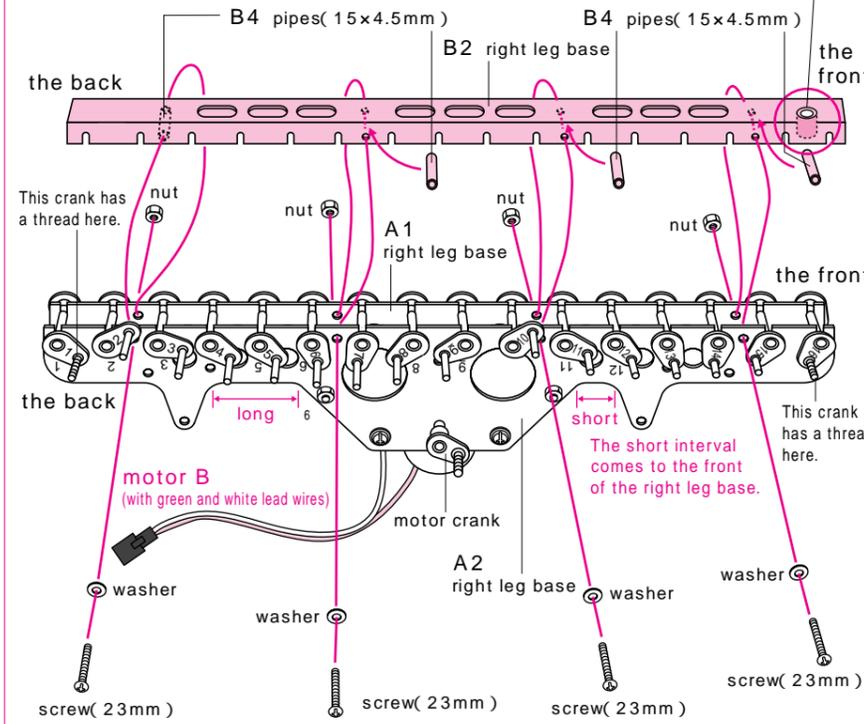
6 Set B1 cranks on the right leg base.



Notice : The inside and the outside of a crank have to be distinguished. **The bent side is the outside (A1 side) and the flat side with a number is the inside (A2 side).** It won't work if the crank is set in the wrong direction. Also, **pay attention not to mistake 6 and 9.**

7 Fasten B1 cranks with the B2 right leg base.

The side with the setting hole for the light sensor is the front. the setting hole for the light sensor

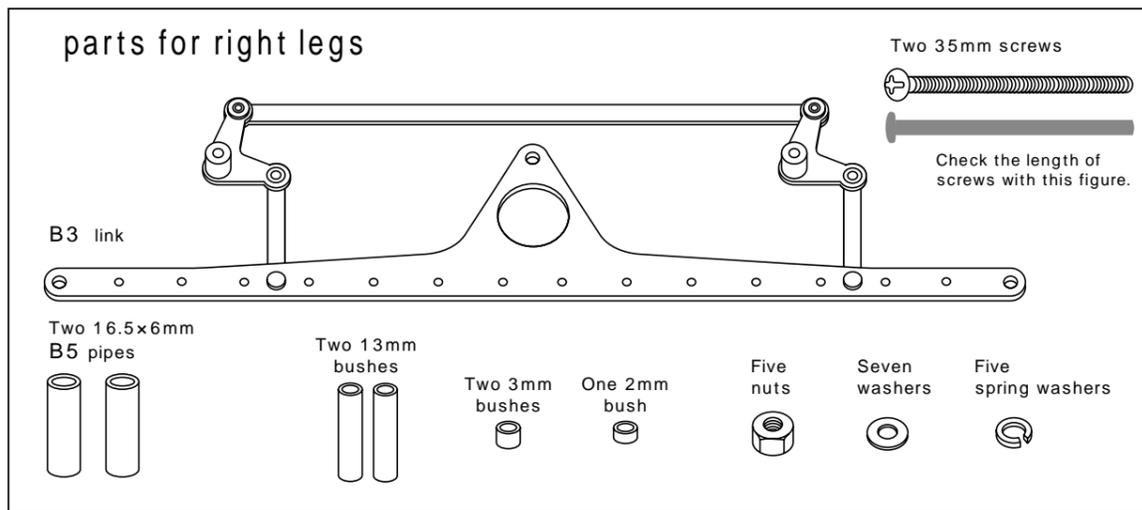
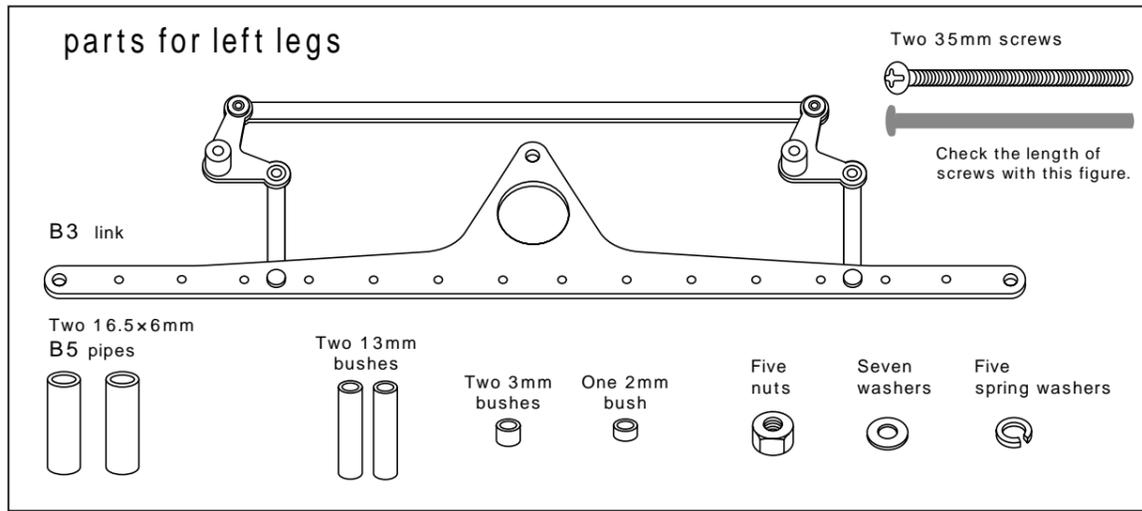


Check if the B1 cranks move smoothly after setting.

Warning Do not touch the Mechamo while it is operating. It is very dangerous. Particularly, never let small children touch it.

3 Attaching Links to Leg Bases

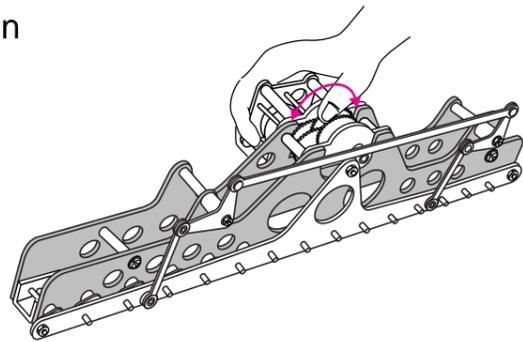
Parts to be used PARTS B Divide the parts into those for left legs and for right legs beforehand.



Be sure to check the motion after attaching links.

After attaching the link, move the motor gears and check if the legs move smoothly. If they don't, check the following points.

- Check that the numbers of the cranks are in order.
- Check that the bent side (without numbers) comes to the motor side.
- Check that each bush is correctly set on the specified place.



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Figure-8 Insert sixteen shafts of the cranks into the holes in the B3 link as shown in the figure. Move the gears of the left leg base to let the shafts in smoothly.

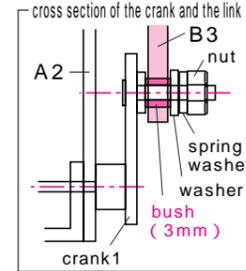


Figure-9 When about three shafts are set, fasten the B3 link at the threaded shaft at the end temporarily. It makes easier to set the other shafts in. After setting all shafts, fasten completely. Connect the crank of the motor at the center too.

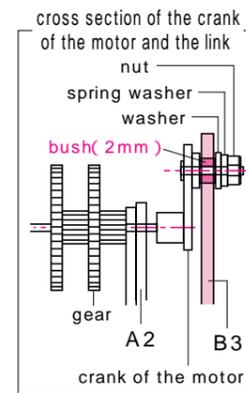


Figure-10 Fasten the link to the left leg base at two points as shown in the figure.

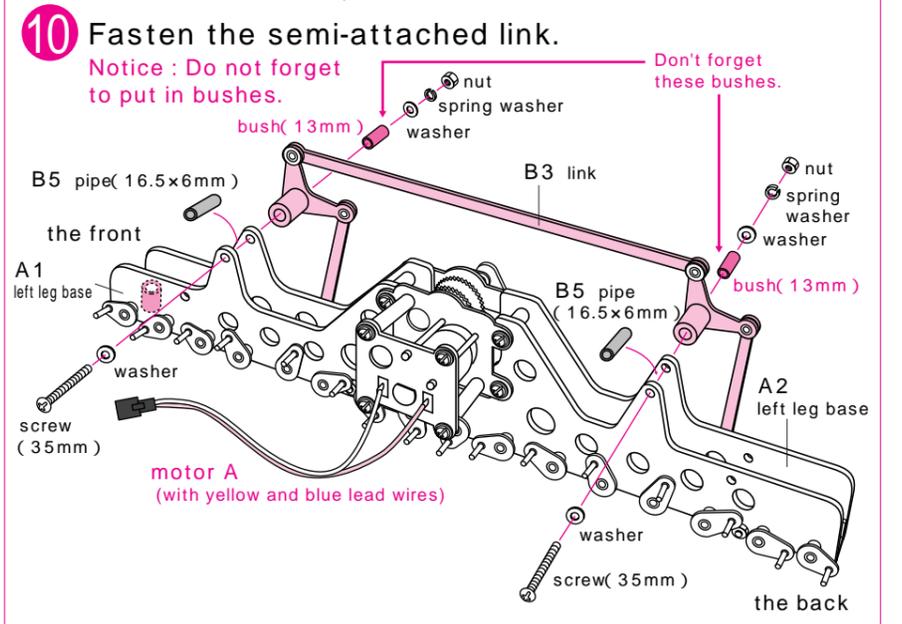
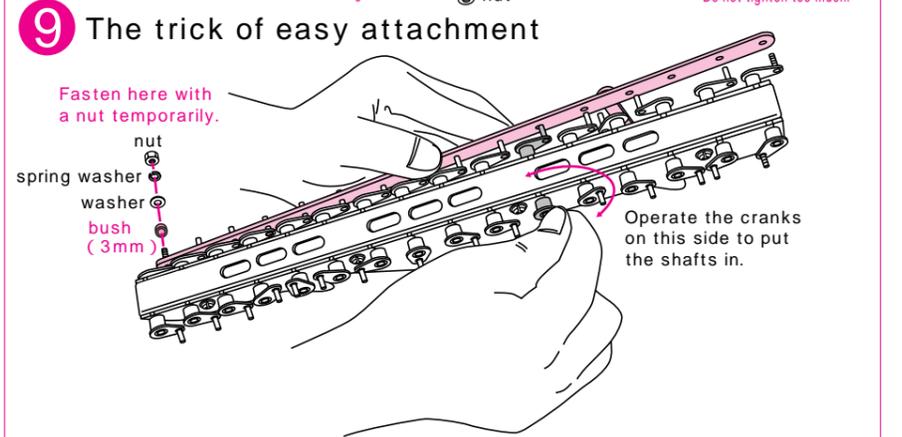
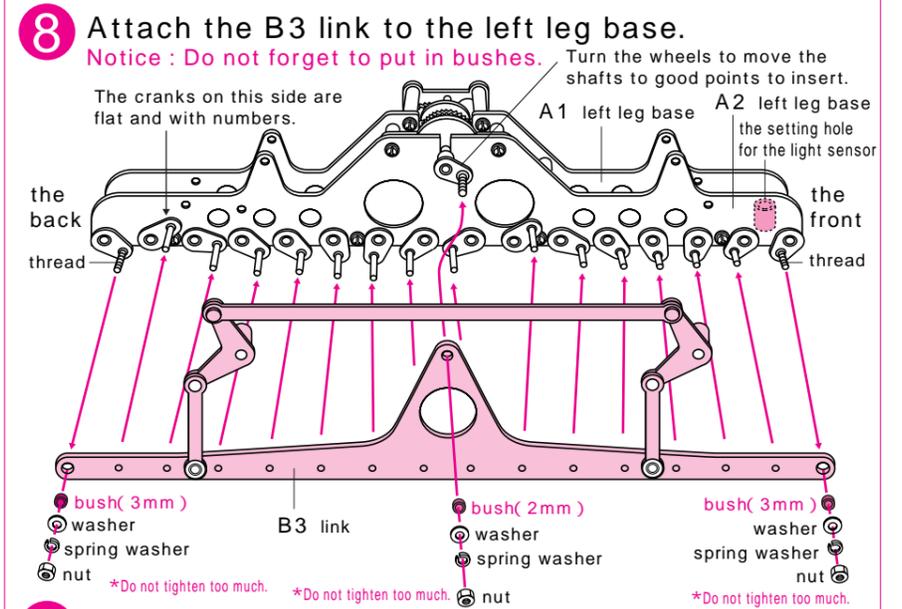
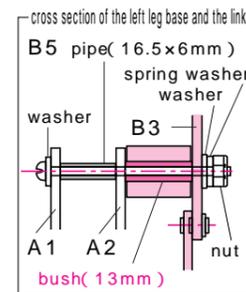


Figure-11

Insert sixteen shafts of the cranks into the holes in the B3 link as shown in the figure. Move the gears of the right leg base to let the shafts in smoothly.

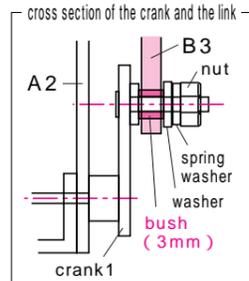


Figure-12

When about three shafts are set, fasten the B3 link at the threaded shaft at the end temporarily. It makes easier to set the other shafts in. After setting all shafts, fasten completely. Connect the crank of the motor at the center too.

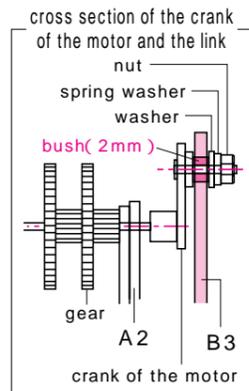
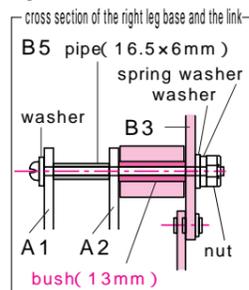


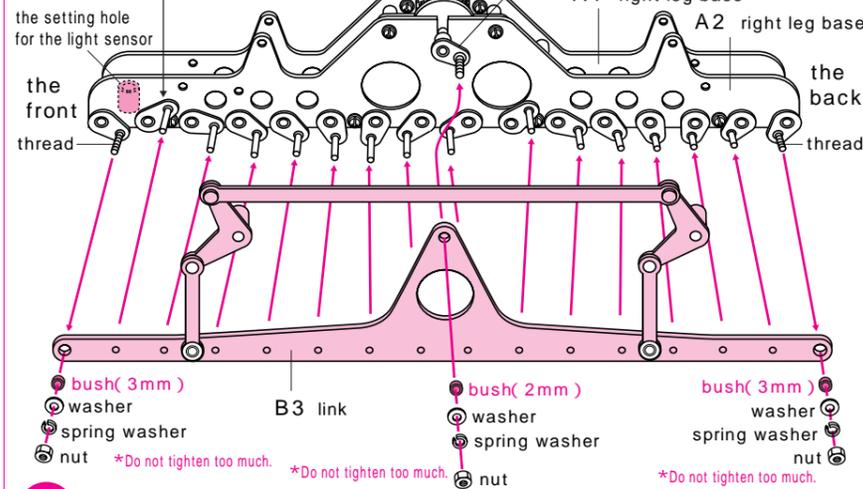
Figure-13

Fasten the link to the right leg base at two points as shown in the figure.



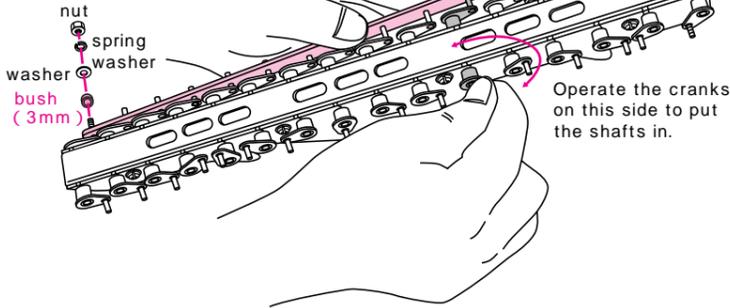
11 Attach the B3 link to the right leg base.

Notice : Do not forget to put in bushes. Turn the wheels to move the shafts to good points to insert. The cranks on this side are flat and with numbers.



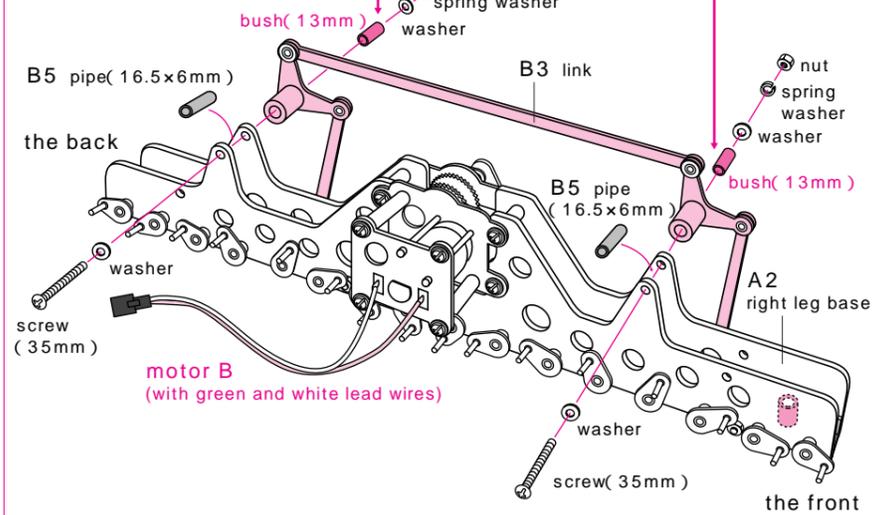
12 The trick of easy attachment

Fasten here with a nut temporarily.



13 Fasten the semi-attached link.

Notice : Do not forget to put in bushes. Don't forget these bushes.



4 Set Right and Left Leg Bases to the Body

Parts to be used PARTS C

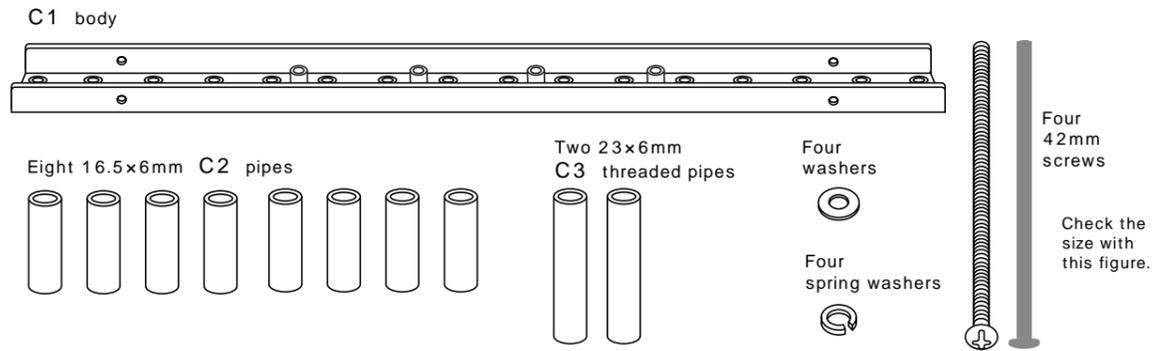
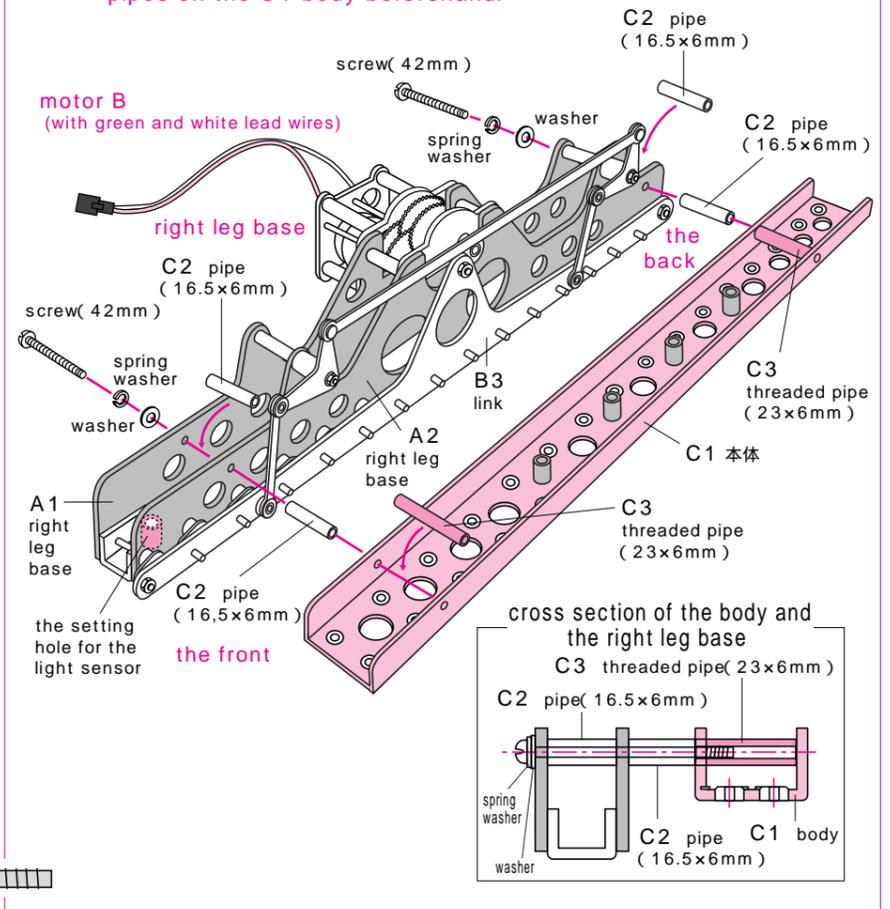


Figure-14

Set the right leg base assembled at Figure-13 to the C1 body. (Set the right leg base first.) Distinguish the right from the left by the colors of the lead wires.

14 Set the right leg base to the body.

***It is easier to set the C3 threaded pipes on the C1 body beforehand.**



Full-scale Check the size with this.
C2 pipe (16.5x6mm)

C3 threaded pipe (23x6mm)

screw (42mm)

Warning Do not touch the Mechamo while it is operating. It is very dangerous. Particularly, never let small children touch it.

Figure-15
Set the left leg base assembled at Figure-10 to the C1 body.

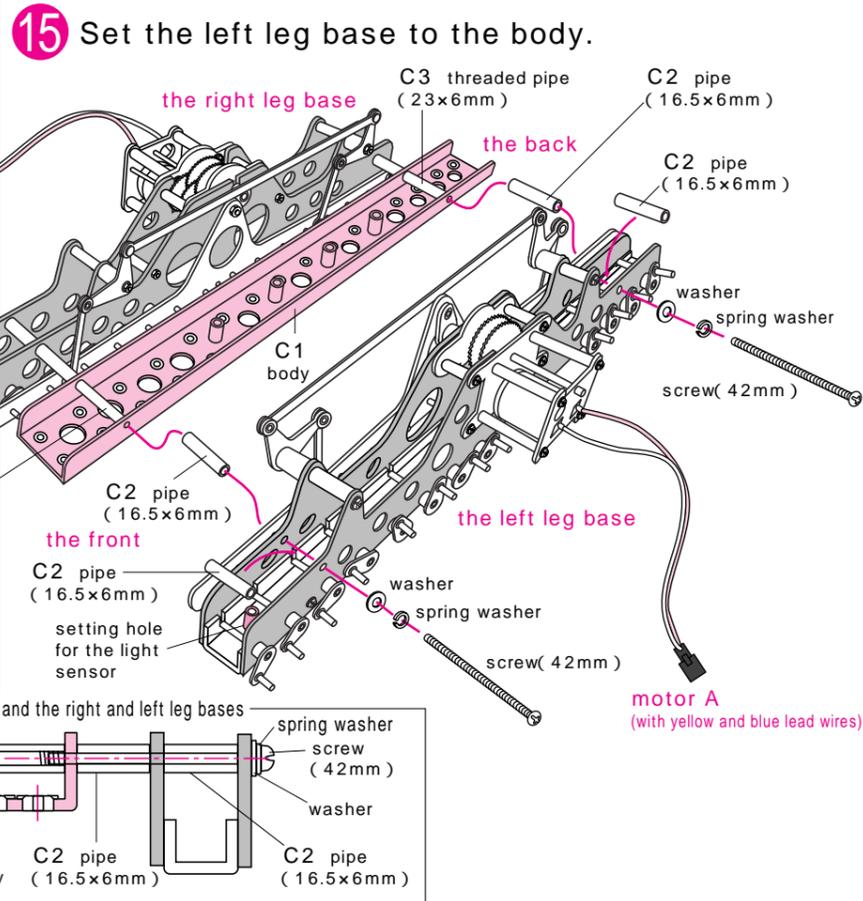
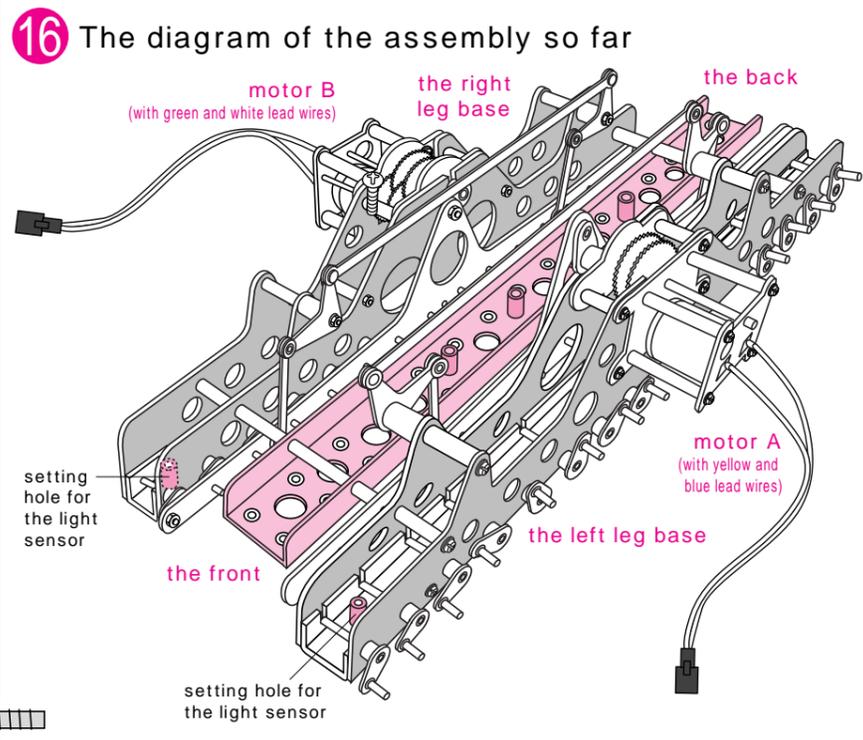


Figure-16
When you have assembled to this process, move the motor gears and check if the legs move smoothly. (See p.10)



5 Attaching the Light Sensor and Battery Boxes

Parts to be used PARTS D

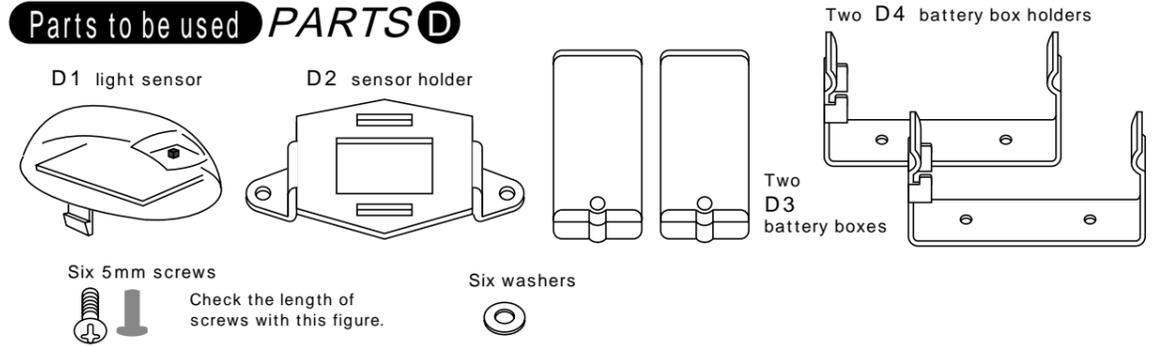
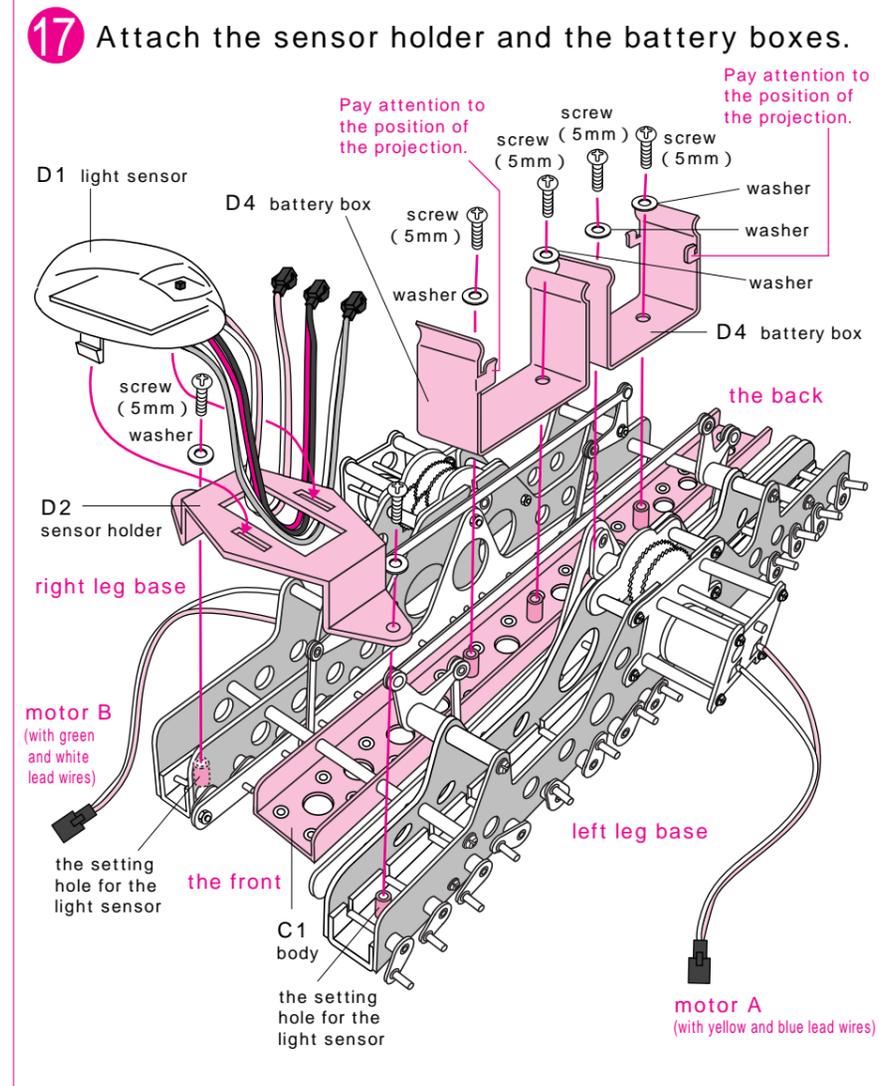


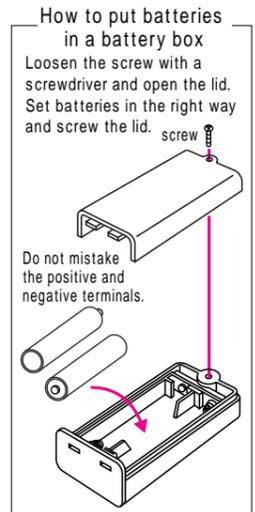
Figure-17
First, put the lead wires of the light sensor through the hole in the sensor holder as shown in the figure. (It is necessary to wire the connector.) Next, set the light sensor on the sensor holder. Then, fasten the sensor holder to the leg bases at two setting holes for the light sensor. Also, fasten battery boxes to the body paying attention to the positions of the projections.



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Figure - 18

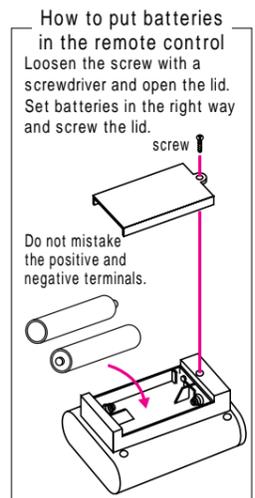
Set the lead wires from the motor A, motor B, and the battery boxes in the connectors of the lead wires from the light sensor. Connect each pair of the same color wires.



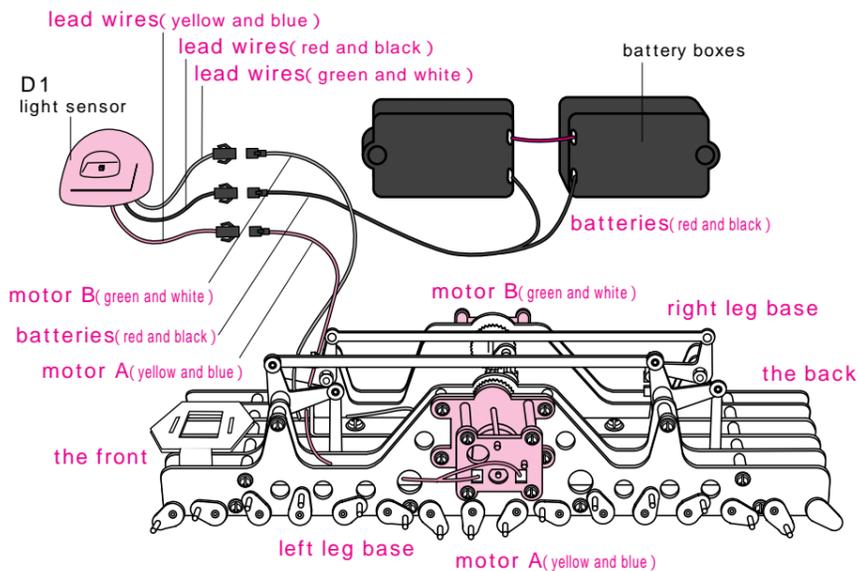
Remove the batteries when not using the machine for a long time.

Figure - 19

First, turn on the switch of the light sensor. Then, you can handle the machine with the remote control.



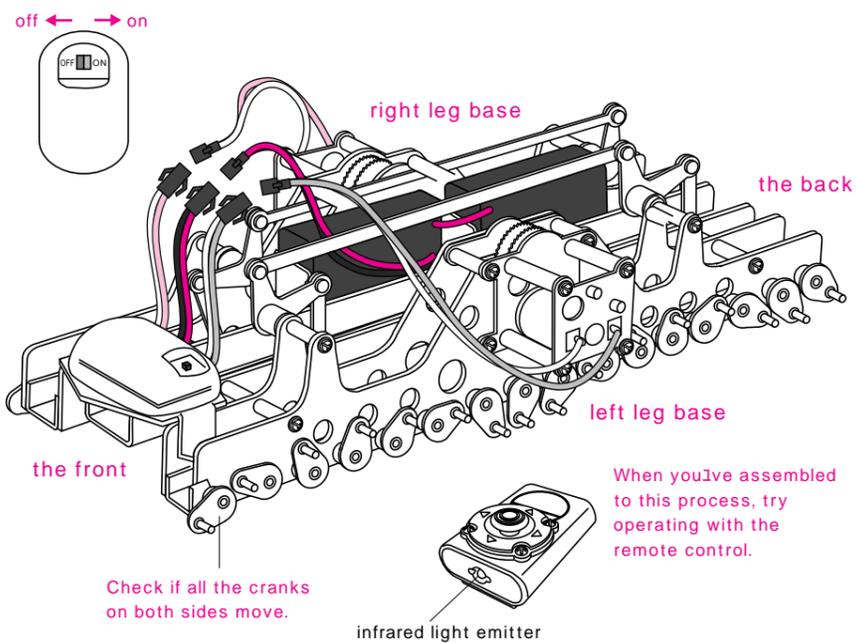
18 Put batteries in the battery boxes and then connect the light sensor to the battery boxes with lead wires.



Notice
Actually, the light sensor has already set on the sensor holder at this point, but in this figure above, it is illustrated separately to clarify the wiring.

19 Turn on the switch of the light sensor and operate the remote control to check the motion of cranks.

See p.19 for the operation of the remote control.



Check if all the cranks on both sides move.

6 Attaching Legs to the Body

Parts to be used **PARTS E**

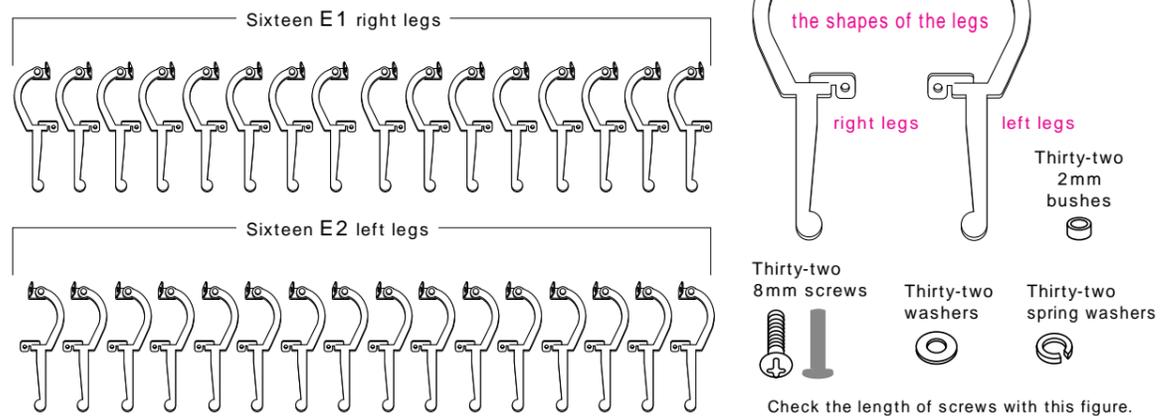
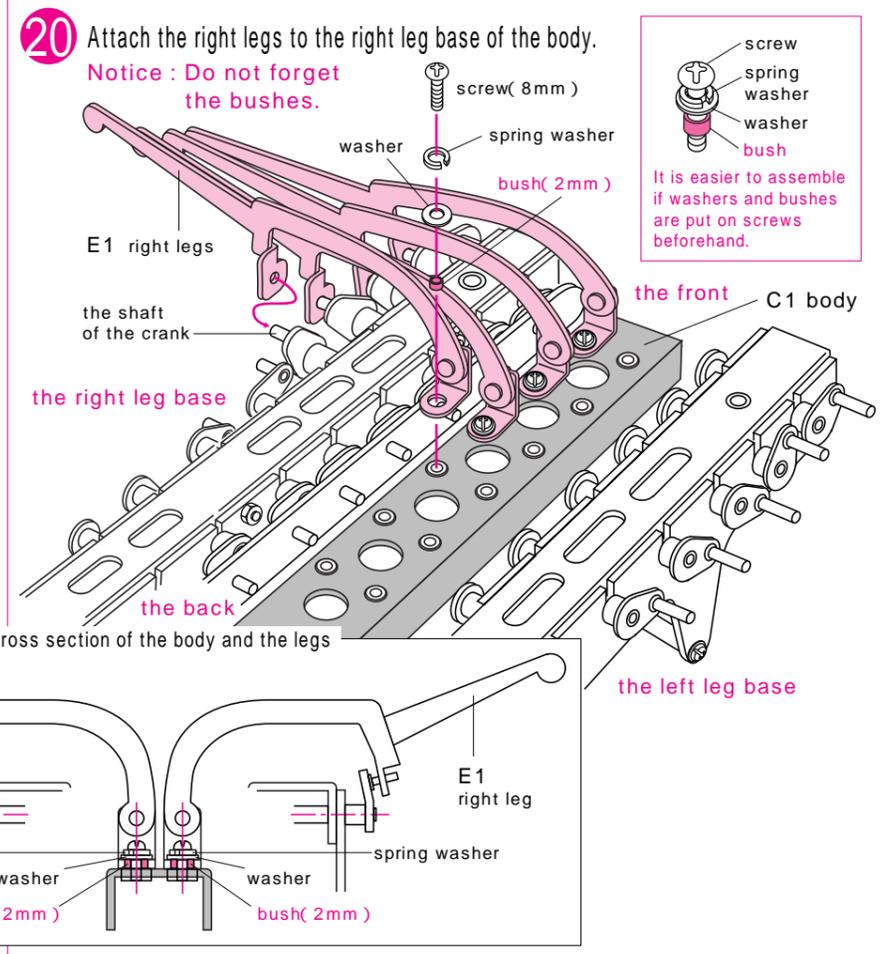


Figure - 20

Turn the machine upside down. Attach the legs to the bottom of the C1 body putting the shafts of the cranks in the holes. Fasten the legs tightly with screws. Be sure to use washers and bushes.

Notice
Set the legs in order from the front. (Otherwise, the assembly becomes harder from halfway.)



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Figure-21
Attach left legs.
Attach them firmly
one by one.

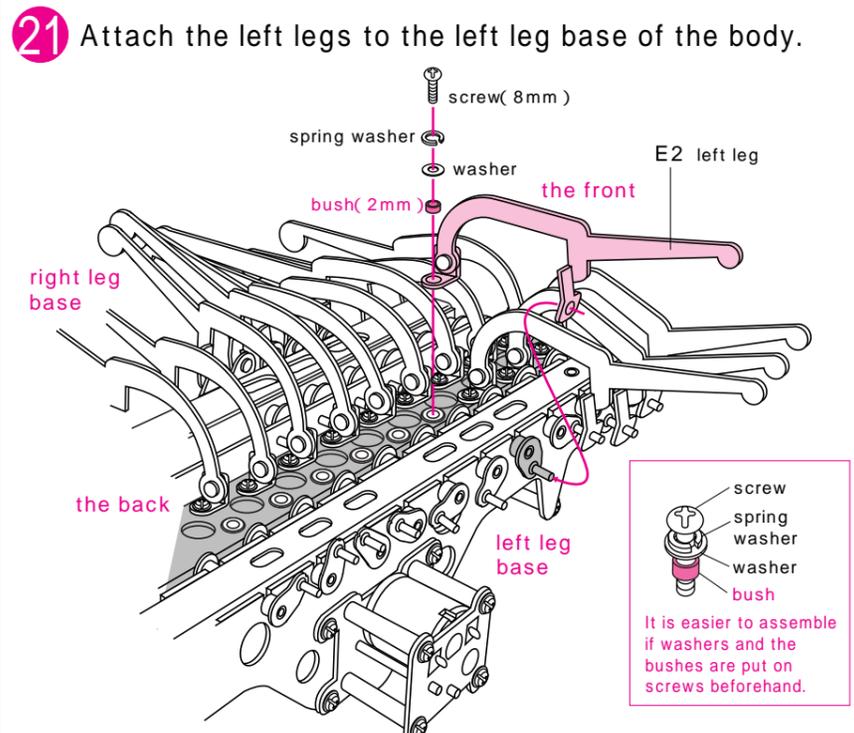
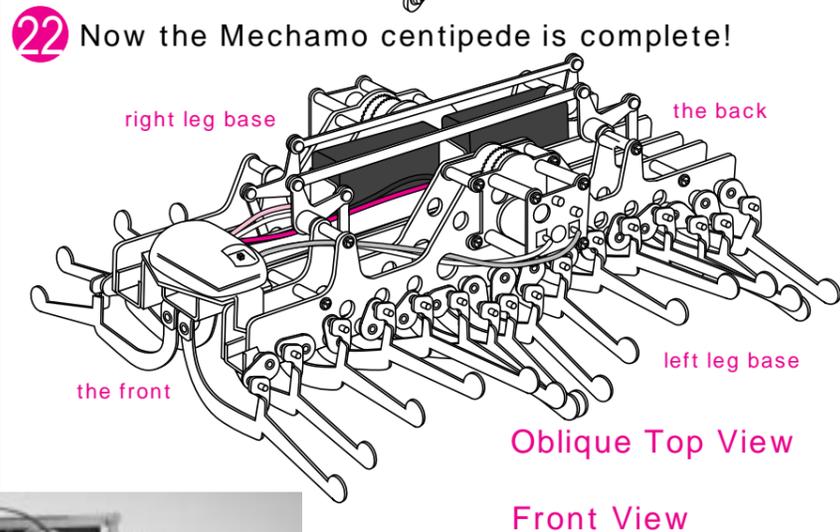


Figure-22
You've finished the
assembly.

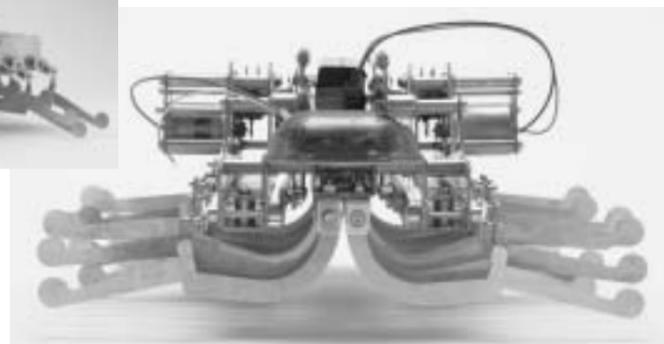


Side View



Regarding oiling
If the motion of the
machine becomes less
smooth, try oiling the
mobile parts. The
machine may recover
smooth motion.

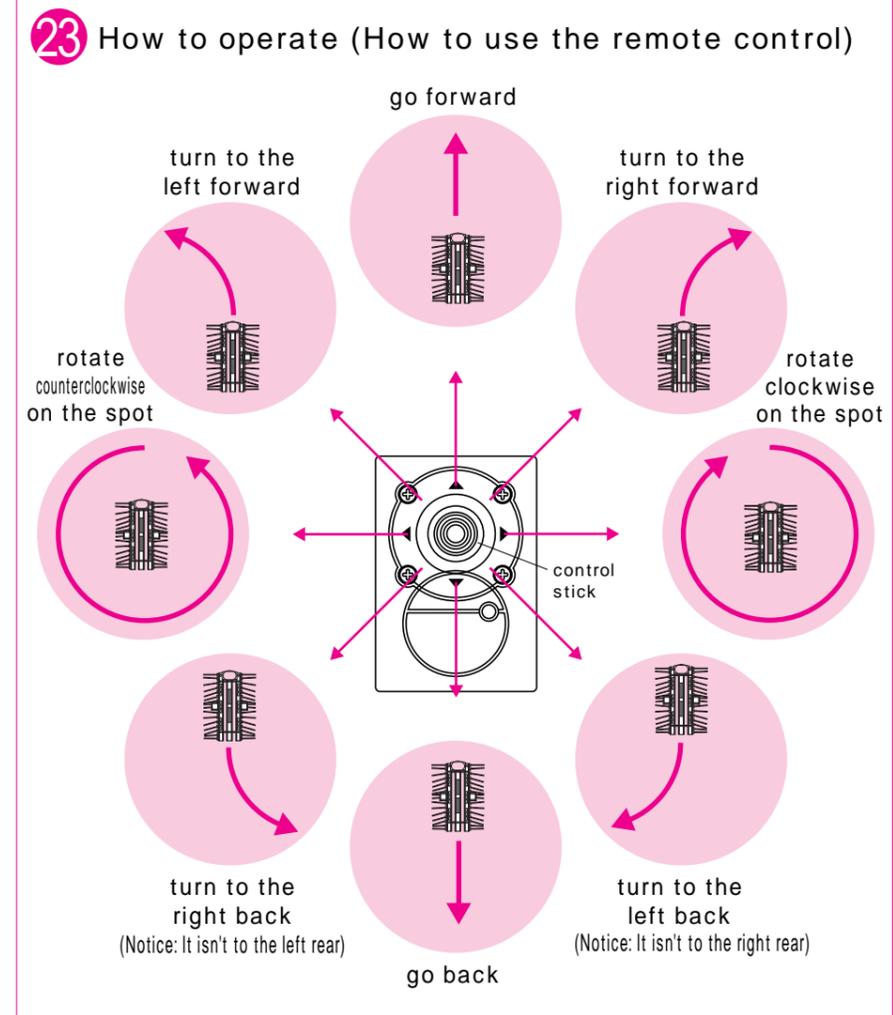
Oblique Top View



Front View

Please note that the shape and the design may appear slightly different from the pictures.

Figure-23
First, turn on the
switch of the light
sensor. Then, you
can handle the
machine with the
remote control. The
machine goes
forward and back or
turns right and left
according to the
operation of the
remote control. See
the right illustrations
for the operation.



Trouble Shooting MECHAMO

Q : The Mechamo doesn't react to the control stick.

A : Check the following points.

1. Have you turned on the switch of the light sensor?
2. Are the six batteries new? (four for the motors and two for the remote control)
3. Have you wired battery boxes, the motors and the light sensor correctly?

Q : The Mechamo reacts to the control stick but doesn't start moving.

A : Check the following points.

1. Have you put all the bushes? (Very important. See p.11, p.12, p.17 and p.18 and check the bushes.)
2. Have you tightened every screw?
3. Have you assembled correctly? (Check the machine with the picture of the finished Mechamo at p.18.)

Warning : Never touch the Mechamo while it is operating. Be sure to stop the Mechamo with the remote control and turn off the switch of the light sensor before you touch. Touching the operating Mechamo may cause injury to your fingers.