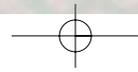


大人の科学<sup>®</sup>  
Otona no Kagaku  
(Sophisticated Science Kit Series for Adults)

Karakuri  
Somersault Doll

Experience the fine technology of  
Edo period through the dolls  
which goes down the stairs  
without using motive power.

\*\*Karakuri\* means the mechanism  
that drives a machine.



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

- To avoid danger of suffocation, do not swallow small parts such as iron balls and screws.
- To avoid danger of injury, use great caution not to point your hands and eyes with the screwdriver and the like in this kit.

★ Please read the assembly instructions and cautions in this booklet carefully before use. Do not use the parts that are broken or deformed while in use.

★ Please handle the doll with care. The doll may be broken if it is treated roughly. For example, do not shake it with its head down.

★ The colors may fade out of the clothes when it is exposed to the sun. Keep the doll with care.

★ Do not wash clothes with whites. The colors may be washed off and stain whites.

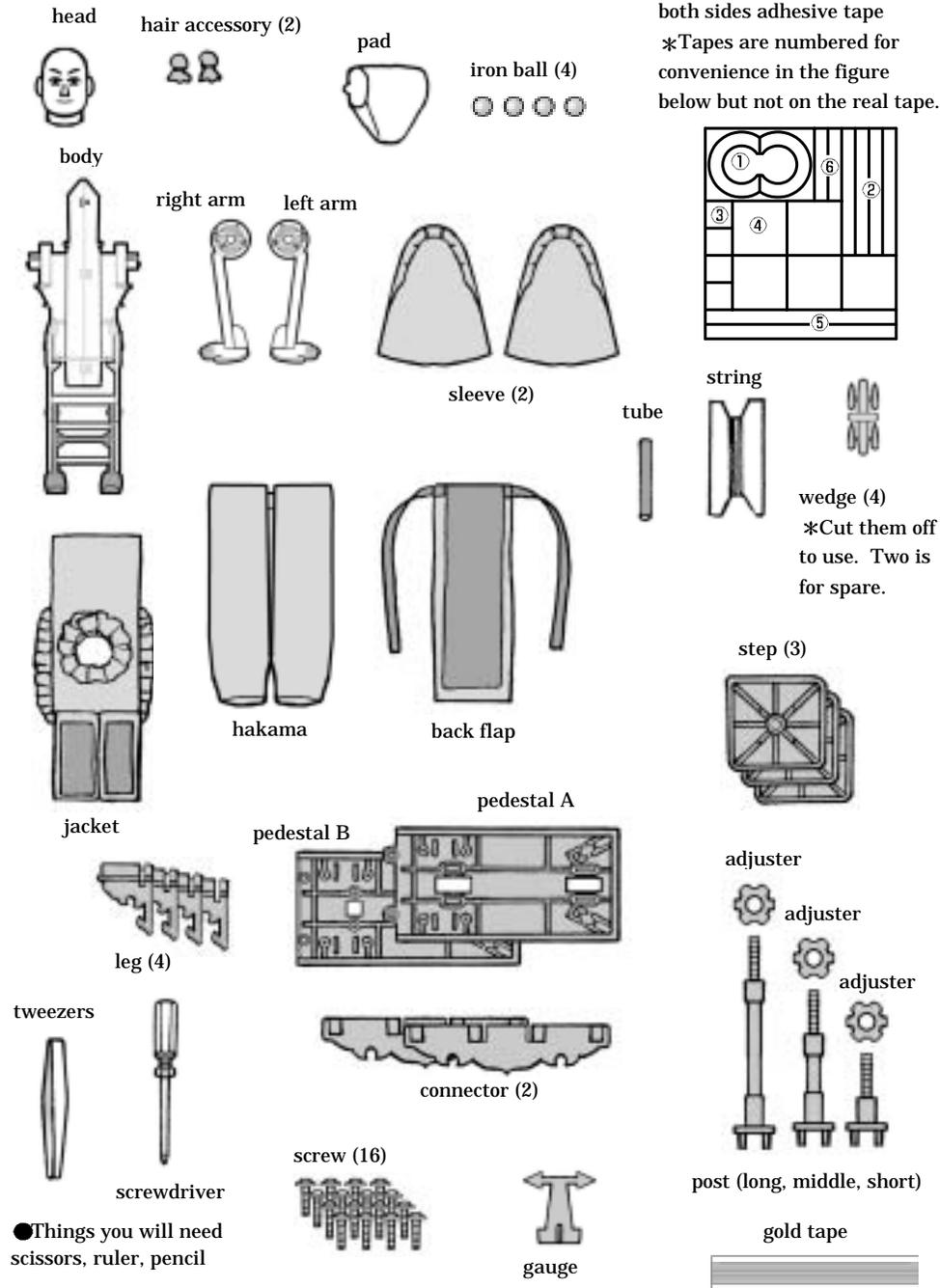
● The plastic materials used in this kit  
 face (white) : HIPS      body arm (red white) : PC      post (black) : ABS  
 handle of the screwdriver (yellow) : PE      small bag (transparent) : PE

● The metallic materials used in this kit  
 iron ball : iron      screw : nickel-plated iron

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



# Parts in this Kit

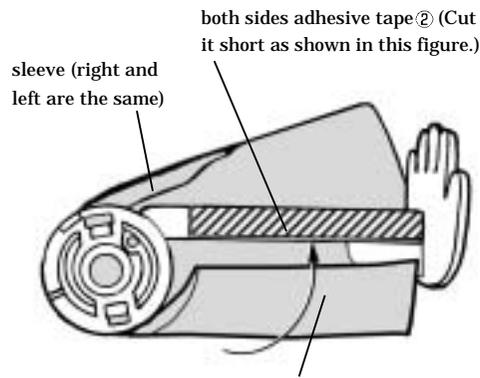


● Things you will need  
scissors, ruler, pencil

# Attaching Sleeves

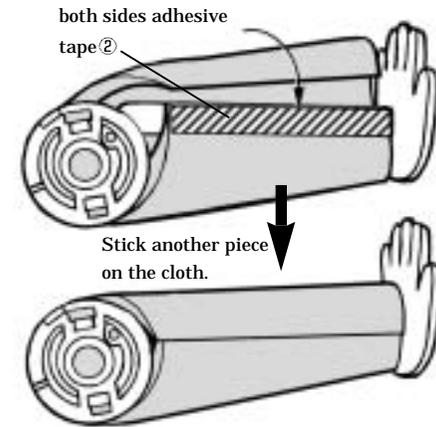
● The following diagrams illustrate the left arm, but the same way applies to the right arm too.

1 Stick a sleeve to the inside of an arm with both sides adhesive tape ②.

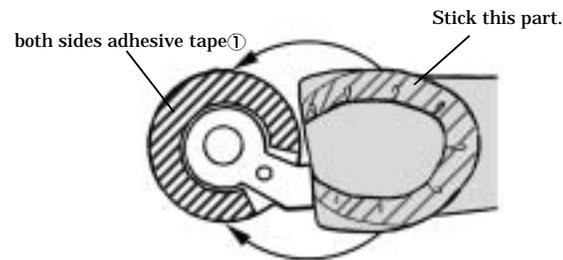


◆ Stick the sleeve near to the hand. (Leave 1mm room.)

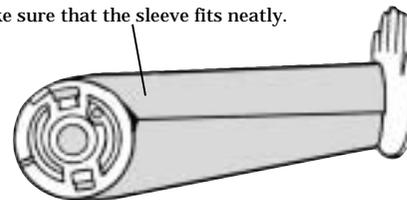
2 Stick another both sides adhesive tape on the stuck end of the sleeve and bring the other end around the arm and stick it on.



3 Overturn the arm and stick the shoulder part of the sleeve with a both sides adhesive tape ①.

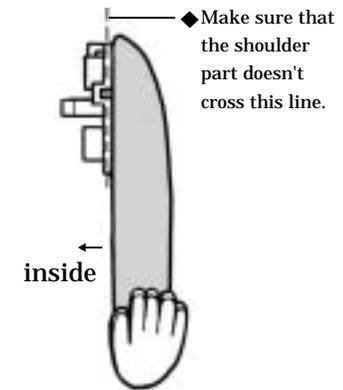


◆ Make sure that the sleeve fits neatly.



## Notice!

Check from the front and attach the sleeve so that the cloth doesn't go inside.



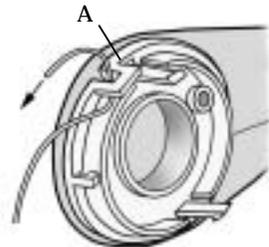
# Stringing

\*Fishlines (0.074mm in diameter) can be used as a substitute.

●The following diagrams illustrate the left arm but the same way applies to the right arm too.

\* Do not dispose the core of the string because it can be used as a doll stand afterward.

Undo the string from the core and cut in half. Tie one of the strings to the A part at the shoulder joint with the tweezers.

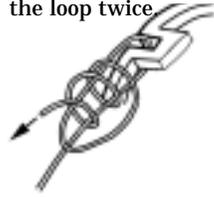


① Put the end of the string through the projection with a hole at the shoulder joint. There are two holes, so make sure the string goes through the hole A first.

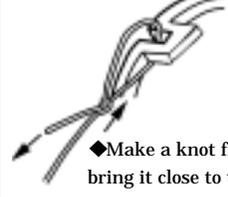
② Make a loop at the end of the string.



③ Put the end of the string through the loop twice.

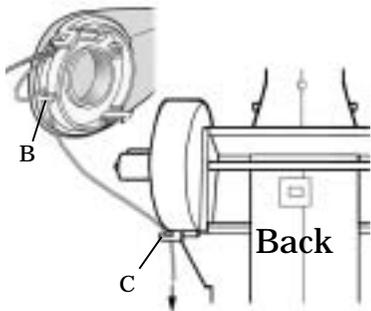


④ Pull the end of the string and tie. Bring the knot close to the arm.



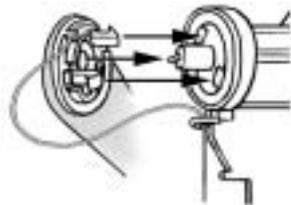
◆Make a knot first, then bring it close to the arm.

② Put the longer part of the string through the hole B in the projection at the shoulder joint and then through the hole C in the projection at the armpit of the body.



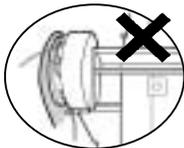
6

③ Attach the arm to the body. Snap it in so that the projections fit in the holes.

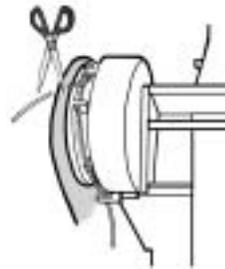


**Notice!**

Be careful so that the string isn't caught in the shoulder.

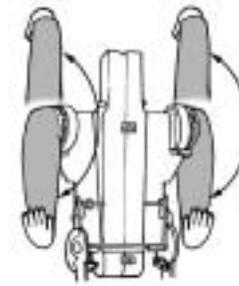


④ Trim off the shorter end of the string which doesn't go through the holes B and C with scissors. Check the motion after both arms are attached.



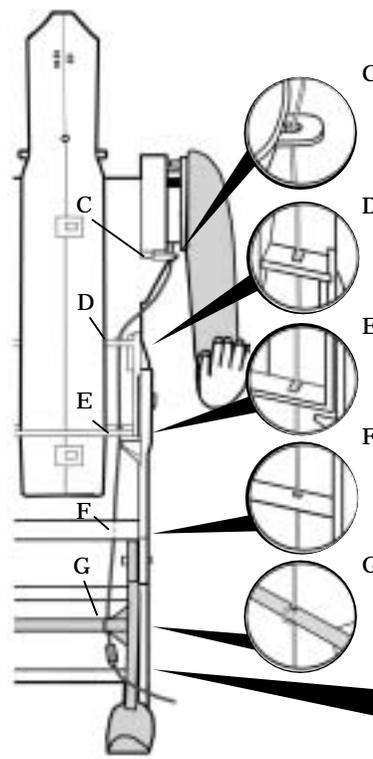
**Check!**

Check that the sleeves don't touch the shoulders and both arms move smoothly.



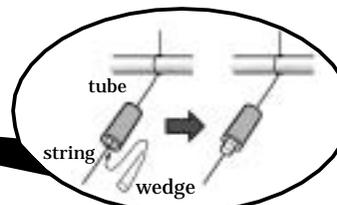
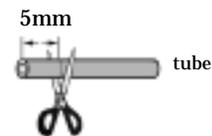
⑤ Let's continue the stringing at the side of the body.

Put the string from the hole C through the hole D and hole E in the side of the body. Then put it through the hole F in the prop between the knees and lastly put it through the hole G twice and pull it down. (It makes one loop.) Do the same thing with the other side.



⑥ Drive wedges.

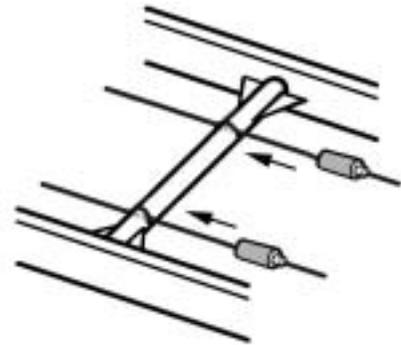
Cut the tube into 5mm. Put the string coming from the hole G through the tube and fix with a wedge. Do the same thing with the other side.



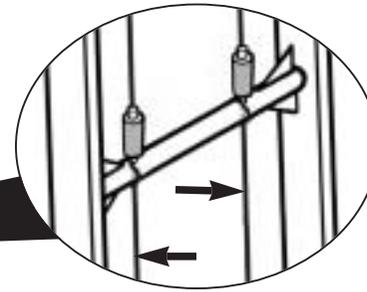
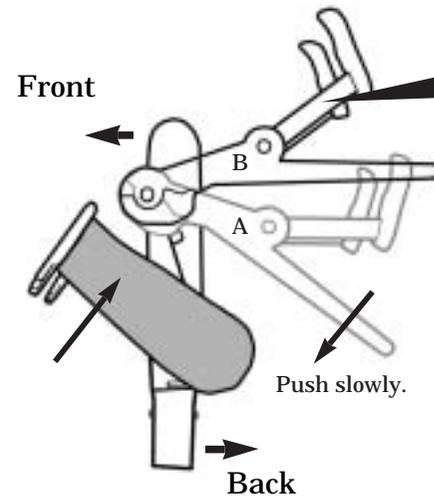
7

7 Adjust the tension of the strings.

① Bring the tubes near to the prop with the arms staying at the position shown in the figure 5. (The arms are down at the front.)



② Keep the hand closest to the body.



▲ When the legs go higher than the position B, that is, the tension of the string is too strong; push the strings lightly with a finger at the arrow part shown in the diagram above and loosen the tension.

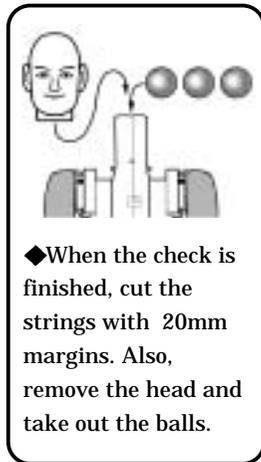
③ Turn the body upside down. Bend the legs until it comes to the position A and then let go of them. If the legs go back to the position B, the tension is adequate.

**[When the legs doesn't go up to the position B]**  
Hold the tube and pull the string to get higher tension.

**[When the legs go higher than the position B]**  
If the legs go higher than the position B, loosen the tension as shown in the upper diagram.

## Checking the Motion

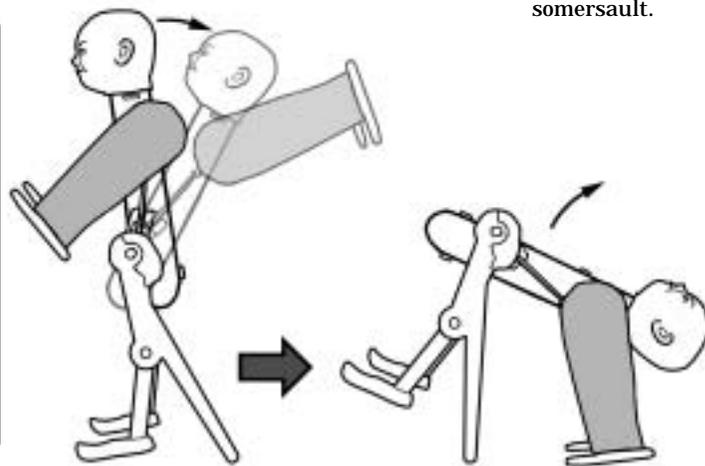
Put three iron balls in the body and set the head and check the motion.



◆ When the check is finished, cut the strings with 20mm margins. Also, remove the head and take out the balls.

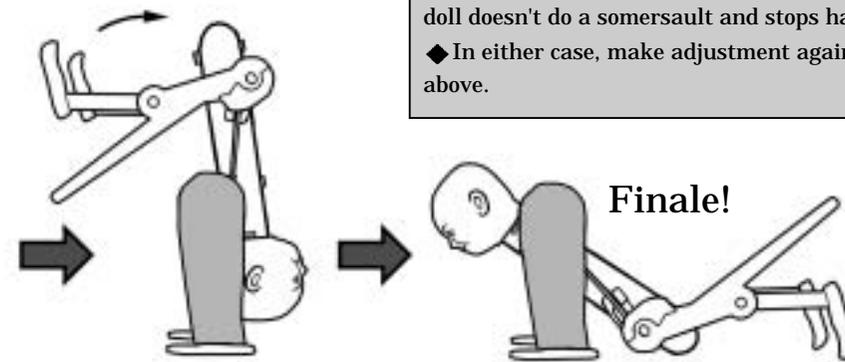
8

1 Stand the doll with the arms down in front, and then push back the doll softly.



2 The doll puts hands on the floor and does a somersault.

3 It makes a landing with its hands on the floor as shown in the diagram below. It is all right if a sequence of motion goes smoothly.



**Unsuccessful Case 1:** When the tension of the string is too loose (or the string is too long), the doll doesn't turn arms to the back and fall down from the head.

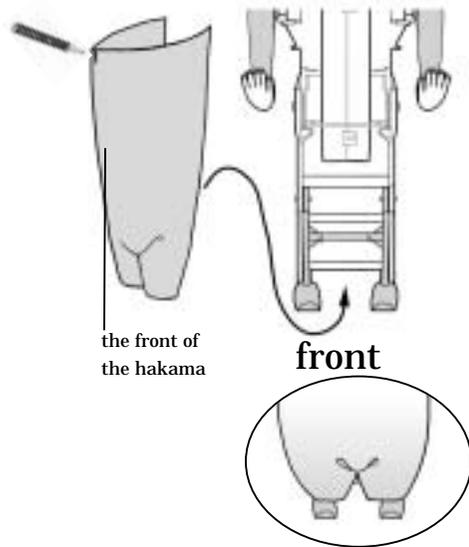
**Unsuccessful Case 2:** When the tension of the string is too tight (or the string is too short), the doll doesn't do a somersault and stops halfway.

◆ In either case, make adjustment again as 7 above.

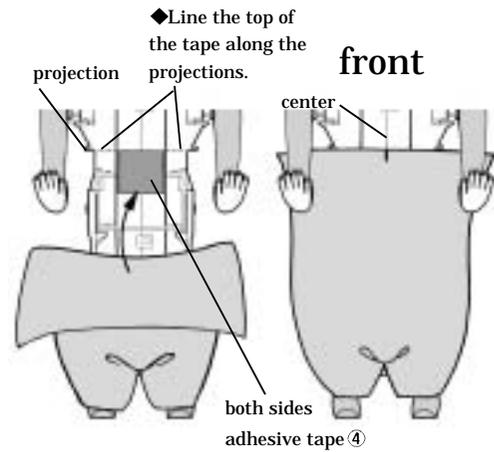
9

# Dressing the Doll in Hakama

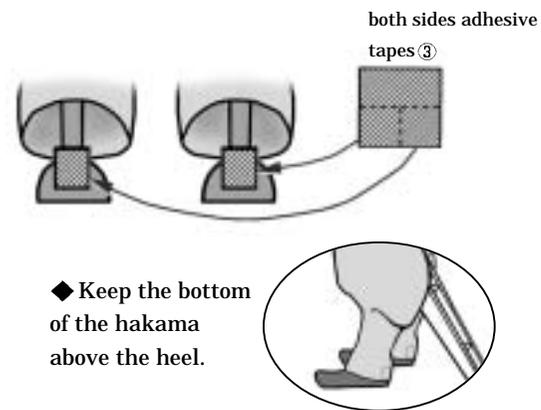
1 First, fold the hakama in half and mark the center with a pencil. Then, put the legs through the hakama.



2 Stick a both sides adhesive tape④ on the belly in front of the body. Bring the center mark of the hakama to the center of the body and stick it with the tape.



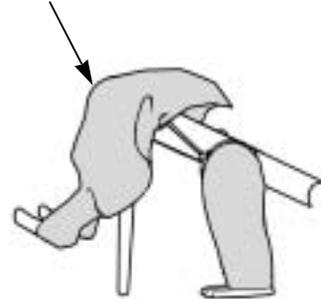
3 Stick both sides adhesive tapes③ over the heels and the ankles and stick the bottoms of the hakama with the tapes.



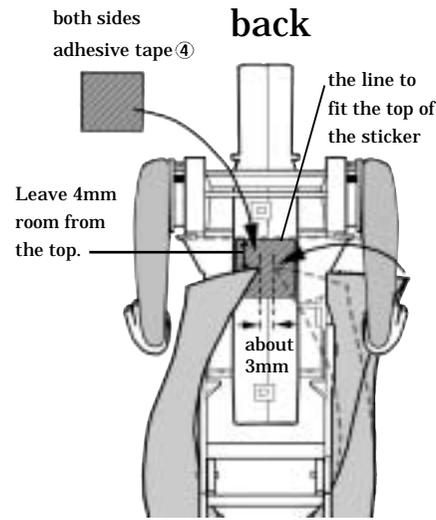
## Check!

After the belly part of the hakama is attached, bend the body to check. If the knee parts are too tight, remove the hakama from the belly and stick again a little lower.

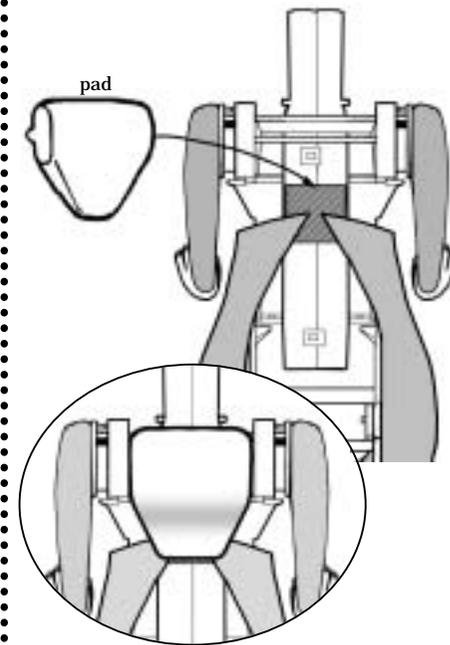
◆ Check if this part is too tight.



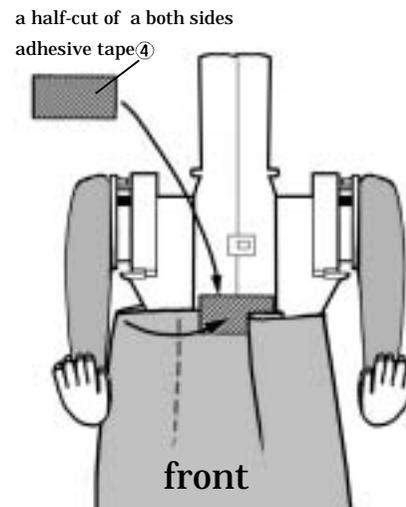
4 Stick the belly part of the hakama with a both sides adhesive tape④. Leave 3mm room at the back.



5 Attach the pad to the back.

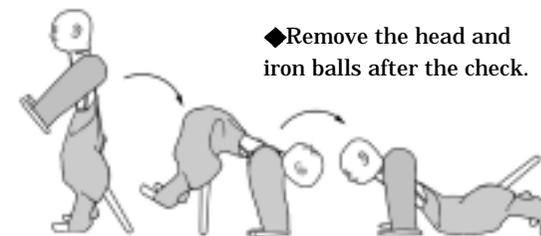


6 Overturn the doll and make tucks from both side to fit the waist and stick with a half-cut of a both sides adhesive tape④.



## Check!

After the doll is dressed in hakama, put in three iron balls and set the head and check the motion just like the Checking the Motion part.

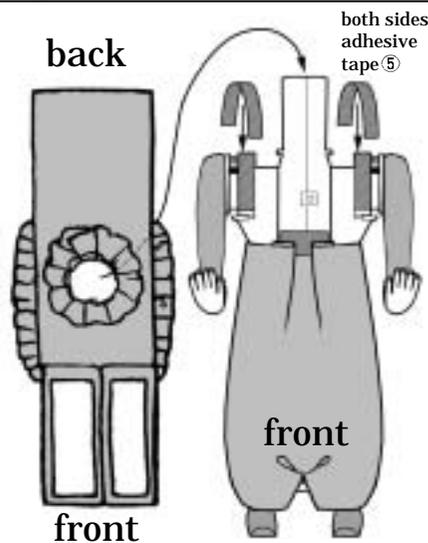


If it doesn't somersault smoothly, adjust the position where the hakama is attached.

## Dressing the Doll in the Jacket

Stick both sides adhesive tapes ⑤ on both shoulders of the body and put the jacket on and stick it.

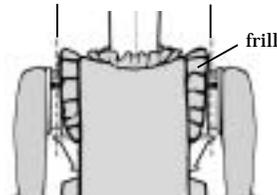
◆The side with decorations comes to the front.



### Notice!

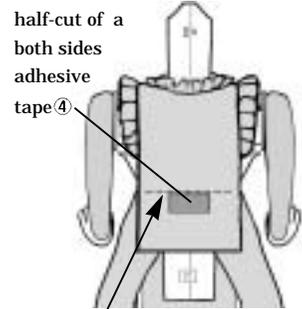
Stick the jacket carefully so that the frills don't go out to the shoulders.

◆Keep the frills inside of these lines.



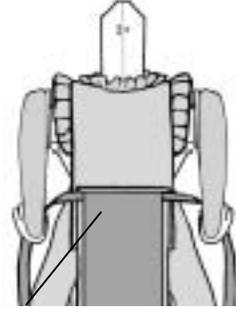
## Attaching the Back Flap

1 Stick a half-cut of a both sides adhesive tape ④ to the back of the jacket.



◆Use the projection under the jacket as a guide.

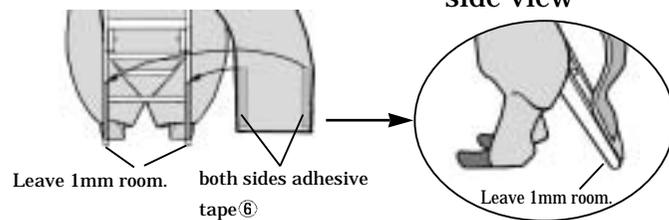
2 Stick the back flap and bring the laces to the front.



3 Tie the laces in front and tuck the ends in.

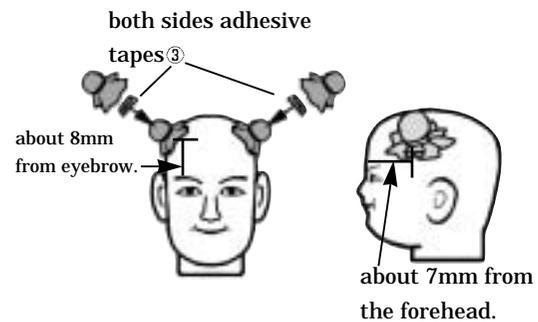


4 Stick two both sides adhesive tapes ⑥ leaving 1mm rooms and then stick the back flap with them.

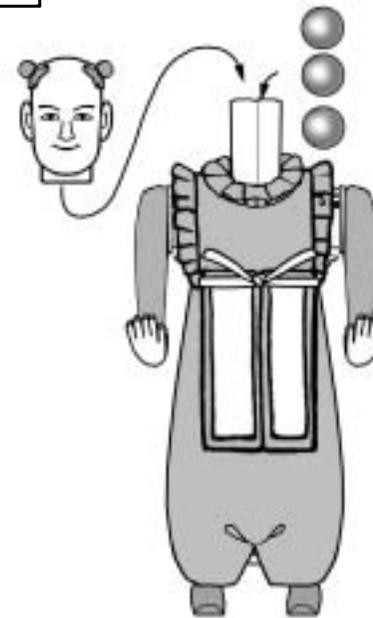


## Attaching the Head

1 Attach hair accessories with both sides adhesive tapes ③.

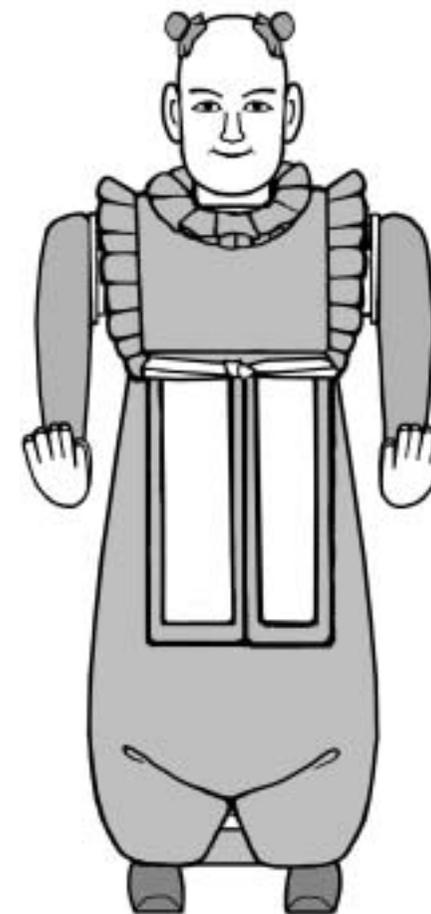


2 Put three iron balls and set the head.



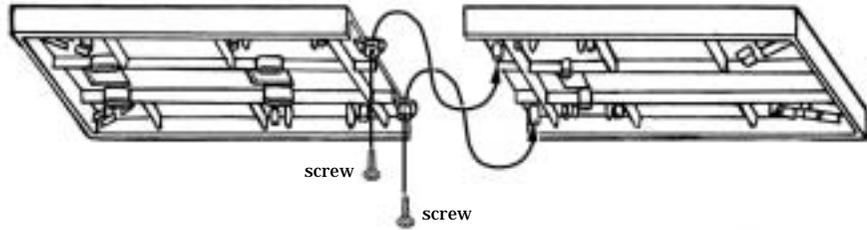
◆Usually, three iron balls are put in the body; however, if the doll stops halfway of the steps, putting in one more ball may make the doll move smoother. Also, use four balls to make the doll move faster.

Now, Somersault Doll is complete!

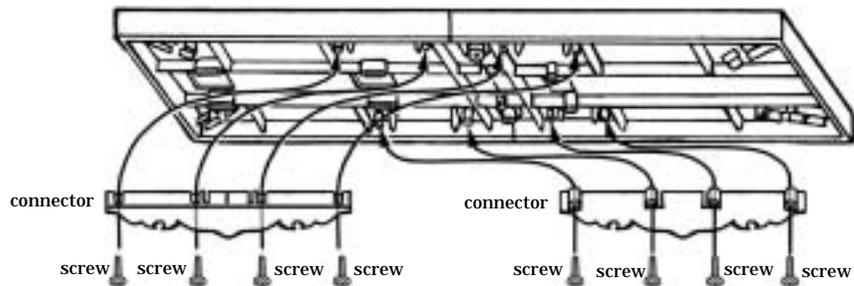


# Assembling the Pedestal

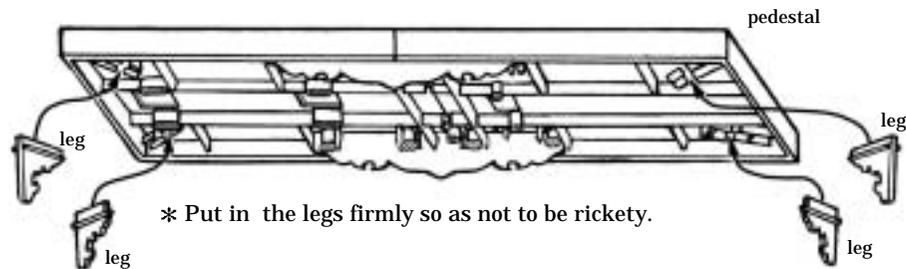
1 Connect the pedestal A and the pedestal B by putting the projections into halls. Make sure that two parts are connected flat and then fasten them with screws. Push the screws in completely.



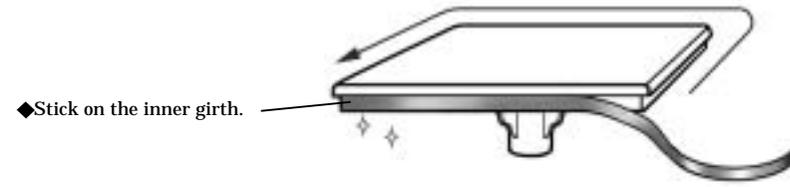
2 Attach the connectors to the pedestal with screws. The connectors are same in shape. Make sure the side with gold line comes outside when attaching.



3 Attach legs to the pedestal. Check the directions of the legs when attaching and push them in completely.

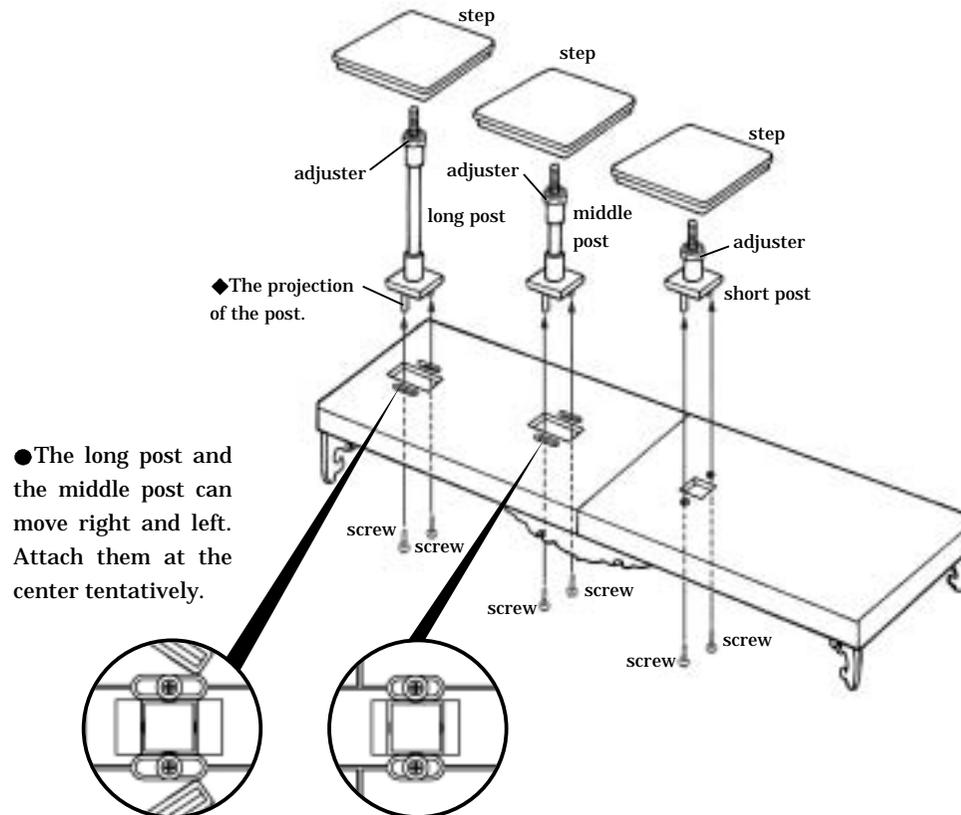


4 Stick gold tapes on the sides of the steps. (Use all three tapes.)



5 Attach the steps and posts in the following order.

- ① Put projections of the posts into the pedestal.
- ② Fasten with screws from the bottom side.
- ③ Screw in the adjusters and steps.

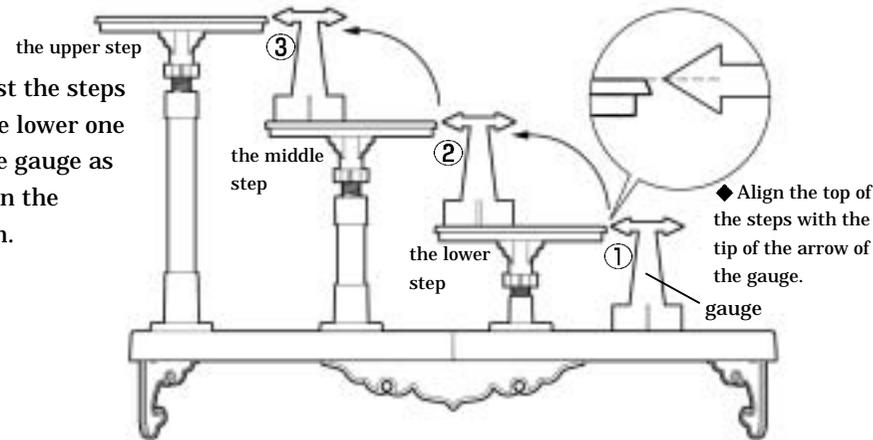


**[Bottom View]**

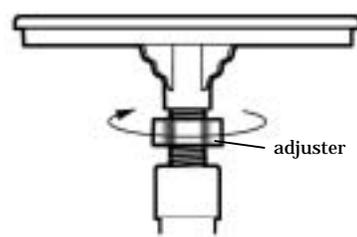
Notice: The short post cannot move.

## Adjusting the heights of the steps

● Adjust the steps from the lower one with the gauge as shown in the diagram.

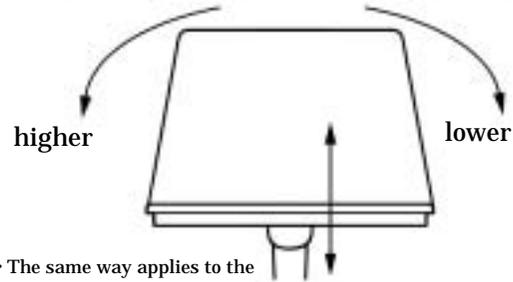


1 Loosen the adjuster of the lower step.



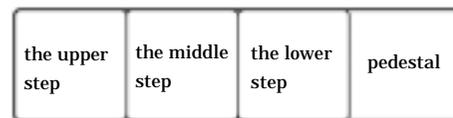
◆ Turn the adjuster clockwise looking from the top.

2 Turn the step to align the top with the tip of the gauge. Next, adjust the heights of the middle step in the same way, and then the upper step.



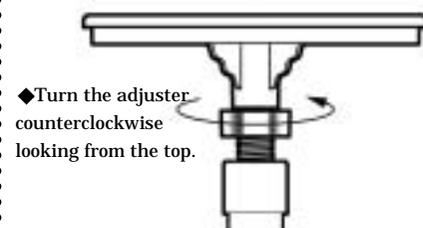
◆ The same way applies to the middle and the upper steps.

3 Keep the heights of each step and adjust the direction of the steps so that the sides form a straight line when looking from the top.



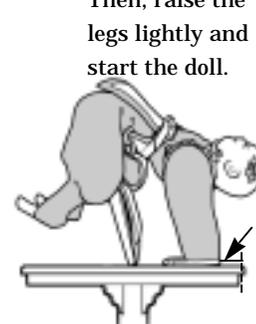
◆ Lay on the sides on a flat table to adjust easily.

4 Lastly, screw the adjuster to fasten the lower step. Fasten the middle step and the upper step in the same way.



## Setting the Doll in Motion

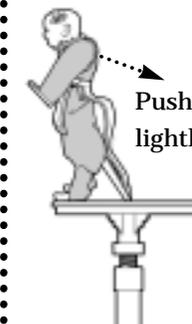
1 Put the doll on the upper step and check the touchdown point of the hands. Then, raise the legs lightly and start the doll.



Leave about 10mm space.

Notice: The 10mm space is tentative. Adjust the distance since each doll moves differently.

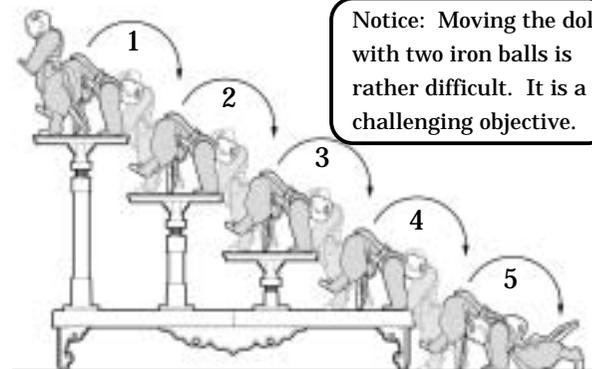
2 In case the doll makes standing start.



Push lightly.

Stand the doll and align its toes with the edge of the step. Push the upper body lightly to set the doll in motion.

3 If the doll makes five somersaults and then stops, the assembly goes well.



Notice: Moving the doll with two iron balls is rather difficult. It is a challenging objective.

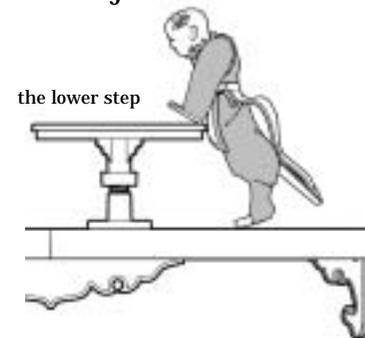
### Changing the number of the iron balls

Though the instructed number of the iron balls to put in is three, increasing and decreasing the number changes the motion. When four balls are put in, the motion becomes quicker because of the weight. When two balls are put in, the motion becomes slower.

### Changing the tension of the string

Changing the tension of the string as instructed at 7 in Stringing changes whole motion of the doll.

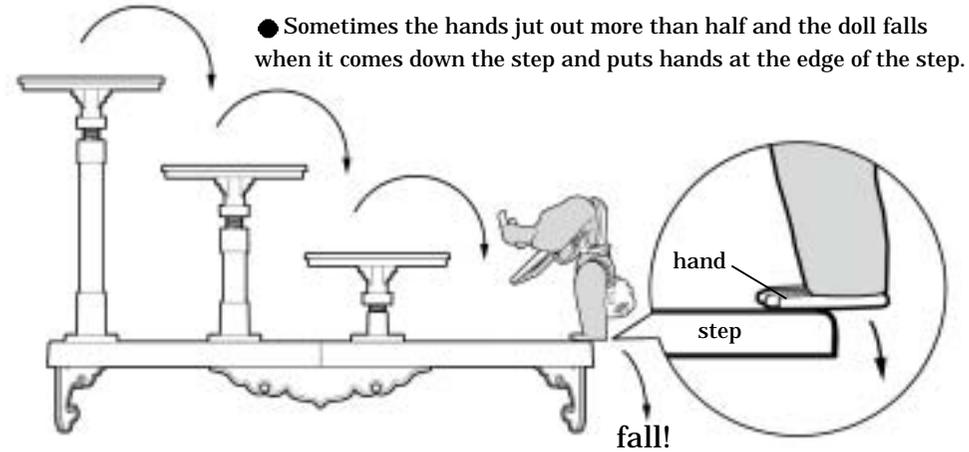
### How to Make Fine Adjustment



● The doll moves most smoothly when the heights of steps are the lowest as far as the doll can move normally. The way to adjust the heights of steps is introduced as a high level technique in the following.

- 1 Adjust the steps from the lowest one. Lower the step little by little until the doll stops moving as shown in the diagram.
- 2 Then, make one round of the adjuster to heighten the step.
- 3 Make fine adjustments in the same way to the middle and the upper steps.

### Unsuccessful Case① Falling Down from the Step



The doll's clothes could be caught in this part.

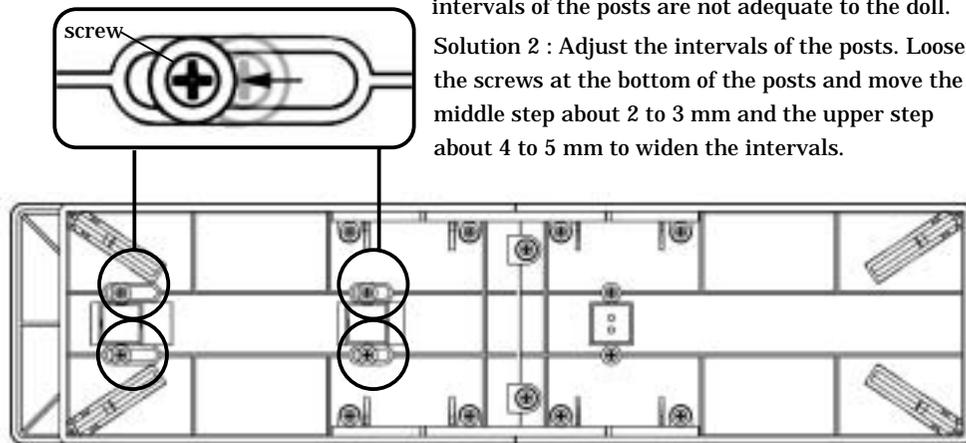


Reason 1 : The doll's clothes are caught in the body.

Solution 1 : When the doll bend back and put the hands on the step, the back flap may be caught in the body. In that case, it has to be straightened. Adjust the clothes with both adhesive tapes not to be caught in.

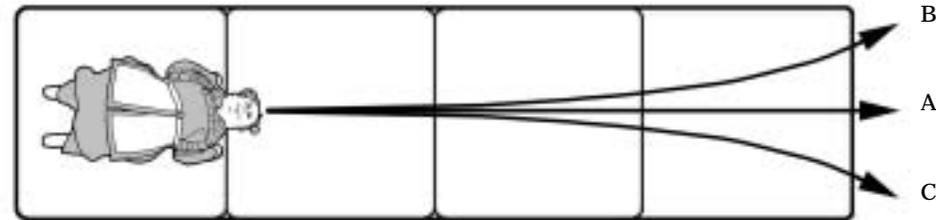
Reason 2 : If the clothes are not caught in the body, the intervals of the posts are not adequate to the doll.

Solution 2 : Adjust the intervals of the posts. Loosen the screws at the bottom of the posts and move the middle step about 2 to 3 mm and the upper step about 4 to 5 mm to widen the intervals.



### Unsuccessful Case② Going off to the side

● Though the course should be A, the doll may go off the course because of the way to set the doll in motion or the way to dress. When the doll always goes wrong, angle the steps to correct its course.

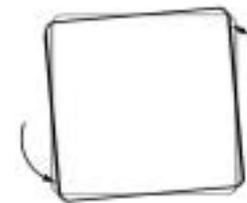


● When the doll follows the course B



Solution : Turn the step a little in a clockwise direction looking from the top.

● When the doll follows the course C



Solution : Turn the step a little in a counterclockwise direction looking from the top.

If it doesn't go well anyhow

See the 7 of the Stringing on the separate sheet and adjust the tension of the string once again. (Adjust from the back of the hakama with tweezers.)

### How to display the doll

The doll can keep a standing posture by putting in the core of the string.

