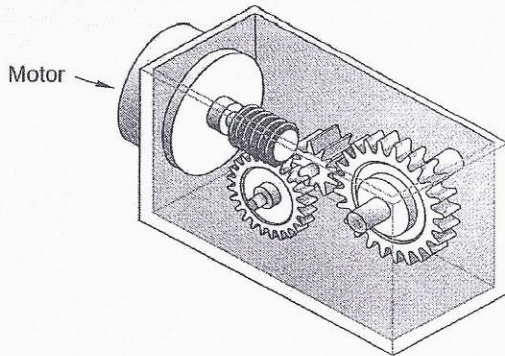


Links, Guides, Systems, Constraints and Materials Pretest

1. The diagram below shows the motion transmission system in a technical object.



The 4 possible characteristics of this type of system are listed below.

1- It increases speed

3- It is reversible

2- It decreases speed

4- It is irreversible

Which combination of characteristics explains why this mechanical system was chosen?

A) 1 and 3

B) 1 and 4

C) 2 and 3

☒ D) 2 and 4

2. Different methods of protecting certain materials are listed below.

Protection methods

1	Zinc coating
2	Oil treatment
3	High temperature treatment
4	Soaking in an acidic solution

Which are the two appropriate methods for protecting a piece of iron from oxidation (rust)?

☒ A) 1 and 2

B) 1 and 4

C) 2 and 3

D) 3 and 4

3. Which statement correctly explains the driver, driven and intermediate?

☒ A) The driver initiates the motion, the driven receives the motion and the intermediate is in between the driver and the driven.

B) The driver receives the motion, the driven initiates the motion and the intermediate is in between the driven and the driven.

C) The driver initiates the motion, the intermediate receives the motion and the driven is in between the driver and the intermediate.

D) The driver receives the motion, the driven initiates the motion and the intermediate comes after the driven.

4. During a violent storm, the windows of the "Three Little Pigs" boutique were broken by flying debris, nearly injuring its customers. As a result, the owners want to replace the glass in their windows with a transparent material that is more resistant. What mechanical properties must the transparent material have?

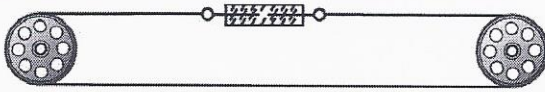
A) Elasticity and hardness

B) Elasticity and malleability

☒ C) Resilience and hardness

D) Resilience and malleability

5. What is the motion transmission system and the motion transformation system shown below?



	Transmission	Transformation
A	Belt and pulley	Rack and pinion
<input checked="" type="radio"/> B	Belt and pulley	Screw gear
C	Screw gear	Worm and worm gear
D	Rack and pinion	Screw gear

6. A washing machine contains many parts that may break down over time. From the choices below, explain which would be the best system to attach the back cover of the machine to the body of the washing machine to permit access for repairs.

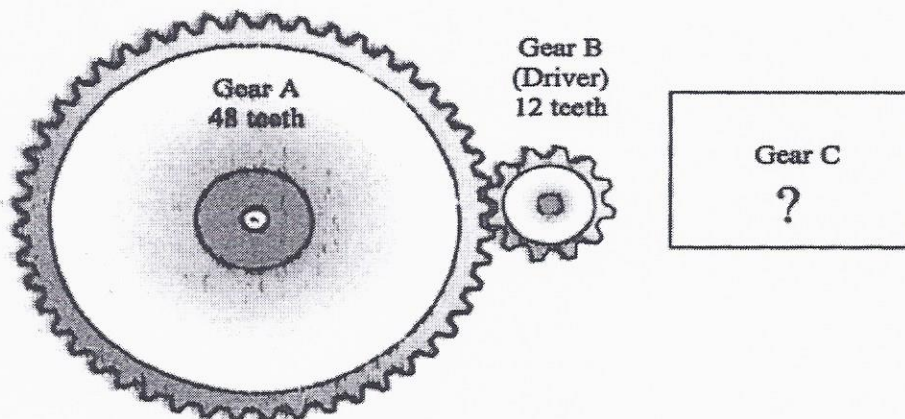
A) rivet

B) glue (adhesive)

☒ C) screw

D) nail

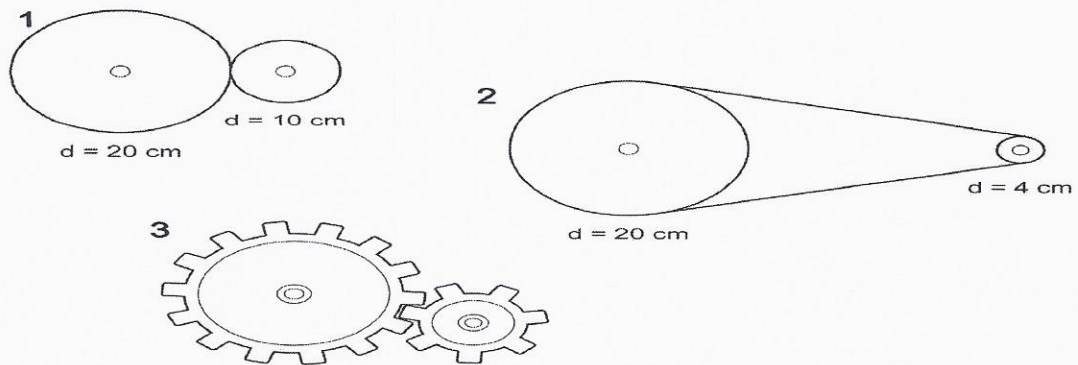
7. The diagram below shows a motion transmission system consisting of three gears. Gear B is the driver.



Which of the following indicates the speed ratio between gears A and B and the number of teeth gear C should have so that speed ratio between gears B and C is $\frac{1}{3}$?

- A) The speed ratio between gears A and B is 0.25, and gear C should have 4 teeth
- ☒ B) The speed ratio between gears A and B is 0.25, and gear C should have 36 teeth
- C) The speed ratio between gears A and B is 4, and gear C should have 4 teeth
- D) The speed ratio between gears A and B is 4, and gear C should have 36 teeth

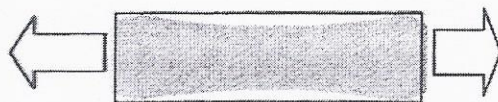
8. Look at the three motion transmission systems below.



In which of these three systems does the biggest speed change occur?

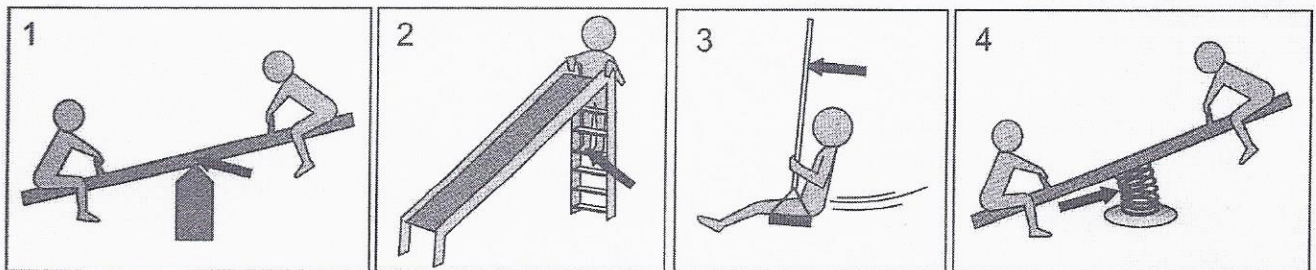
- A) System 1 because the diameter difference between the driver and the driven is greater than system 2 and 3.
- ☒ B) System 2 because the diameter difference between the driver and the driven is greater than system 1 and 3.
- C) System 3 because the diameter difference between the driver and the driven is lesser than system 1 and 2.
- D) System 1 and 3 because the diameter difference between the driver and the driven is lesser than system 2.

9. What mechanical constraint is illustrated below?



- A) Compression
- B) Deflection
- C) Torsion
- ☒ D) Tension

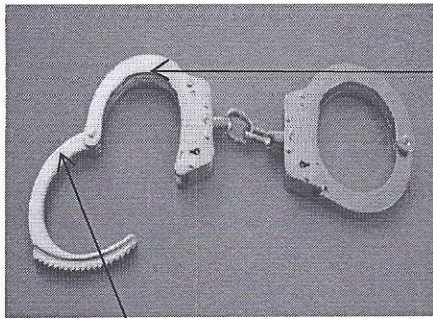
10. The following diagrams show different playground activities, for each item of playground, the arrow indicates where something is subjected to a constraint.



Which diagram shows tension being exerted?

- A) Diagram 1
- B) Diagram 2
- ☒ C) Diagram 3
- D) Diagram 4

11. Give the links for Part A and Part B which is attached with a rivet.

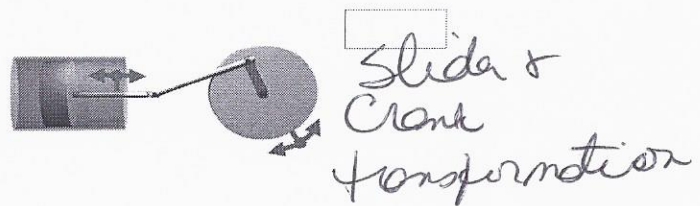
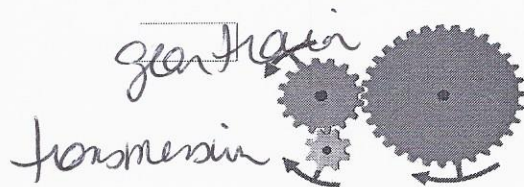
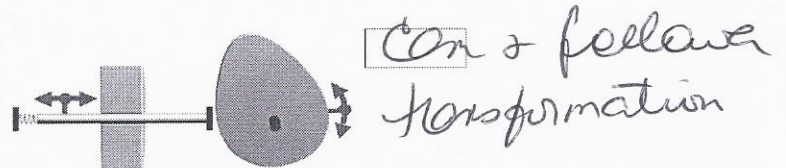
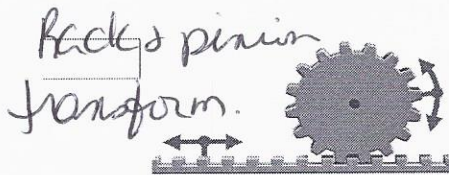
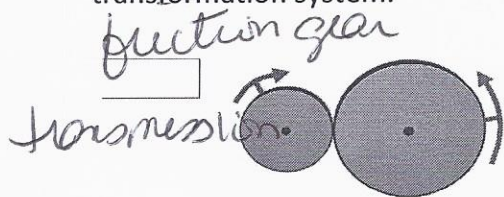


Part A

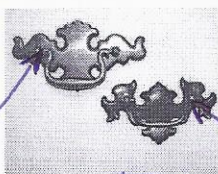
Part B

NR, indirect, rigid, partial

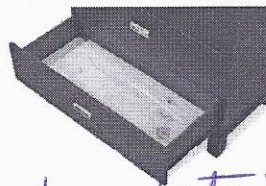
12. Name each system below and state whether they perform a transmission system or transformation system.



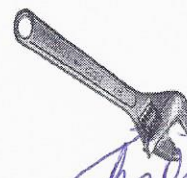
13. Identify the type of guide in the pictures provided and determine what controls the movement..



rotation
clip

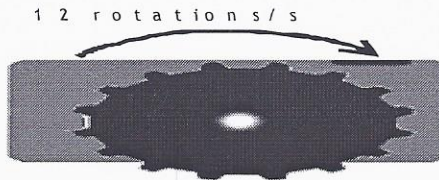


translation
track



helical
bolt

14. An electric motor spins a 16-tooth gear in a clockwise fashion at the rate of 12 rotations per second.



You are working on a project and need to reduce the overall speed to 8 rotations per second clockwise. Four different gears are available: A, B, C, and D.

Gear A 8-tooth gear	Gear B 16-tooth gear	Gear C 24-tooth gear	Gear D 32-tooth gear

Describe how you would add gears to the motor gear in order to create an overall clockwise motion of 8 rotations per second.

Indicate the order in which the gears must be added, the direction of motion of each gear (clockwise or counter-clockwise) and the number of teeth on each gear.

Justify your answer with calculations.

$$\frac{2}{3} = \frac{16}{x} = 24 \text{ teeth}$$



15. Match the constraint with its description with its example

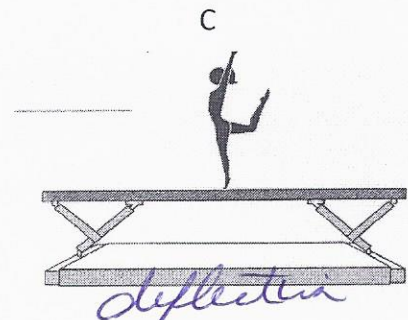
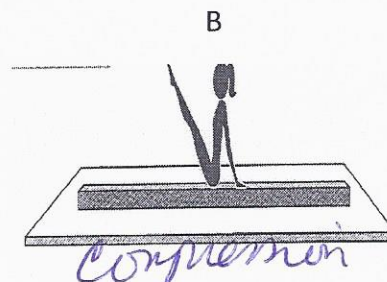
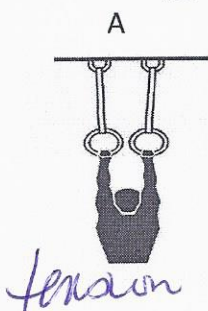
Constraint	Description	Example	Draw symbol
A- Compression	squeezing	crush a can	$\rightarrow \leftarrow$
B- Tension	stretching	tug of war	$\leftarrow \rightarrow$
C- Torsion	twisting	wringing a towel	$\curvearrowright \curvearrowleft$
D- Deflection	bending	flexing rod	$\downarrow \uparrow \downarrow$
E- Shearing	cutting	cutting	$\nearrow \searrow$

16. What is the difference between thermoplastic and thermosetting?

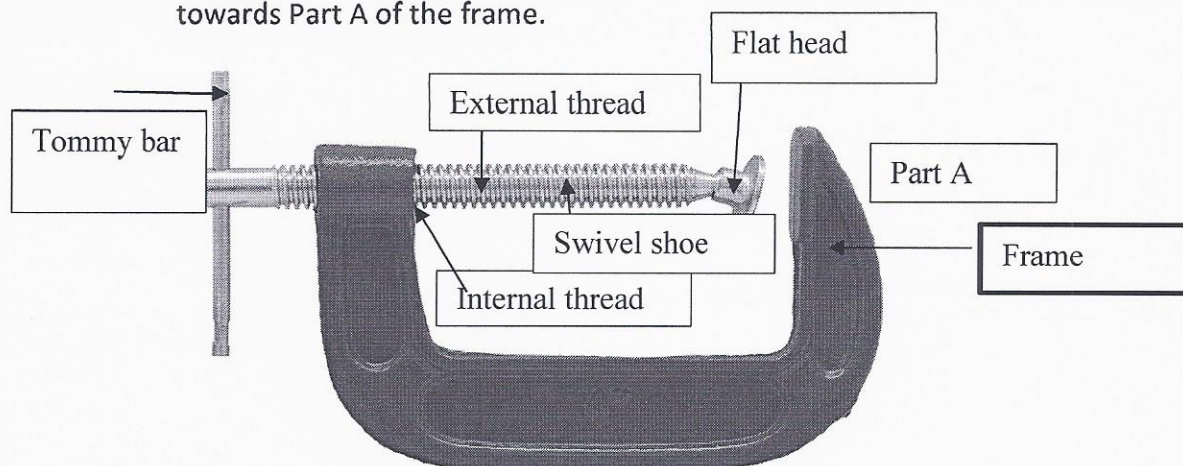
deforms when heat \searrow
+ cooled + recyclable

not deformed when
heated + cooled + not
recyclable.

17. Gymnastics equipment is subjected to many constraints. Name each constraint for the following pictures.



18. Below is a picture of a C clamp. If the Tommy bar rotates clockwise the Swivel shoe moves towards Part A of the frame.

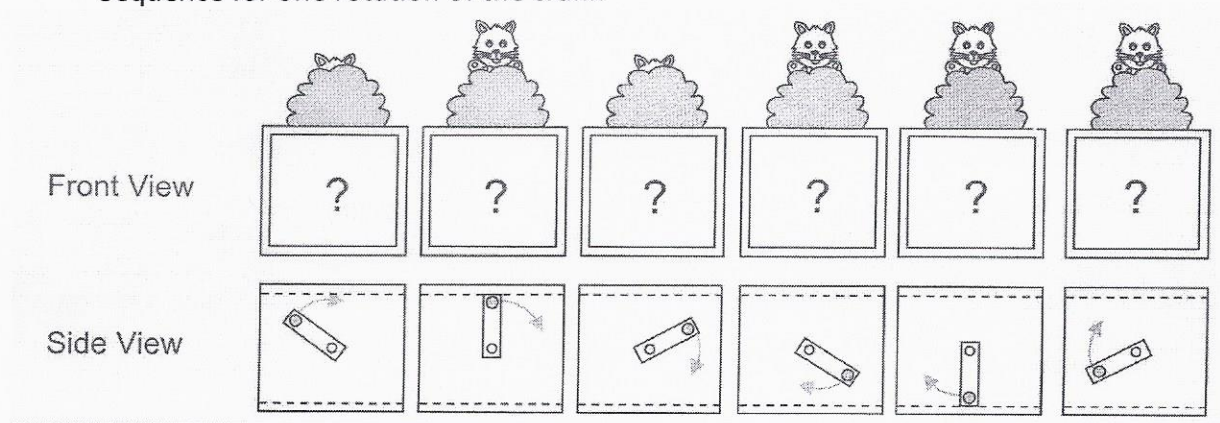


- a- Specify what **acts** as a guiding control for the Swivel shoe as it rotates to Part A.
b- Indicate the **type** of guiding involved.

internal thread
helical

19. A toy is represented in the diagram below. This toy is a box containing a cam that can move a cat in and out of the box through the rotation of a crank.

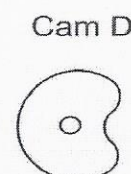
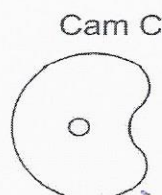
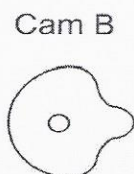
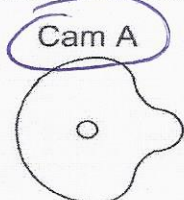
Sequence for one rotation of the crank



The designers want the toy to work as follows:

- The cat must move in and out of the box twice with each rotation of the crank and remain out longer the second time.
- The cat's head must come out as far out of the box as possible.

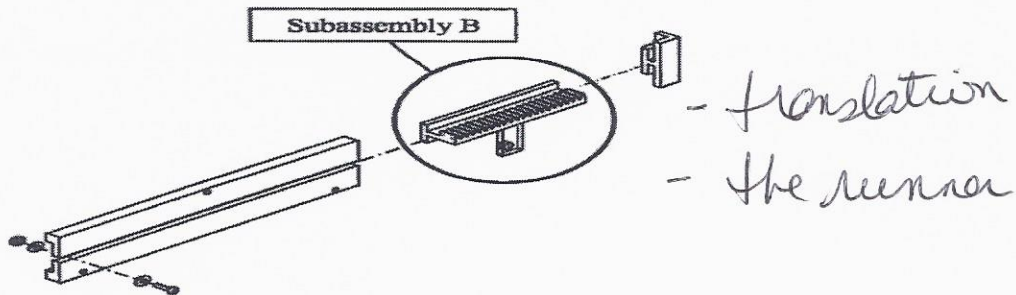
Which one of the cams below will make the toy move according to the designer's specifications? Justify your answer.



Cam must have 2 close ~~set~~ cavities to enter the box 2x rapidly. Need cam with largest diameter for head to come out as far as it can.

Use the appendix on last page to answer questions 20-22

20. To move appropriately, subassembly B represented below needs a guiding control. Which part acts as the guiding control for this subassembly and what type of guiding is involved?

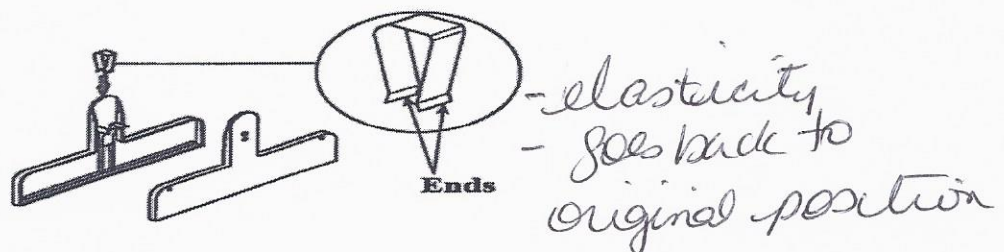


21. a- To what constraint are the two ends of the clip subjected when the memo holder is opened? *deflection*

b- The following are mechanical properties of materials.

- Hardness - Elasticity - Malleability - Stiffness - Resilience

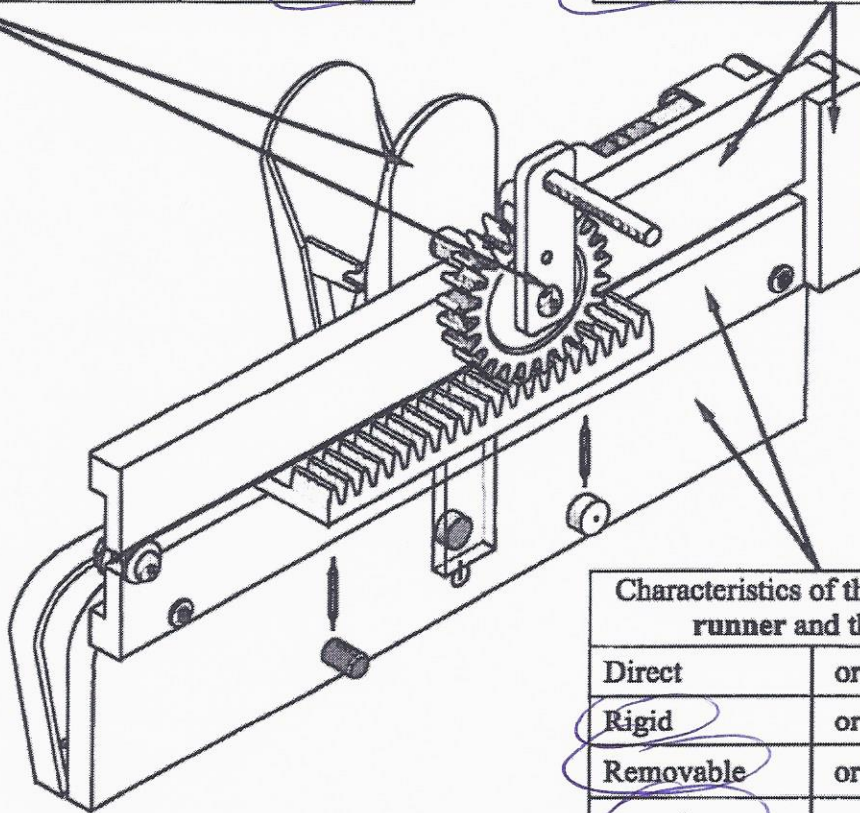
What mechanical property must the clip have so that it can be subjected to this constraint when the memo holder is used? Explain why.



22. Circle the links for each part.

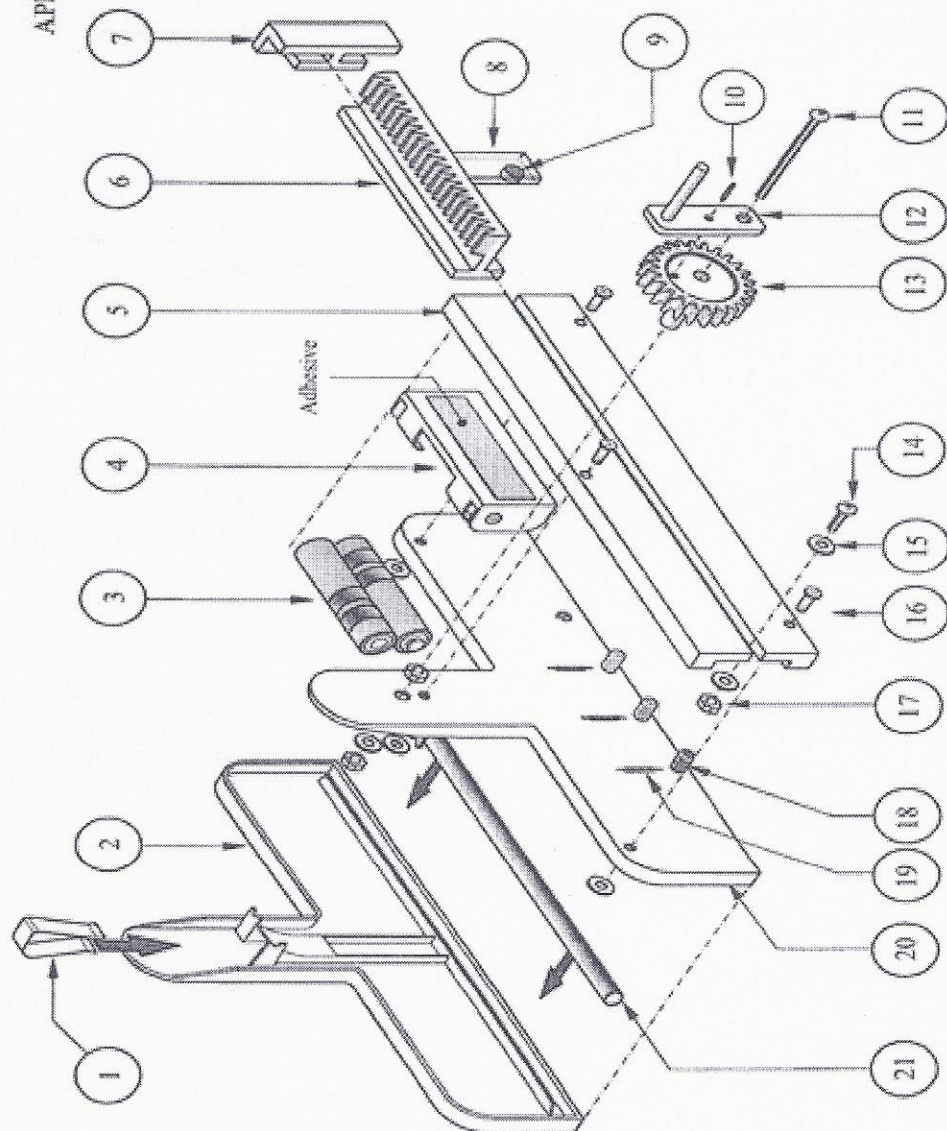
Characteristics of the link between the front jaw and the crank		
Direct	or	Indirect
Rigid	or	Elastic
Removable	or	Non-removable
Complete	or	Partial

Characteristics of the link between the metal end fitting and the runner		
Direct	or	Indirect
Rigid	or	Elastic
Removable	or	Non-removable
Complete	or	Partial



Characteristics of the link between the runner and the front jaw		
Direct	or	Indirect
Rigid	or	Elastic
Removable	or	Non-removable
Complete	or	Partial

APPENDIX I



ITEM	QUANTITY	NAME	ITEM	QUANTITY	NAME	ITEM	QUANTITY	NAME
1	1	Clip	8	1	Magnet holder	15	6	Washers
2	1	Rear jaw	9	1	Magnet	16	3	Bottom rivets
3	2	Batteries	10	1	Locking pin	17	3	Nuts
4	1	Battery holder	11	1	Bolt	18	3	Indicator lights
5	1	Runner	12	1	Crank	19	3	Magnetic switches
6	1	Rock	13	1	Pinion	20	1	Front jaw
7	1	Metal end fitting	14	1	Stop screw	21	1	Rubber strip

Memo Holder: Parts Named and Separated From One Another