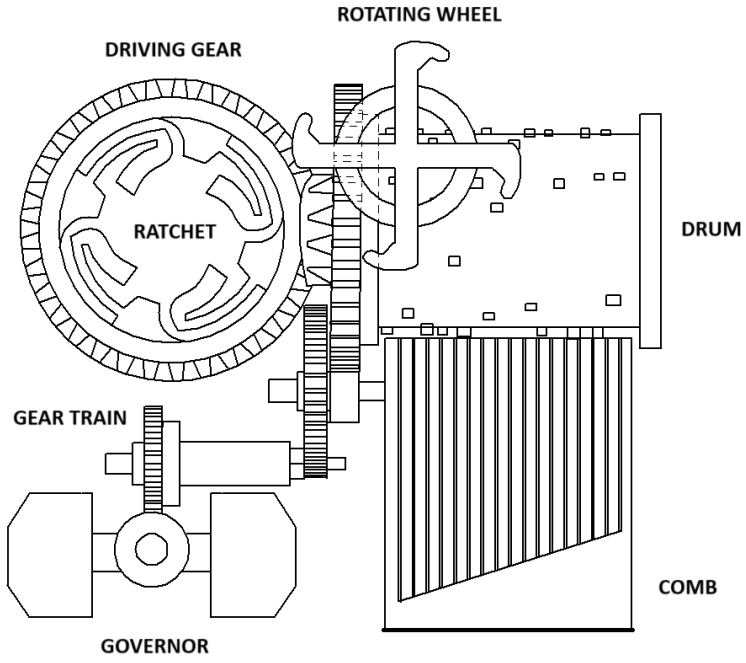
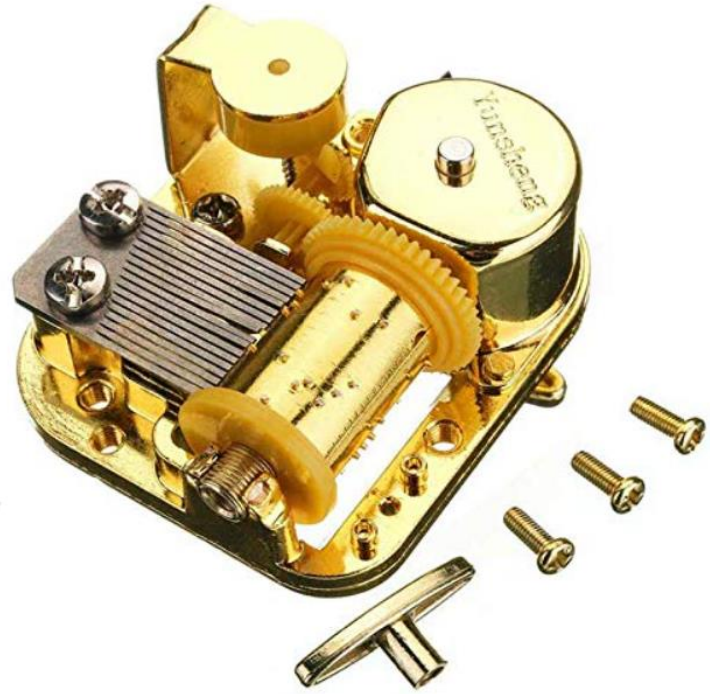
KINEMATICS AND DYNAMICS OF MACHINERY – ASSIGNMENT 1



WIND UP MUSIC BOX



AADI SINHA (ME23BTECH11001)

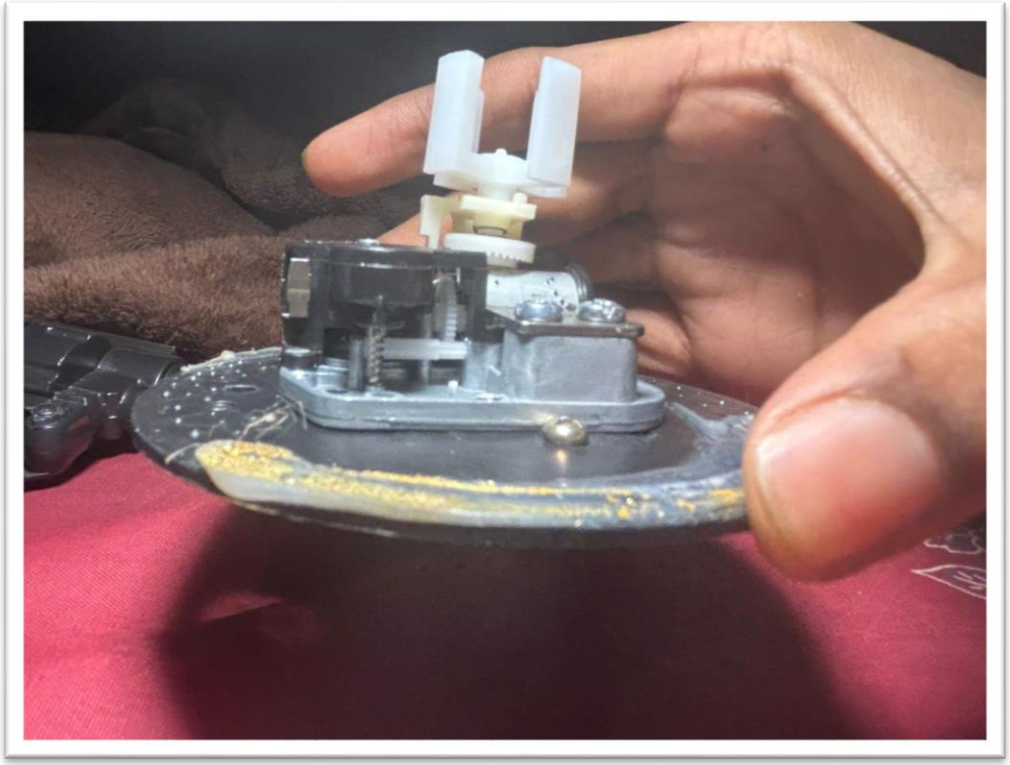
REASON FOR TOY SELECTION

I have chosen this toy because when I received this toy as a gift, I was intrigued at how winding a key can generate music. So, I took my curiosity to Google. I was amazed at the juxtaposition between the simplicity of the mechanism and the ingenuity of the design. When this assignment was given to me, I wanted to take this as an opportunity to disassemble the toy to really see the workings first-hand and use the concepts taught in KDM and apply those to labelling links and kinematic pairs and further analyse the mobility of the mechanism. After a thorough analysis what I like the most about the toy in terms of mechanism is the rolling drum that vibrates the notes in a fashion that produces music

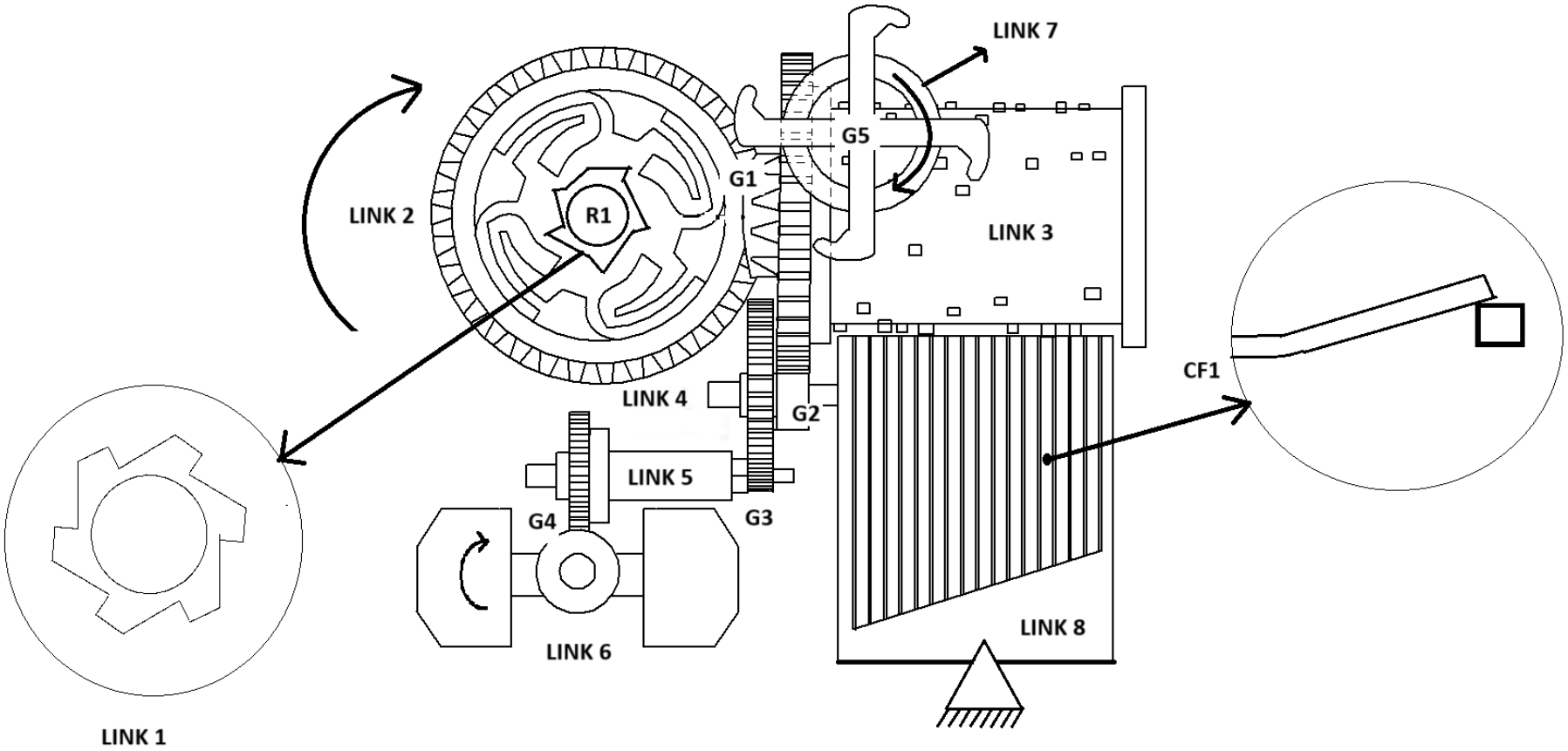
PHOTO OF TOY PROCURED

AADI SINHA (ME23BTECH11001)

PHOTO OF DISASSEMBLED TOY



AADI SINHA (ME23BTECH11001)

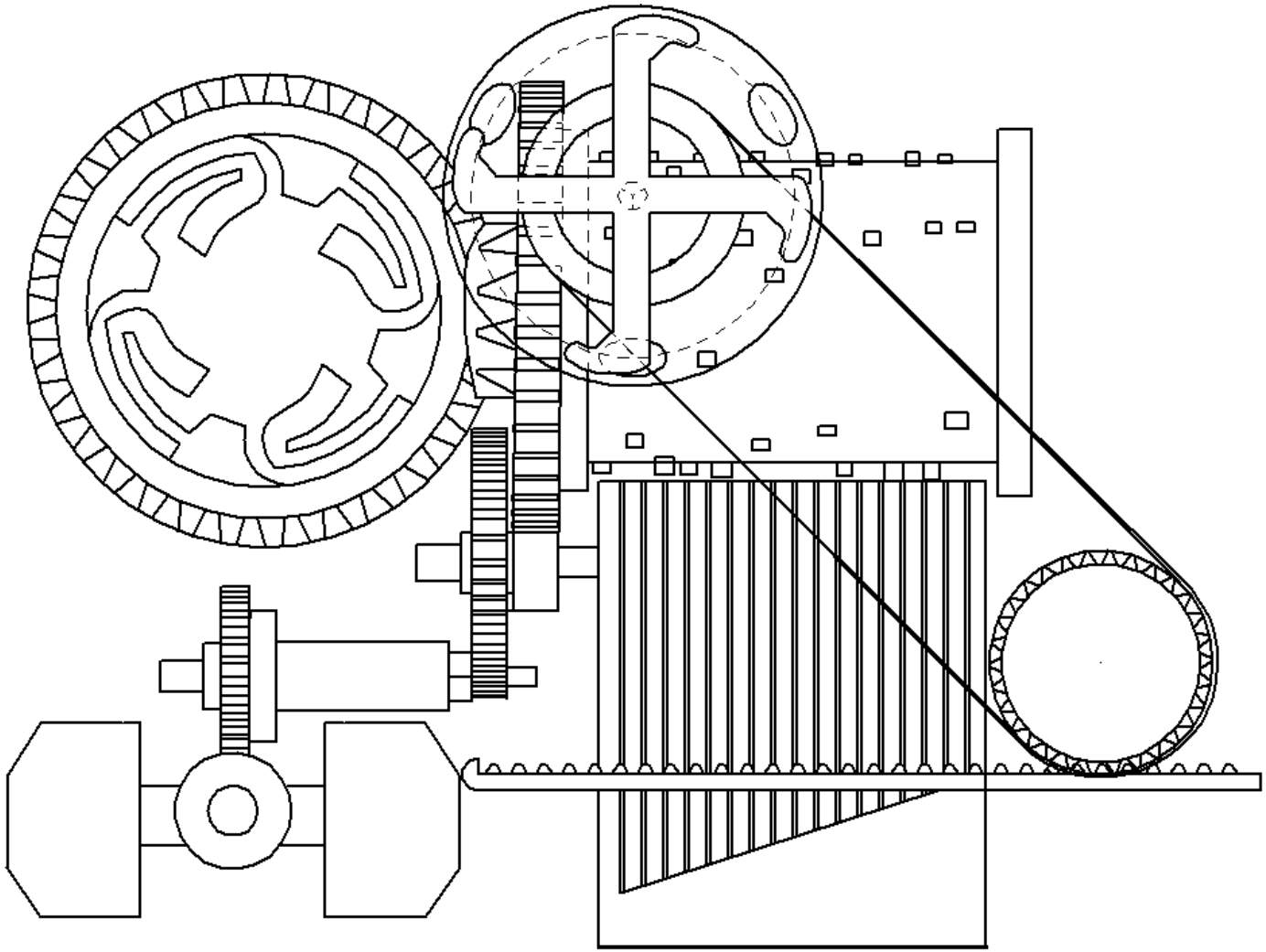


KINEMATIC DIAGRAM

AADI SINHA (ME23BTECH11001)

MOBILITY ANALYSIS

GX – Stands for gear pairs. The gear pairs provide no additional degree of freedom as the next gear link is driven by the one before it. So, Degree of Freedom due to all gear kinematic pairs is ***0***. That leaves us with R1 and CF1 where R1 is a revolute joint and CF1 is a Cam and follower joint. R1 in this case provides ***1*** degree of freedom i.e. rotation along a plane. For CF1 the follower is rigidly attached to link 1. So it is not exactly a cam and follower as link 8 doesn't have the freedom to displace freely in the z direction but the cam on link 3 still causes slight displacements giving rise to vibrations at specific frequency (the length and the weighted end of the comb decides frequency) that causes the music. Hence if the position of Link 3 is known we can accurately determine the position of Link 8 hence CF1 provides no additional degree of freedom. Hence the overall degree of freedom is **1**. Therefore it is a constrained mechanism



ADDED LINKS

AADI SINHA (ME23BTECH11001)

ADDITIONAL LINKS

I have added two additional links. The first is 3 followers to the rotating link 7 which would act like a bouncing puppet stick. I would stick some sticker on the follower so the puppets would jump. To make them jump at different intervals from each other I've geometrically positioned them in that fashion.

The second is a timer gear that stops the music after a fixed time has passed by. It has a rack and pinion gear attached to it. It can be reset quite easily as the Link 3 is heavy and Link 7 doesn't have enough torque to rotate the drum in the reverse direction. Intervening with the governor stops all motion completely. We could calibrate the gear such that it plays the song from the beginning to the end and not more than that.