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DESIGN, ANALYSIS AND FABRICATION OF ROUND RING CLOTH PEG ASSEMBLY MACHINE

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Abstract - *Cloth pegs are used for holding clothes especially when kept for drying .Cloth peg consists of two plastic parts and a metal ring. The plastic parts and the ring are manufactured separately and then assembled together. Assembly of the plastic parts and the ring is done manually. This is a very tedious and troublesome process. So, the researcher has designed and fabricated a mechanism so that human efforts should be reduced.*

Key Words: **Cloth peg, Clothes, Plastic parts, Metal ring, Mechanism**

1. INTRODUCTION

A cloth peg is a fastener used to hang up clothes for drying, usually on a clothes line. They are made from plastic, metal or wood. A ring, spring or U-pin is inserted between the two parts of the cloth peg. The assembly of the cloth peg (two plastic pieces and ring) can be done manually by workers, or by semiautomatic or fully automatic machines.

Fig -1: Cloth peg assembly

2. NEED OF THE PROJECT

Inserting the ring in the two parts is very tedious and troublesome job for the workers. So, by developing the machine for the same will reduce the manual efforts of the workers which will ultimately benefit the company.

Fig -2: Cloth peg assembly parts

3. EXISTING METHOD FOR INSERTING THE RING

The ring is inserted manually into the two plastic parts of the cloth peg. The inserting of the ring is a two stage process. In the first stage, the ring is inserted into the rectangular grooves. Then in the second stage the ring is inserted into the upper circular grooves. In the second stage tablespoon is used to stretch the ring as the ring is made of spring steel.

4. MACHINE DESCRIPTION

The major component of the machine is a grooved lever with a knob, mounted on a round up table. The round up table is mounted on a stand. The stand is made by welding two cross MS plates with a central rod. The dimensions of the plates are 250×45×10mm. Bolted holes of diameter 16mm are provided on the two cross plates for foundation and mounting of the whole setup on to a platform. The diameter of the central rod is 24mm. The round up table exactly fits in the central rod. The dimensions of the round up table are 350×50mm. At the two ends of the table two sockets having the shape of the cloth peg are made. The fulcrum of the lever is at the center of the round up table. The diameter of the fulcrum pin is 5mm. The dimensions of the cross-section of the lever are 13.4×6.7mm. A groove of 1mm thickness is made on one side of the lever to hold the ring. A knob is provided on the other side of the lever. The knob restricts the horizontal and vertical motion of the ring. A plier is used for stretching the ring for inserting it into the rectangular and circular grooves of the cloth peg.

5. DESIGN CALCULATIONS

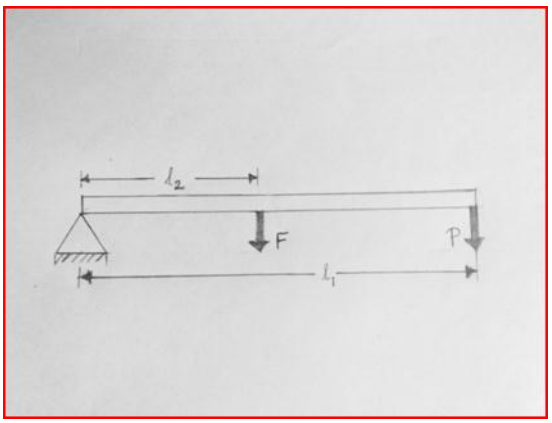

Fig -3: Lever

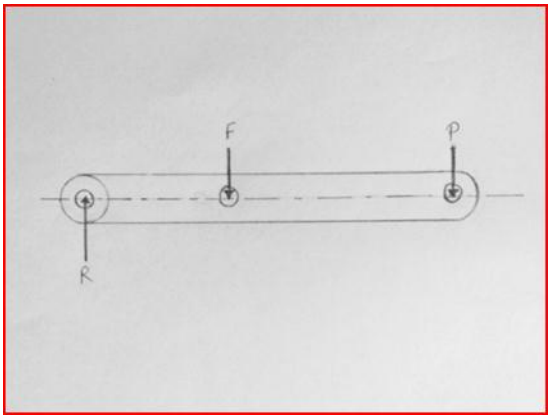

Fig -4: Free body Diagram of Forces acting on Lever

Where, F- Force to be applied on the knob to hold the ring in the groove
P- Effort required to produce that force
R- Reaction at the fulcrum pin
l_1- Effort arm
l_2- Load arm

STEP 1: **Force Analysis**

Taking moments about the fulcrum, we get,

$F \times l_2 + P \times l_1 = 0$

$P \times l_1 = -F \times l_2$

$P = -F \times (l_2/l_1)$

$= -0.5*9.81*(0.138/0.353)$

P = -1.917 N

$R = F + P$

$= (0.5*9.81) + (-1.917)$

R= 2.988 N

STEP 2: **Design of lever arm**

Bending moment, $M_b = P^* (l_1 - d_1)$

Where, d_1-Diameter of pin

We have d_1=0.5 cm=0.005 m

$M_b = -1.917*(0.353-0.005)$

M_b= -0.667 N-m

Bending stress, $\sigma_b = \frac{M_b * y}{I}$ ——— (1)

Where, I- Moment of Inertia

y- Distance from neutral axis to the outer-most fibre.

We have, $I=bd^3/12$ and $y = d/2$

Where, b- Distance parallel to the neutral axis

d - Distance perpendicular to the neutral axis

We have, $\sigma_b = \frac{Force}{Area} = \frac{F+P}{d*b} = \frac{2.988}{d*b}$ ——— (2)

Equating equations (1) and (2)

$$\frac{2.988}{d*b} = \frac{0.667*\frac{d}{2}}{\frac{bd^3}{12}}$$

Generally, d=2b

$$\frac{2.988}{2b*b} = \frac{0.667*\frac{2b}{2}}{\frac{b*(2b)^3}{12}}$$

b=0.67 cm

Therefore, **d=1.34 cm**

6. CAD MODEL OF ROUND RING CLOTH PEG ASSEMBLY MACHINE

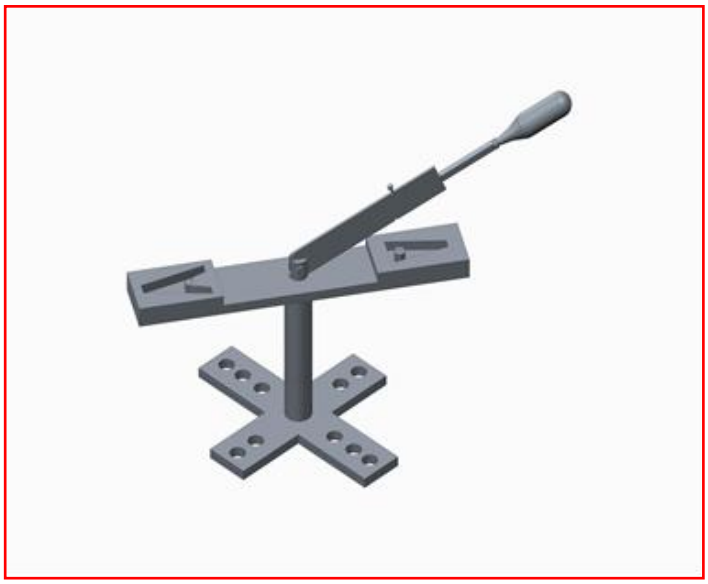

Fig -5: Round Ring Cloth peg Assembly Machine

Fig -6: Exploded view of the machine

7. CAD MODEL OF DIFFERENT PARTS OF THE ASSEMBLY MACHINE

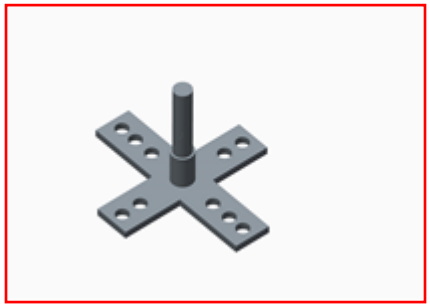

Fig -7: Stand

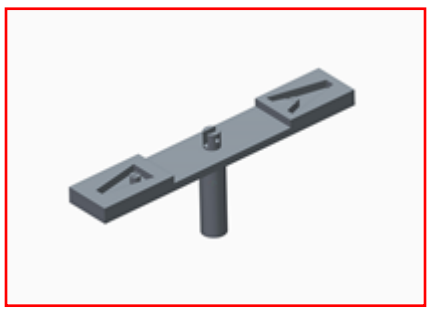

Fig -8: Round Table

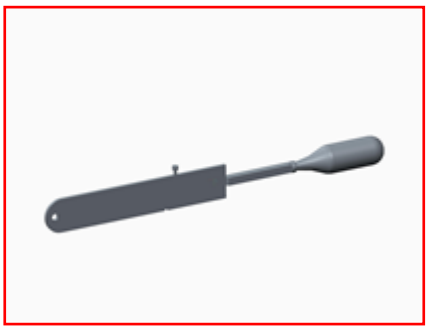

Fig -9: Grooved Lever with knob

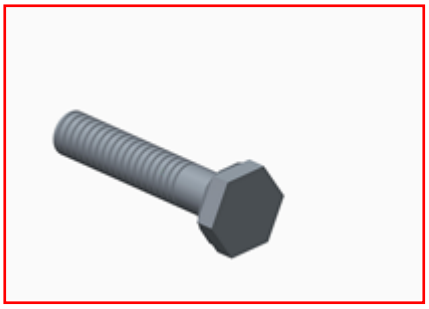

Fig -10: Bolt

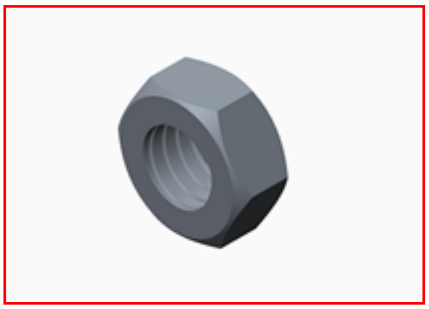

Fig -11: Nut

8. DESIGN ANALYSIS- ANSYS WORKBENCH-16.2

Mild Steel is selected for fabrication of the machine.

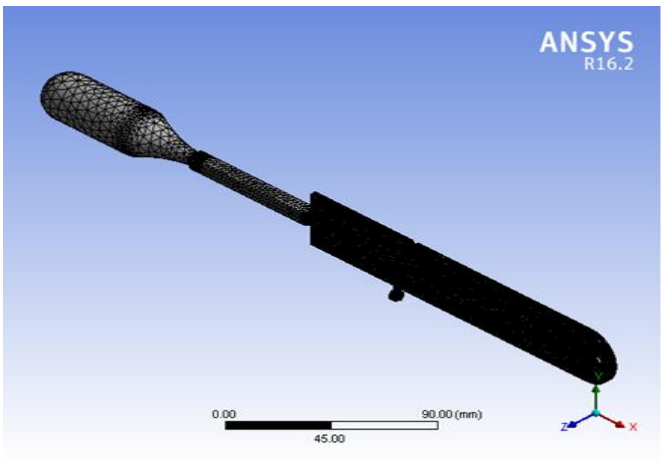

Fig -12: Meshing of lever

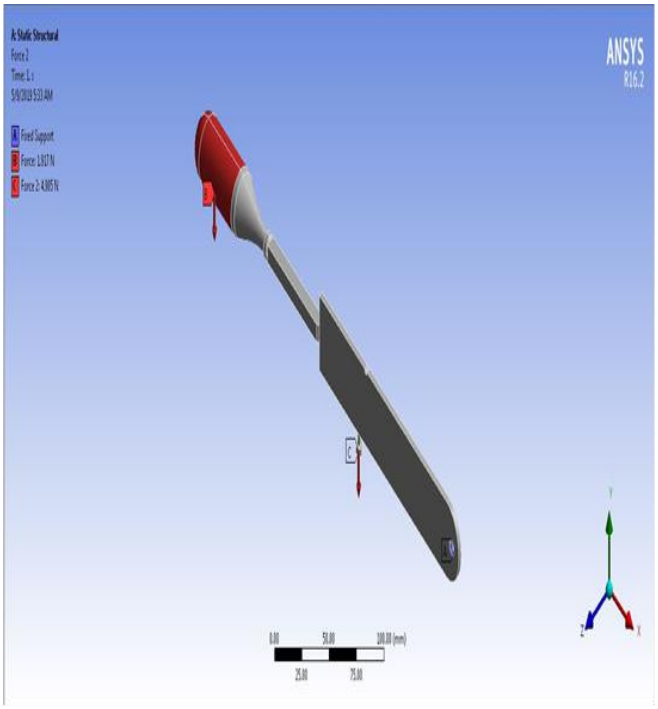

Fig -13: Boundary conditions of forces acting on the lever

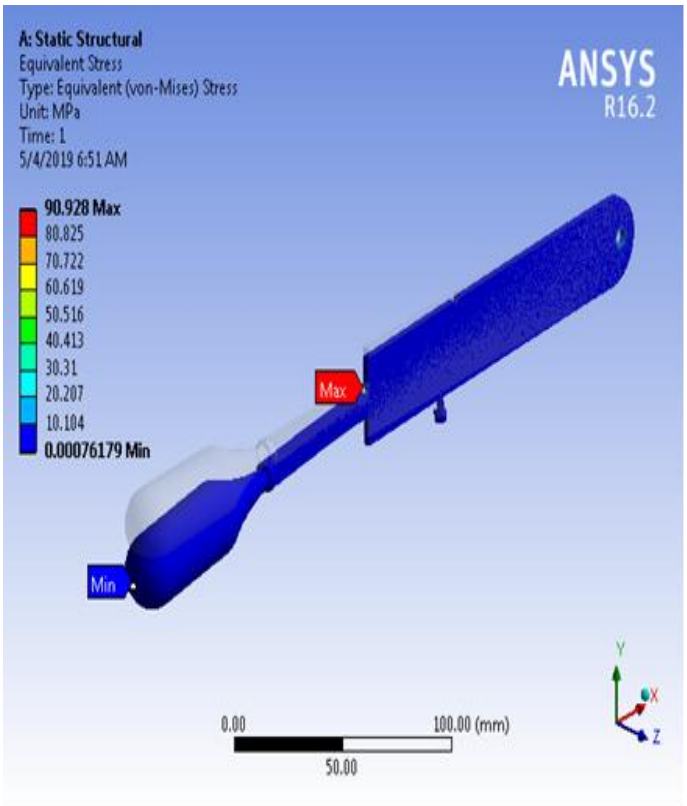

Fig -14: Stress due to the forces acting on lever

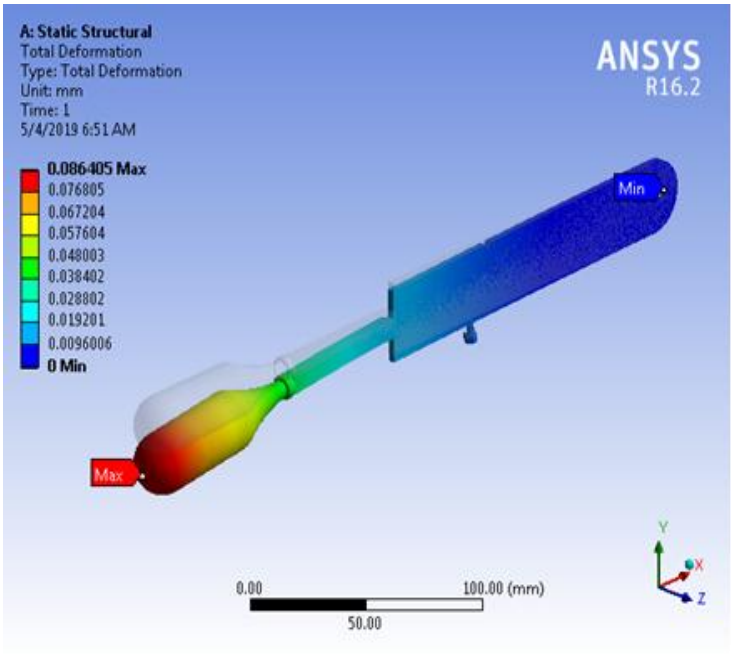

Fig -15: Deformation due to the forces acting on lever

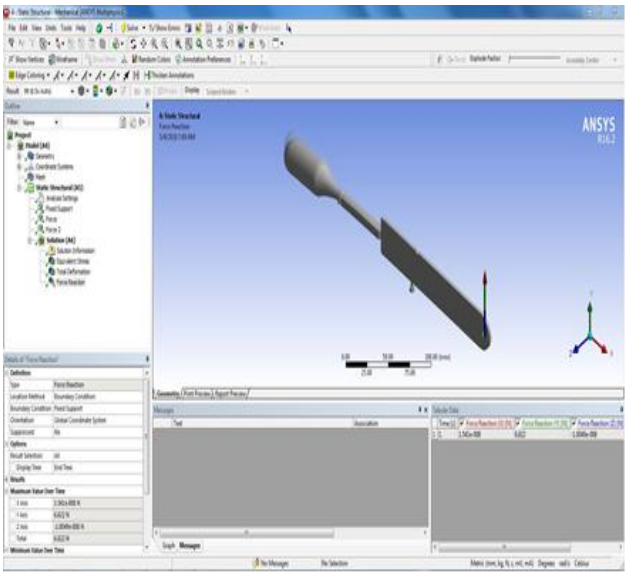

Fig -16: Force reaction

Table -1: Force Reaction

Time [s]	Force Reaction (X) [N]	Force Reaction (Y) [N]	Force Reaction (Z) [N]	Force Reaction (Total) [N]
1.	1.541e-008	6.822	-1.0049e-008	6.822

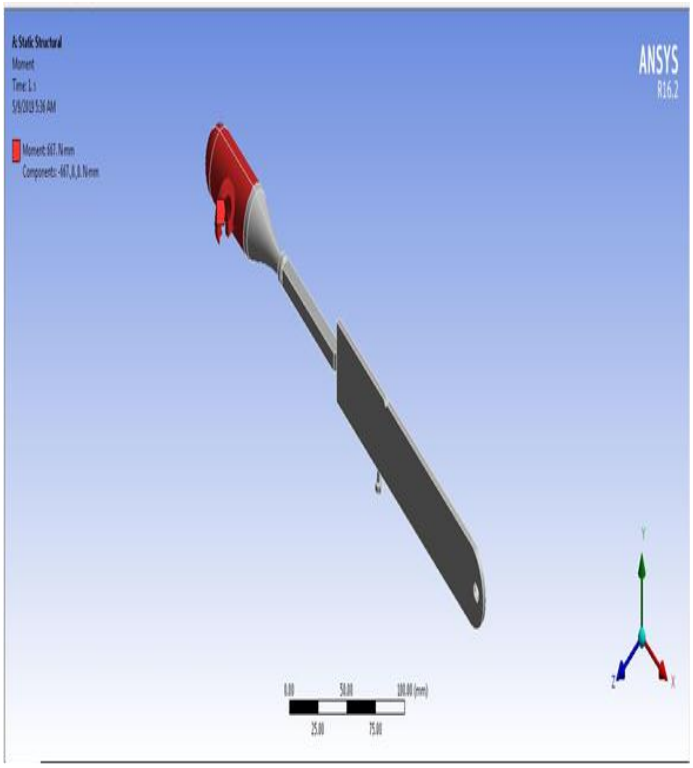

Fig -17: Bending Moment acting on lever

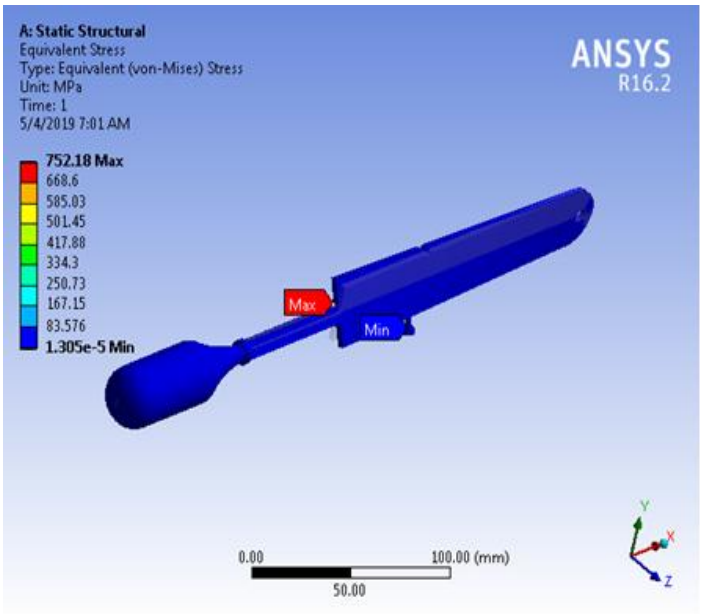

Fig -18: Stress due to the Bending Moment acting on lever

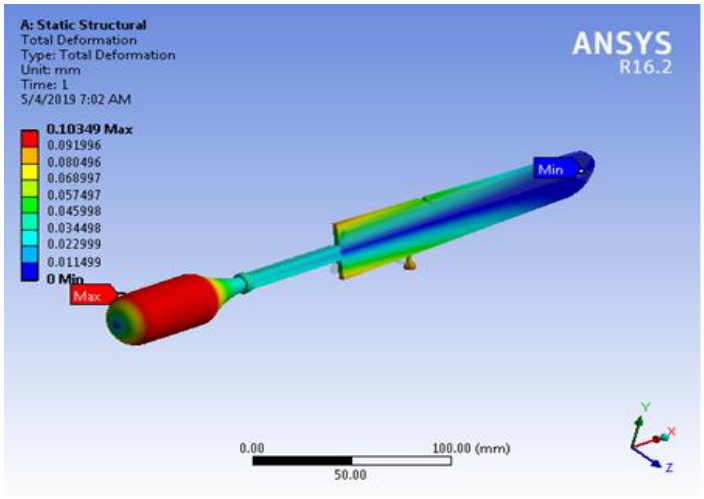

Fig -19: Deformation due to the Bending Moment acting on lever

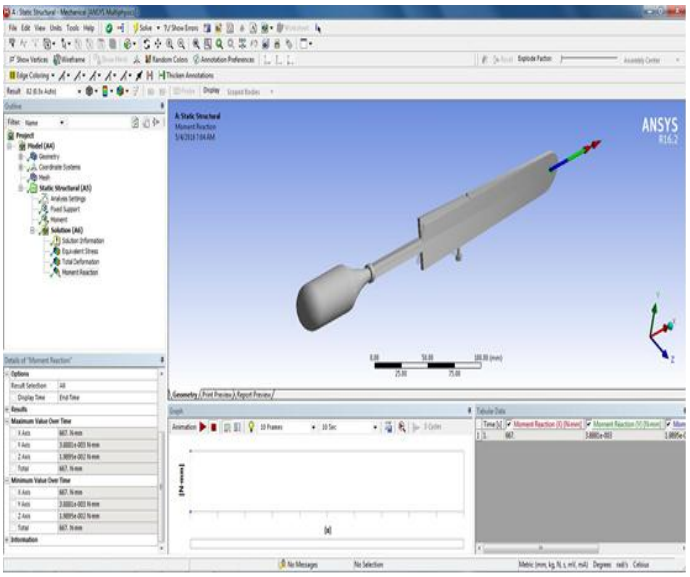

Fig -20: Moment reaction

Table -2: Moment Reaction

Time [s]	Moment Reaction (X) [N·mm]	Moment Reaction (Y) [N·mm]	Moment Reaction (Z) [N·mm]	Moment Reaction (Total) [N·mm]
1.	667.00	3.8881e-003	1.9895e-002	667.00

9. FABRICATION

For fabrication of this machine various lathe operations like turning, facing, drilling, boring are done. Shaper and milling

machines are used. For joining the different parts of the machine Gas welding and Arc welding methods are used. Fabrication consists of the following steps:-

1. First a stand is prepared by welding two cross MS plates of dimensions 250×45×10mm and 220×45×10mm.
2. At the center of these plates a rod of length 115mm and diameter 24mm is welded. The rod is prepared on lathe by different operations like turning and facing.
3. For making round up table a MS plate of size 350×50×5mm is used.
4. At the center of this round up table a hollow cylinder of length 100mm and inner and outer diameter 25mm and 31 mm respectively is welded from one side. This hollow cylinder is prepared on lathe by different operations like turning, facing, drilling and boring.
5. In this hollow cylinder, the center rod of diameter 24mm easily fits so that the round up table can be easily mounted on the stand. A cylindrical support is provided at the base of the center rod so that the hollow cylinder fits there properly.
6. Then two MS plates of size 94×45mm are prepared.
7. On these MS plates sockets of size of the cloth peg according to the stages of assembly are made by filing.
8. These two MS plates are welded to the round up table at both the ends.
9. A lever of rectangular cross section 13.4×6.7mm is fabricated.
10. On one side of the lever, a groove is made to hold the ring. The size of the groove is equal to the thickness of the ring.
11. On the other side of the lever a knob is welded.
12. The fulcrum of the lever is at the center of the round up table. The lever is attached at the fulcrum by a rivet.
13. Bolted holes of diameter 16mm are drilled on the two cross MS plates for foundation and mounting of the whole setup on to a platform.

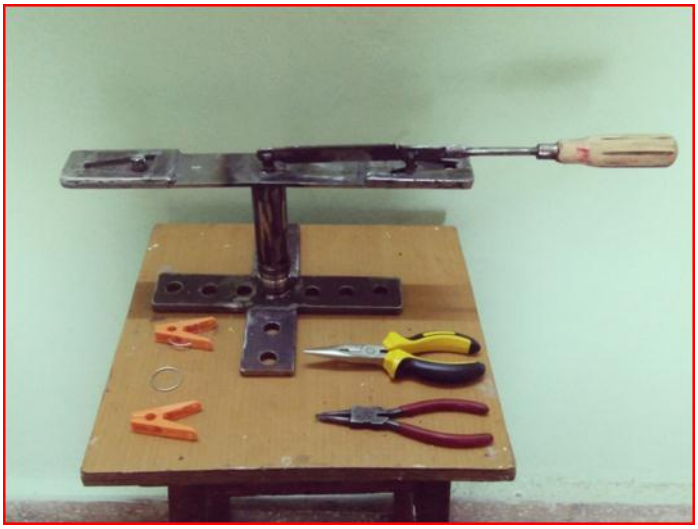

Fig -21: Round Ring Cloth peg Assembly Machine

10. WORKING OF THE MACHINE:

The machine consists of a round up table which allows us to rotate the platform as we wish. There are sockets made on the two sides of the round up table. The sockets are of the same shape as that of the cloth peg. These sockets help to constraint the motion of the two plastic parts while assembling. Now the two plastic parts are put into the sockets. Make sure that the two plastic parts fit there properly. Special grooved lever is provided which adjacently places the ring into its base position. Now with the help of a plier, the ring is inserted into the rectangular grooves. Now the plastic parts are removed and the platform is rotated. Turning the platform allows us for further second stage of implementation. Now again the plastic parts are kept into the second socket. Assembling is done such that the ring is placed into the groove and the plastic parts are arranged properly. A knob is provided on the grooved lever. The knob restricts the horizontal and vertical motion of the ring. The knob is pressed on the ring and with the help of plier the ring is inserted into the upper circular grooves and the cloth peg is ready. Arrangement is so simple and well-constructed that it could be placed over various platforms. Various sockets according to the stages of assembly are provided. A round table lever is provided for the convenience of the worker. Bolted holes are provided for foundation and mounting of the whole setup on to a platform.

11. CONCLUSION:

Cloth peg consists of two plastic parts and a metal ring. The plastic parts and the ring are manufactured separately and then assembled together. Assembling of the plastic parts and the ring is a tedious and troublesome process. So, the "Round Ring Cloth Peg Assembly Machine" is designed and fabricated which will reduce the human efforts and time.

ACKNOWLEDGEMENT:

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REFERENCES

[1] https://en.wikipedia.org/wiki/Clothespin
[2] VB Bhandari, "Design of Machine Elements", Tata McGraw Hill Education Private Limited, New Delhi, India, Third Edition, 2012.
[3] R.S. Khurmi, J.K. Gupta, A Textbook Of Machine Design(S.I. Units), S.Chand Publications, Eurasia

Publishing House(Pvt.) Ltd., Ram Nagar, New Delhi-110055, Fourteenth Edition, 2005.

[4] Er. R.K. Rajput, "Strength of Materials (SI Units), S.Chand & Company Ltd., Ram Nagar, New Delhi-110005, Fifth Revised Edition, 2012.

[5] R.S. Khurmi, J.K. Gupta, "Theory of Machines", S.Chand Publications, Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-110055, Fourteenth Revised Edition, 2007.

[6] SS Rattan, "Theory of Machines", McGraw Hill Education (India) Private Limited, New Delhi, India, Fourth Edition, 2016.

[7] J.S. Rao, R.V. Dukkipati, Mechanism and Machine Theory, Second Edition, New Age International (P) Limited, Publishers, 1998.

[8] A.M. Kuthe, "Computer Graphics Including CAD, AutoCAD And C", S.Chand & Company Ltd., Ram Nagar, New Delhi-110055, First Edition, 2005.

[9] Ibrahim Zeid, R Sivasubramanian, "CAD/CAM Theory and Practice", Tata McGraw Hill Education Private Limited, New Delhi, India, Second Edition, 2010.

[10] S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, Elements of Workshop Technology, Vol: 1 Manufacturing Processes, Media Promoters & Publishers Pvt. Ltd., Mumbai-400007, 14th edition, 2010.

[11] S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, Elements of Workshop Technology, Vol: 2 Machine Tools, Media Promoters & Publishers Pvt. Ltd., Mumbai-400007, Thirteenth edition, 2014.