DESIGN AND DEVELOPMENT 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 tried to find out a mechanism so that human efforts should be reduced.

INDEX TERMS - Cloth Peg, Plastic parts, Metal ring

I. INTRODUCTION:

A cloth peg is a fastener used to hang up clothes for drying, usually on a clothes line. During the 1700s laundry was hung on bushes, limbs or lines for drying .The clothespin for hanging up wet laundry only appears in the early 19th century patented by Jérémie Victor Opdebec. This design does not use springs, but is fashioned in one piece, with the two prongs part of the peg chassis with only a small distance between them—this form of peg creates the gripping action due to the two prongs being wedged apart and thus squeezing together in that the prongs want to return to their initial, resting state. This form of peg is often fashioned from plastic, or originally, wood. Today, many clothes-pegs are manufactured very cheaply by creating two interlocking plastic or wooden prongs, in between which is often wedged a small spring. This design was invented by David M. Smith of Springfield, Vermont, in 1853. By a lever action, when the two prongs are pinched at the top of the peg, the prongs open up, and when released, the spring draws the two prongs shut, creating the action necessary for gripping.

The design by Smith was improved by Solon E. Moore in 1887. He added what he called a "coiled fulcrum" made from a single wire, this was the spring that held the wooden pieces together, acted as a spring forcing them to shut, and as a fulcrum on which the two halves could rock, eliminating the need for a separate component, and reducing costs. This became the first successful spring-actuated clothespin, being manufactured and sold in huge quantities all across the United States. [1]

Today cloth pegs are made of different materials like plastic, metal or wood having a metal ring, spring or U-pin inserted between the two parts of the cloth peg.

Figure 1 : Cloth peg assembly

II. 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.

Figure 2: Cloth peg assembly parts

III. 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.

IV. MODIFIED METHOD FOR INSERTING THE RING:

In the newly developed method, the ring is inserted into the two pieces of cloth peg using a 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. Then there is a bearing shaft arrangement having transition fit of free rotation. Bolted holes are provided for foundation and mounting of the whole setup on to a platform.

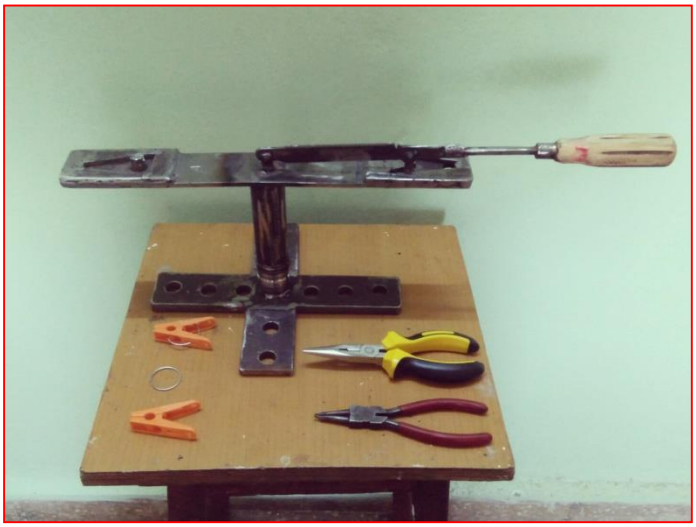

Figure 3: Round Ring Cloth peg Assembly Machine

V. ADVANTAGES OF MODIFIED TECHNIQUE OVER EXISTING TECHNIQUE:

The newly developed machine reduces efforts of the worker and if trained properly saves time. The machine is handy, portable, economical and simple in construction.

VI. DESIGN CALCULATIONS:

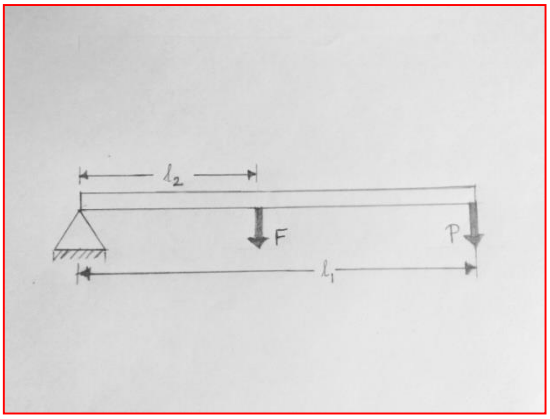

Figure 4: Lever

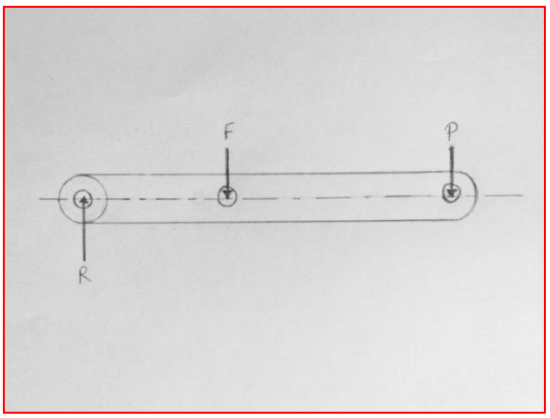

Figure 5: Free body Diagram of Forces acting on Lever

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** [2]

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**

VII. 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 which will reduce the human efforts and time.

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