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FABRICATION of LIFE SAVING MACHINE

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Abstract:

Lifesaving machine can be guided to the depth of the bore well and controlled remotely. It consists of two main parts, the carrier vehicle and the rescue robot. The carrier vehicle takes the whole device into the depth of the bore well, when the position of the child is detected by camera, infrared LED and sensors; the rescue robot does the rest of work; grasp the child and escape safely from the bore well.An experiment shows that the rescue operation takes only l/5 of the total time taken by conventional procedure. The condition inside the bore well is always unknown. This machine is attached with all possible equipment required to observe the condition inside the bore well.Though bore well child saver machine is in its infancy but with further study and more safety considerations would not only became the most effective bore well rescue medium but also provide solution to many other problems regarding operational difficulties due to the compactness of the work space and time binding.

Keywords—**Central frame,Translationalelement,Compressionspring,Electric rotaryactuator,Pneumatic linear actuator,Centrifugalcompressor,Rubber wheel.**

I. INTRODUCTION

The main problem afflicting human society today is the scarcity of water, which leads to the loss of a large number of wells. These perforated wells in turn have started to lead many innocent lives. The perforations that have produced the water and then are exhausted are left uncovered. A colored cap to cover your mouth well prevents these accidents. Young children, without noticing the hole, digging for the hole, slipping and becoming trapped. The human search for water has finally ended in disaster.

Because the holes are dug too deep, it is impossible to save lives. Tire strength and medical equipment have difficulty rescuing children due to unknown levels of humidity, temperature and oxygen in the depths of the well. Rescue work can be a prolonged problem that lasts about thirty hours. Time spent is enough to kill a precious life. Even if it is saved, the child may die because of the injuries reported. This created an open challenge for the field of engineering and medicine. salvation and the whole of human society.

We had tried to source this equipment from mine rescue companies in Canada & the U.S.A. Unfortunately, only methods to apply in open mines and mine shafts are available with them and no company or agency has methods to achieve a narrow borewell rescue.

II. DESIGN CALCULATION

1. Design:

The importance of design in engineering work can't be refused. Proper designing is essential to ensure the success of any machine. Various components of bore well child saver machine are thoroughly checked for all type of load and stress exerted on them. For designing the parts some parameters are assumed based on the data collected from previous cases.

Following components are checked for relevant stresses acted on them:

1. Link: bending stress
2. Shan: direct axial stress
3. Spring: compressive stress

2. Design of spring:

Spring material - chromium vanadium steel SAE 6145

Properties of spring material,

S_{ys}: 775 Mpa

G = 84 Gpa

Force acting on spring (F) = 49.01 N

Number of turns (n) = 8

Diameter of wire (d) = 2.5mm

Inside diameter of spring (D_i) = l9 mm

Outside diameter of spring (D_o) = D_i + 2*d = 24 mm

Mean diameter of spring (D_m) = D_i +d = 21.5 mm

We know that for compression spring,

D_m /d = C (C 1 spring index)

C = 8.6

K = ((4c - 1)/ (4c – 1)) + (0.0615/C) = 1.17

Take factor of safety (FOS) = 3

Permissible stress (τ) = S_{yt}/ FOS

= 258.33 Mpa

Design stress (τ) = $(K*8*F*D_m)/\pi d^3$

= 224.8 Mpa

Design stress < permissible stress

So design is safe.

Deflection (δ) = $(8*F* n*D_m^3) / (G*d^4)$

=13.21 mm

Effective number of turns (n) = 8+2 = 10
Solid length of spring (L_s) = n*d = 25 mm
Free length of spring (L_f) = n*d+ δ_{max}+ 0.15*δ_{max}
= 40.19mm.
Pitch (p) = Free length of spring (L_f)/No of active turns (n)
= 4.46 mm

3. Design of link:

Material of link - Mild steel with galvanised
S_{yt} = 246 Mpa
S_{ut} = 435 Mpa
σ_s= S_{ut}/FOS
=87 Mpa
σ_t= S_{yt}/FOS
=49.2 N
Take factor of safety (F OS) = 5
Mass of robot (m_r)= 3 kg
Mass 0f child(m_c)= 2 kg
Total mass of system (m)= mass of robot +Mass of child
=5 kg
Total weight of system= mass (m) * gravitational force (g)
=49.01 N
Total load of the system is distributed by the three links
So load acting on each link = Total weight (W) / 3
=16.34 N
Direct stress on link (σ_D)= W/A
=W / (b*t)
=16.3/10t^2
Bending stress (σ_b) = M/ Z
So design is safe. =W*e/(t*b^2 /6)
= (16.3*1500*6)/(100t^3)
Total stress= Direct stress on link (σ_D) + Bending stress (σ_b)
49.2 = (16.3/10t^2) + (16.3*1500*6)/(100t^3)
t =2 mm
b = 20 mm

4. Design of shaft:

Material - Mild steel
S_{ut}= 632 Mpa
S_{yt} = 350 Mpa
Outer diameter of shaft (D_o) = 18 mm
Inner diameter of shaft (D_i) = 16 mm
Factor of safety (FOS) = 4
τ = S_{ut}/FOS = 158.5 Mpa
σ_t= S_{yt} /FOS = 87.5 Mpa
σ_t = W/A
= W/((π/4)*(d_1-d_2))
= 0.91 Mpa
Design stress < Permissible Stress
So design is safe.

5. Static force analysis:

<u>Static force analysis:</u>

Analytical method

We know that:
2K=a^2-b^2+c^2+ d^2
K= (0.4^2 - 1^2+ 0.75^2 + 0.5^2) / 2
K= -0.01375
A=k- a (d-c) × cosϴ - cd = -0.01375-0.4(0.5- 0.75) cos 120° - 0.75×0.5
A=-0.439
B= -2ac sinϴ = -2× 0.4 × 0.75 sin 120°
B= -0.52
C=k- a (d+c) cosϴ +cd
C= -0.01375- 0.4(0.5+0.75) cos120° +0.75 ×0.5 = 0.611
ø= 2 $\tan^{-1}$ (0.727 or -0.439)
= 72° or - 47.4°
Taking the First value, we have
A sin ϴ +bsin β =c sin ϴ
0.4 × sin 120° +1 × sin β + 0.75× sin 72°
β = 21.5°
Position vectors
AB= 0.4□ 120°, BC =l □21.5°, DC= 0.75 □72°, DE=0.35□72°
The direction of F_{34} is along BC since it is a two force member
F_{34} = F_{34} □ 21.5°
As the link DC is in static equilibrium, no resultant forces or moments are acting about point D.
M_d=F_4×D_4×DE+F_{34}×DC=0 ....,. (1)
Moments are the cross multiplication of the vector, so we should done in rectangular co- ordinates
F_4 = -14.1i+8.15j
DE = 0.35 < 72°
= 0.108i+0.33j
F_{34} = F34< 21.5°
= F_{34} (0.93i + 0.367j)
DC = 0.75< 72°
= 0.2321+ 0.7135
Inserting the vectors in equation ......,... (1)
= (-14.1i + 8.15j)*(0.108i+0.33j) + F_{34} (0.93i + 0.367j)* (0.232i + 0.713j)
=16_3*< 150°

I	j	k
-14.1	8.15	0
0.108	0.33	0

Or {(-14.1× 0.33) - (8.15× 0.1080)} + (0.93 F_{34} × 0.713 -0.367 F_{34}× 0.232) =0
-5-573 + 0.577 F_{34}=0
F_{34}= 9.5N
Thus F_{34}=9.5□ 21.5°
F_{32}=-F_{23}-F_{43}=1-F_{34} =9.5 □21.5°
F_{12}= -F_{32}=9.5 □ 21.5°
Torque =F_{12} × AB = 9.5 □ 21.5° ×0.4□120°
<u>Torque= 1.2 N-m</u>

III. CONCLUSION

Human life is precious The boredom of the child's welfare is a significant attempt to save the victim's life from fatal accidents. In addition to this, the unique ability to scale through vertical and sloped pipes broadens the scope of application in manufacturing industries and other relevant fields.

Following are some important points observed during the design and manufacture of the machine.

- In the current design of the puncture-proof machine, the child was manufactured to adapt to all possible situations that may occur in rescue operations.
- The structure is strong enough to withstand all possible loads, although it is made flexible at the same time to adjust the wide range of hole diameters and any variation in the hole diameter.
- In this rescue operation, time is a vital factor that alone can determine the success or failure of the entire operation. Therefore, it was designed taking into account all the obstacles that may arise during the operation.
- The control of the vehicle and the rescue robot is highly sensitive, which allows you to reach a great depth as soon as possible and to manipulate the child without hurting him..

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