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DESIGN AND MANUFACTURING OF FILLER WIRE REWINDING MACHINE

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ABSTRACT:
Electrical machines starting from motors, generators to transformer are working with the coils of conductors placed for some function. Mostly the coils are carrying the current to produce the magnetic effect. These machines can either convert the energy from electrical to mechanical or mechanical to electrical or electrical to electrical form. The proper arrangement of the conductors to be placed in minimum space with good mechanical strength can be considered as coil. These coils are practically consisting of few hundred to thousands of turns of the conductors. Rewinding of the coil is very common in case when the winding gets damaged due to the overheating. Making the coils with hand is very challenging task. Special skills are required to manually preparing the coil of conductors. It's very critical to complete even with the manually operated machines to prepare a coil. We have designed a machine to automatically wound a coil as per the requirements of the number of turns and other size parameters. The CAD design for the machine and calculations are presented in this paper.

KEYWORDS: Wire rewinding, Wire Rewinding Machine, Automatic Rewinding machine, etc.

INTRODUCTION:

The machine for wire rewinding is being used for electrical coil winding since many years. These machines are manually operated and it requires special skills to work on these machines. At the same time the time taken for completion of work with these machines is even very high. The problem with these machines leads to development of the automatic machines.

We have designed a machine which handles the coil winding in less time with accuracy. This machine will be suitable in transformer and motor rewinding shops and workshops. It's another application is to make the coils required in electrical chokes. Cam follower can helps in proper completion of the winding. We have carried out a case study of CO2 welding wire utilization. We found monthly 25 bundles of wire are required in company out of which two are wasted due lack of proper winding. So we found a need of development of rewinding machine, which might save cost of wire & also safe the wire from being waste. The conventional rewinding machine looks like the one shown below.

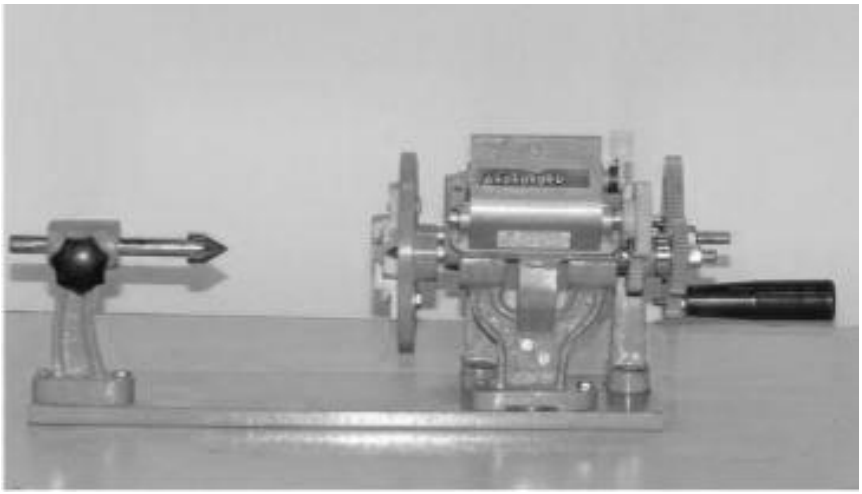

Fig.1: Manual Coil Winding Machine

OBJECTIVES OF WORK:

The work is carried out with following objectives.

- Building a low cost automation machine.
- Maintaining accuracy and precision.
- Determining proper methods of coil winding
- Identifying the importance of tension control in coil winding machine.
- Optimizing the performance of machine.

SYSTEM DESIGN:

Bearing:

Series 62 ball bearings are selected to be used.

I S I No.	Bearing of Basic design No.	d	D1	D	D2	B	Basic Capacity	
20 BC03	6004z	20	15	42	38	13	10000	6550

$P = X F + Y F_a$

For our application F a = o

$P = X F_r$

Where F_r = 204.5 N

As; $F_r < e \rightarrow X = 1$

$P = F_r$

Max radial load = F_r = 204.5 N

P = 204.5 N

Calculation dynamic load capacity of bearing

L = (C) p where p =3 for ball bearings

When P for ball Bearing

For m/c used for eight hr of service per day;

L h = 12000- 20000 hr

But; L = 60 n L h

L = 600 mrev

Now; 600 = $(C)^3$

= $(204.5)^3$

C =1724.8 N

As the required dynamic capacity of bearing is less than the rated dynamic capacity of bearing; bearing is safe

Fig.2: Rolling Contact Ball Bearing

Material of bearing
Babbits or (white metal alloy)
1) Lead –based babbits –
Pb-80%- lead
Sb-10%-antimony
Sn-05%Tin
Cu, Cd, Zn small amount

2) Tin –Based babbits
Sn- 90%
Sb-5%
Cu-3%
Pb, Cd,Fe, Zn small amount

Design of Torque Transmitting of Shafts:

Shaft material selected as C30 steel, with diameter 10.80 mm , hence it is subjected to rotating bending fatigue loading, fatigue factor =1.612
Assuming
$K_{size} = 0.85$ K
Surface = 0.83 K
Reliability = 0.896
$S_e' = 0.5\ \sigma$ ultimate
= 245 mpa
$S_e = k_{size} \times k_{surface} \times k_{reliability} \times 1/k_s \times s_e$
This fatigue strength calculated is less than endurance strength of standard C 30 steel, shows that the design is safe. Power transmission consists of the following arrangements

- Motor with Standard specification.
- Stepped pulley arrangement.

Considering power transmission shaft as beam

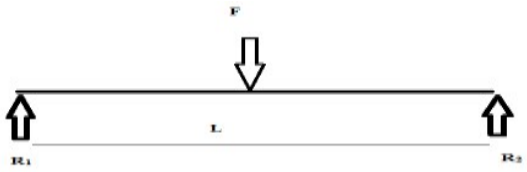

Fig.3: Simply supported beam of shaft

$Y_{max} = FL^3/48EI$
= 0.00249 mm

E= Young's Modulus N/mm^2
L=40 mm Assumed
Σ Bending = M/z
M= Moment,
Z= Section Modulus mm^3
Σ Bending = 79.66 N/mm^2

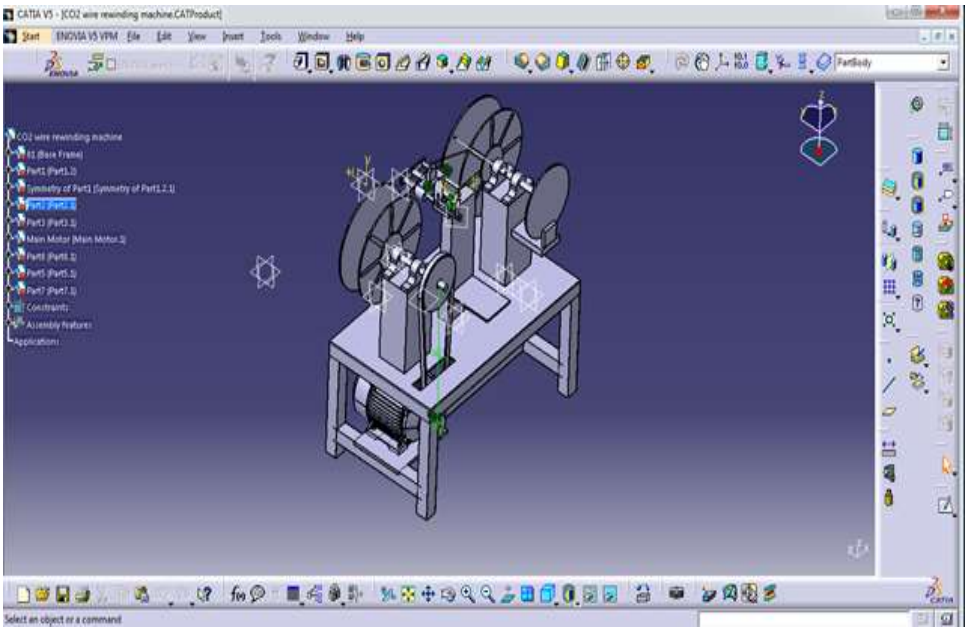

Fig.4: Top view of the CAD Model Developed

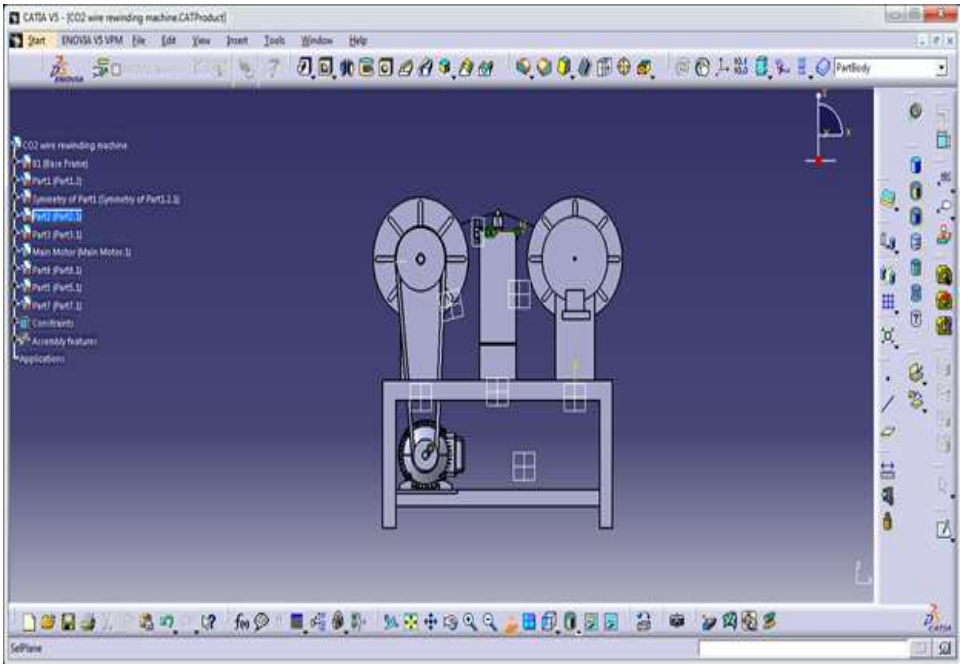

Fig.5: Side view of the CAD Model Developed

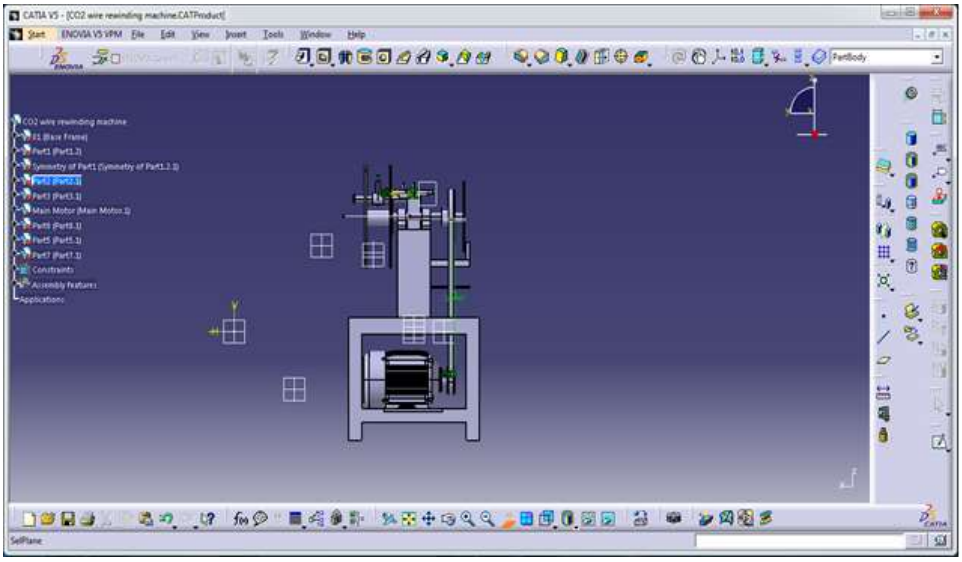

Fig.6: Front view of the CAD Model Developed

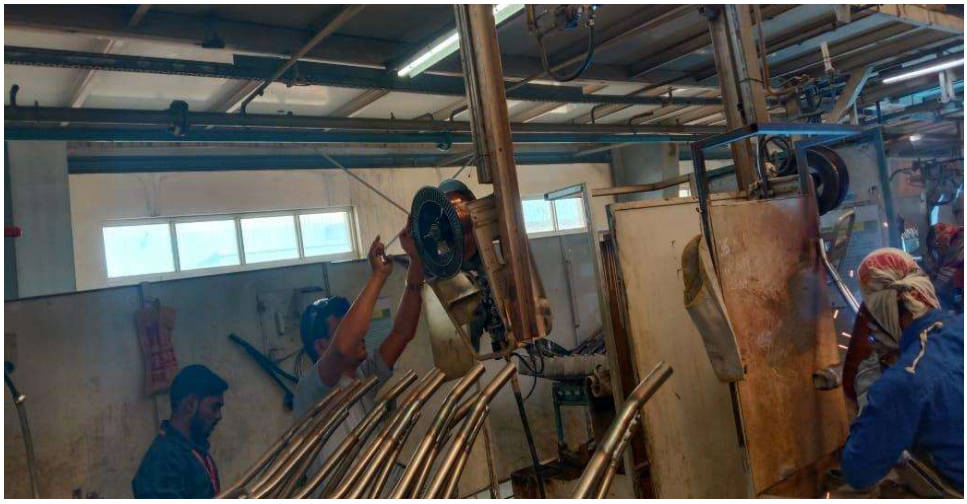

Fig.7: Picture of Hardware Developed

CONCLUSION:

The CAD design for the rewinding machine of coil is presented in this paper. The machine is capable of automatically prepare a coil of conductor. The earlier method of manual coil winding was hectic and time consuming. The accuracy of winding was very low and even spacing between two consecutive winding could not be achieved with old machines. The main objective of the work was to overcome these hurdles by building a low cost and compact automatic coil winding machine. This design is suitable for the small workshops working for rewinding of the machines.

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