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Spring Producing Machine

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Abstract

In the modern age of technology spring has got primary importance right from application of retaining the motion to the storing of the energy for some positive work. The springs, which are to be manufactured, should be in various diameters and of different stiffness, pitch, helix angle etc. either of closed coil type or of open coil type, either to take compressive or to take the tensile load.The springs which are manufactured somewhere does not meet the standard parameters such as helix angle, coiled diameter, pitch etc. Thus when used in the practical application the springs life reduces due to unevenness in the design parameter stated above. Due to non uniformity in the design of the spring's pitch and helix angle the springs may not withstand the load for which the spring is design to take up the load. And hence the springs may fail.Various testing devices are used to check completed springs for compliance with specifications. The testing devices measure such properties as the hardness of the metal and the amount of the spring's deformation under a known force. So we are going to make a machine for spring industry using gear box having mechanical advantages and make it multipurpose & should be used as grooving machine . The machine is light weight, simple to maintain easy to operate. The machine will be operated in such a condition that the spring which it will design will have an constant parameters accurate motion of the shaft with respect to the tool guidance or coil wire suppliance is the essential functioning of the machine. We have designed a machine which may be hand operated/motor operated depending upon the requirement.

***Keywords*:** spring making machines, coiling shaft, gear box, motor, shaft.

1. Introduction

The conventional spring making machine consists of manufacturing the spring using lathe machine or by hand hammering operation by hot forging method. But to manufacture delicate softer springs there is a requirement of such a machine with the massive ability to manufacture the spring using special mechanism which simply utilizes the potential energy stored by the raised weight of the rack shaft and energy stored by the spring operated mechanism. Also it is installed with the special attachment of self pitch adjustment that is the inclination of the strip linkage is so adjusted that the inclined strip with the pre-selected angle when comes down, it will push the trolley with that rate of adjusting the pitch. The machine work on principle of gear boxes in which speed is varying using different gearing arrangements. We make this machine manually/motor operated.

2. Theory and Concepts

2.1 Definition

A spring is defined as an elastic body, whose function is to distort when loaded and to recover its original shape when the load is removed. A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. There are a large number of spring designs; in everyday usage the term often refers to coil springs. When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length.

2.2 Types of springs

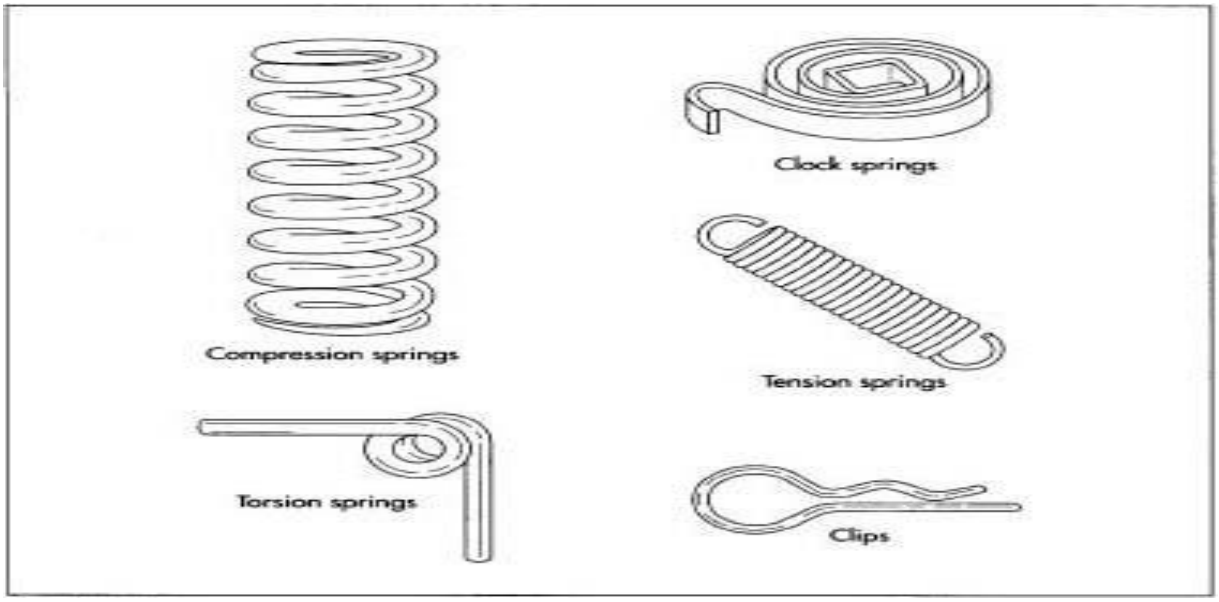

Figure 1: Examples of different types of springs.

2.3 Concept of spring design

The design of a new spring involves the following considerations:

• Space into which the spring must fit and operate.
• Values of working forces and deflections.
• Accuracy and reliability needed.
• Tolerances and permissible variations in specifications.
• Environmental conditions such as temperature, presence of a corrosive atmosphere.
• Cost and qualities needed.

The designers use these factors to select a material and specify suitable values for the wire size, the number of turns, the coil diameter and the free length, type of ends and the spring rate needed to satisfy working force deflection requirements. The primary design constraints are that the wire size should be commercially available and that the stress at the solid length be no longer greater than the torsional yield strength.

2.4 Problem statement

Every dynamic spring is subject to these constraints where variation of forces and alignment takes place. Instability, even whilst the spring is guided, can lead to stiffness fluctuations, scuffing, and other undesirables. And also many companies manufacture valves and also in the cam operation automobile applications and they required the springs for installing in their products (hydraulic valves). Depending upon the valve size there is variations in sizes and shapes of springs, hence company are facing problem due to variation in parameters of spring. Approximately one-third of defective springs result from production problems. The other two-thirds are caused by deficiencies in the wire used to form the springs. In 1998, researchers reported the development of a wire coil ability test (called FRACMAT) that could screen out inadequate wire prior to manufacturing springs. Understanding the Industry problems and based on its usage criteria, we have designed and developed a spring making machine. Buckling is a very dangerous condition as the spring can no longer provide the intended force. Once buckling starts, the off-axis deformation typically continues rapidly until the spring fails. As a result, it is important to design compression springs such that their likeliness to buckle is minimized.

2.5 Past researches

By doing some research in the past we can say that it is seen that major factors that affect the strength of springs are design parameters, material selection, raw material defect, spring geometry and surface imperfection. It is seen that design parameters i.e. operating modes, operating temperature, shot peening and imperfections on inside the coil spring affect directly on fatigue life of spring, as we seen as temperature increases the modulus and torsional yield strength of spring material decreases. It is observed that if the inner side of the coil spring is shot peened the stresses on inside coil surface reduces and fatigue life of coil spring increases. It is also seen that presence of any impurity, inclusion in raw material reduces the strength of coil spring.

3. Spring Producing Machine

3.1 Working of machine

The machine works on principle of gear boxes in which speed is varying using different gearing arrangement. We made this machine manually operated. Te working is easily understood in below figure. In below figure the input revolution is given to upper shaft. The holding chuck is mounted on upper shaft. The rpm of upper shaft is same as in put revolution. A moving nut is mounted on lower shaft on which coil holding trolley is mounted .the out put shaft is attached with lead screw & nut arrangement .the traveling speed of trolley is depends upon gearing position of gear box. The pitch of spring is adjusted by gearing i.e. speed of lead screw is constant & upper shaft speed is variable that means at high speed pitch is more vise versa. Also by changing spring shaft coil diameter of spring is changed.

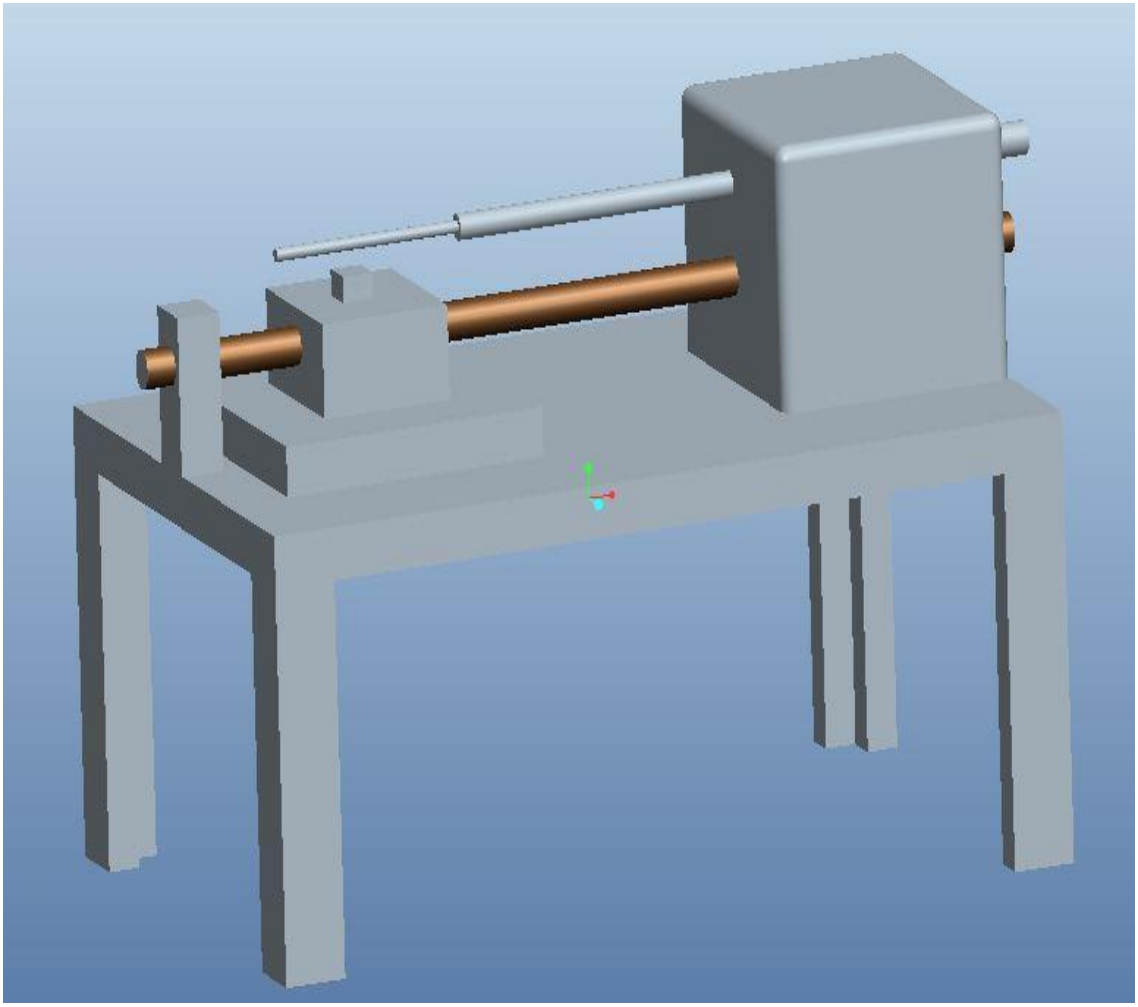

Figure 2: Cad model of spring making machine

3.2 Objectives

According to the problem statement defined above, we chalked out the objectives of this machine which are as follows:

1. To avoid use of different machines for the production of springs having different pitches, helix angle, coiled diameter.
2. To reduce manufacturing cost.
3. To reduce investment cost on machine.
4. To increase profit of company.
5. To save time.

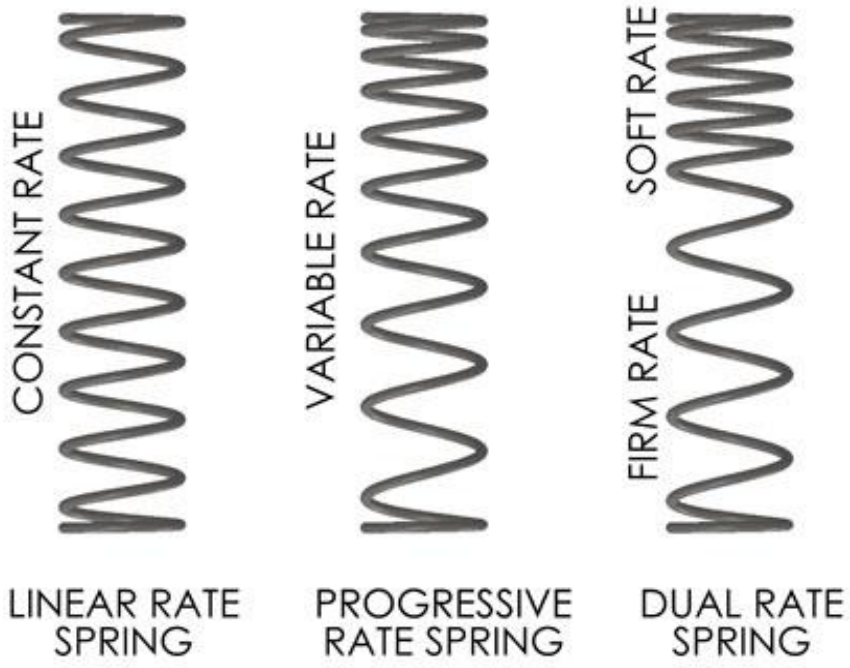

Figure 3: Springs to be produced on this machine

3.3 Advantages of machine

1. No external source is required as machine is manual operated.
2. Different pitch & coil diameter is obtained
3. Force required to make spring is less.
4. Machine is portable & compact.
5. Less skill is required to make spring.

3.4 Disadvantages of machine

1. Only coil spring is manufactured.
2. Rate of production is low.
3. Wire diameter up to 5 mm spring is made.
4. Length of spring is limited up to length of screw.
5. Only four different pitch is made.

3.5 Applications of machine

1. In small scale industries for producing small springs.
2. For producing tapered and conical springs.
3. For producing springs of constant as well as varying pitch.
4. In toy making industries for producing small springs to be used in toys.
5. In watch making industries for producing springs to be used in watches.

3.6 Machine specifications

1. SHAFT – variable diameter shafts are their depending upon the coiled diameter needed.
2. GEAR BOX—it is a single stage gear box having spur gear to minimize the cost of the machines.
3. BEARING—roller bearing is used as there is no high radial force acting on it.

4. CHUCK—standard drill chuck of mild steel is used.
5. LEAD SCREW—made of mild steel has a carbon content from 0.15% to 0.30%.
6. HANDLE—if it is hand operated the handle is provided and made up of mild steel.
7. MOTOR—for faster production motor is provided.

3.8 Components and material selected

1. Shaft - En 8.
2. Gear Box -Spur Gear Box
3. Gear - Mild Steel.
4. Bearing - Skf6204.
5. Chuck - Standard Drill Chuck Mild Steel
6. Bolt - M12.
7. Cover Sheet - Mild Steel
8. Lead Screw - Mild Steel
9. Lead Nut - Mild Steel
10. Frame - Angle (40 X 40 X 5 Mm).
11. Handel - Mild Steel

3.9 Modifications

Our project is simply a spring making machine, which is hand operated without consumption of power. Following different modification can be done to improve the output and efficiency.

a. It can be made power driven, by installing reversible motor thus the productivity can be increased.
b. The gear holding shafts can be extended and can be used as sheet-shearing machine.
c. By utilizing the long teeth gears in between the two post (sliding housed) this machine can be utilized as sugarcane juice abstraction (extraction) plant.
d. By replacing the wire holding chuck by drill chuck it can be used as the drilling and by installing tap set it can be used as tapping machine.

Hence by having above modifications above machine can be made a multipurpose output machine, which can be may power driver as well as manually operated.

4. Conclusion

The spring manufacturing machine is designed and manufactured by using gear changing and shaft coupling principle. It consist mainly three phase induction motor, gearbox, different diameters shafts ,gear changing lever, wire feeder from which spring would be formed. On the spring making machine we can make springs of different diameters constant pitches coiled as well as tapered spring can be formed. The manufactured springs have an constant parameters. This machine manufactures the constant parameters and of constant pitches and thus reduces the failure of the spring due to changes in the parameters.

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