ISSN 2395-1621

Drilling Machine With Flexible Shaft Attachment

#1S.Kangane, #2P.Dahibhate, #3S.Avhad, #4J.Chavan, #5Prof.S.Durgavade

1santosh.kangane007@gmail.com
2pravindahibhate1994@gmail.com

#1ISB&M School of Technology, Savitari Bai Phule Pune University

ABSTRACT

Work with hand-held power tools can be found in most industries all over the world. This type of work exposes the operators to different kind of loads like gripping- forces, feed-forces, exposure to vibration and noise, holding hot or cold surfaces and the exposure to dust. Thus there is a need for special purpose machine that address to the problem above by reducing the weight of the tooling so that it can be operated with single hand, while other hand holds on to the support, the machine be multi- functional i.e. should perform drilling, hole sawing, rectangular/ elliptical template cutting by jig sawing, profile cutting by jig sawing operation. Functionally designed flexible shafts can meet all these challenges. A flexible shaft is a very effective and cost efficient way to transmit rotary motion, power or torque. Flexible shafts are made with wire spiralled tightly around a central wire. With each layer you increase the diameter of the shaft and with that the torque it can transmit.

ARTICLE INFO

Article History

Received :29th February 2016

Received in revised form :

1st March 2016

Accepted : 4th March 2016

Published online :

6th March 2016

Keywords— gripping- forces jig sawing, Flexible shafts, central wire

I. INTRODUCTION

Drill bits are cutting tools used to create cylindrical holes, almost always of circular cross-section. Drill bits come in many sizes and have many uses. Bits are held in a tool called a drill, which rotates them and provides torque and axial force to create the hole. Specialized bits are also available for non-cylindrical-shaped holes. These machines are used in variety of application for drilling operation. These machines are hand held so Hand-arm vibration (HAV) is vibration transmitted from a work processes into workers' hands and arms. It can be caused by operating hand-held power tools, hand-guided equipment, or by holding materials being processed by machines. Multiple studies have shown that regular and frequent exposure to HAV can lead to permanent adverse health effects, which are most likely to occur when contact with a vibrating tool or work process is a regular and significant part of a person's job. There are many different types of hand-held power tools and equipment which can place workers at increased risk of developing HAVS. Some of the more common ones are

chainsaws
- impulse tools
- ratchet screwdrivers
- concrete breakers
- cut-off saws
- hammer drills
- hand-held grinders
- impact wrenches

Tools for industrial use must be of very robust design to withstand the very hard use they are exposed to. Industrial tools are therefore normally designed with the main parts made of metal .From a vibration point of view this means that most tools can be regarded as rigid bodies, especially because the dominating frequency normally is equal to the rotational frequency of the tool spindle or the

blow frequency for a percussive tool. These frequencies are with few exceptions below 200 Hz. Handles however cannot always be regarded as rigidly connected to the tool. There are several examples of weak suspensions designed to reduce vibration transmitted to the hands of the operator.

II. PROBLEM STATEMENT

In many applications the operator has to work on ceiling or roofs standing in up- right position with the power tool in hand, majority of the times the power tool needs to be supported by both hands, thus the operator has to balance himself while performing the operation, this awkward position of working further leads to cramps, back ache, discomfort leading to fatigue and health disorders. Figure below elaborates one such case study to shed light on relevance of the flexible shaft machine to be designed.

III.OBJECTIVE

1.Design and development of waist belt mounted 300 watt power tool with flexible shaft drive and 1:3 reduction ratio gear box to perform multiple functions like drilling, hole sawing and jig sawing operations.
2.Reduce the vibrations generated during cutting.
3.Comparative analysis of the performance of the jig saw machine with and without vibrations damper as to cutting speed (m/min) & dimensional accuracy.

IV.LITERATURE SURVEY

MULTI-FUNCTION FLEXI-SHAFT POWER TOOL

Flexible Shaft Tools or flex shafts are a connection that moves the spinning end of the rotary tool off the motor and into a smaller hand piece. Although they vibrate, the motor is away from the tool, and more precision is possible as the smaller hand piece is designed for better control, as well as easier movement around detailed work, especially useful for modellers', dedicated flexible shaft tools are connected to powerful motors, usually hung from a stand or mounted on a work bench. The tool is designed to be hand held with the motor held away from the worker.

Flexible shaft

Flexible shafts are mechanical power-transmission devices used to transmit rotary motion through bends and curves. They can be routed over, under, and around obstacles which would be otherwise impossible for a solid shaft and costly for universal joints. Flexible rotary shafts eliminate tight installation tolerances and difficult assembly procedures required with solid shafts. Flexible shafts are made of layers of high-tensile wire wound over each other at opposing pitch angles.When torque is applied to the flexible shaft, the wire layers expand or contract depending on the direction of the rotation. If the torque causes the outer layer to contract, the layer underneath will expand. This creates a dynamic interference between the layers of the shaft resulting in high torsional stiffness approximately 100 times greater than the sum of the individual layers acting alone. But flexible shafts also eliminate alignment problems because they do not require tight tolerances. This gives designers more options when positioning motor and drive components, and they permit a full 180° offset while maintaining efficiency. Engineers can use flexible couplings or universal joints, but they allow only 5 to 30° offset and reduce efficiency by 40 to 50%. Flexible shafts in general are 85 to 95% efficient, which is typically better than gears, universal joints, and belts and pulleys, which lose efficiency because of higher frictional losses. And they have a 3 to 1 weight advantage over these other design options .Flexible shafts can run from 0.020 to 1.25 in. in diameter and from 2-in. to 100-ft long. Very-high yield strength is critical in maintaining precise positioning response over many rotations. Yield strength can be as high as 400 lb-in. of torque at speeds reaching around 18,000 rpm for some aerospace applications. The vibrations from these systems do not affect the performance of a flexible shaft. Because of these variances in size paired with high yield strength, flexible shafts are used extensively in the aerospace, medical, automotive, and other industrial markets. [3]

Effect of vibration on health of worker and norms for vibration

What you may need to do as an employer under the Control of Vibration at Work Regulations 2005 which came into force in July 2005

- An employee, or self-employed person, who uses vibrating equipment,
- A trade union safety representative or an employee representative.
- An adviser on occupational vibration risks.

EQUATION

1) Volume of material removed / sec = MRR × t 2)Power (N) = U x Q

Where,

N= Power Kw

U = unit 1 cm^3 /min

Q = Volume of material removed /min 4)Power=

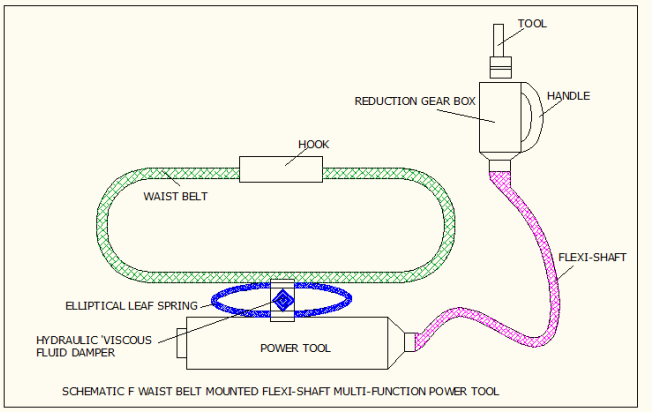
MATERIAL SELECTION

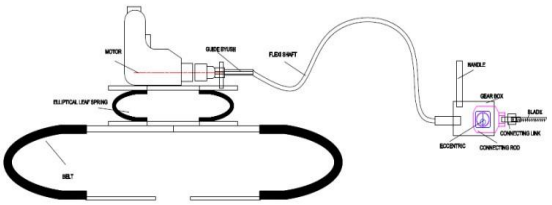
Material is procured as per raw material specification and part quantity. Part process planning is done to decide the process of manufacture and appropriate machine for the same.

GENERAL MATERIAL USED
EN24- Alloy Steel
EN9-PLAIN CARBON
STEEL MS-MILD STEEL
STD- Standard Parts Selected From PSG
Design DATA/MANUFACTURE
CATALOUGE

FIGURE

Fig7.1Line Diagram





7.2Fig-Portable Drilling machine

V. CONCLUSION AND FUTURE SCOPE

This concept leads to reduce fatigue of worker during drilling on roof, ceiling. This is also reducing hand arm vibrations, vibrations are absorbed by vibration isolator. This increases comfort of worker. A flexible shaft is a very effective and cost efficient way to transmit rotary motion, power or torque. Flexible shafts are made with wire spiralled tightly around a central wire. With each layer you increase the diameter of the shaft and with that the torque it can transmit. Radius can be reduced; the torsional deflection will go up, which for remote control cable is not a good thing. Related to this basic "reality" of flexible shafts, two main design groups emerge. First there are torque-transmission shafts, mainly for higher speed, continuous speed, pure torque transmission applications like speedometer cable or shafts for drilling applications. Second are the torsion stable flexible shafts for mechanically remote applications, with low speed and focus on low torsional deflection. An example is slide adjustments for stationary cutting machines. Also there are special cables like flocked shafts, hollow shafts, shafts with helix wire and so on. Figure shows some examples of special flexible shafts. Direct influences on flexible shaft specifications are: the number of layers, the number of wires-per-layer, the diameter of the wire, the wire material (with higher or lesser carbon, different tensile strengths, different plating) and the manufacturing process (settings on the winding machines). Considering influences related to shaft manufacturing processes, it has to be understood that winding is a high- speed process where gap settings will influence the flexibility of the shaft. The winding speed and the gaps must be uniform and controlled. It helps to prevent damage to hands, joints as minimum vibrations transmitted to hand. As there are lesser vibrations the noise is also reduced to some extent. This system is simple to implement.

The motor part is installed on the waist belt, whereas the tooling is to receive power via flexible shaft .The tooling to be developed to be multi-functional so as to perform

i.Drilling up to 10 mm diameter.
ii.Round shape hole sawing up to 50 mm diameter. iii.Jig sawing in wood / plywood up to 12 mm thickness.
iv.Profile cutting on plaster of paris.

VI. ACKNOWLEDGEMENT

We express our sincere thanks and profound gratitude to our **Guide Prof.S.Durgavade** for his valuable guidance and co-operation without which we would have found it unable to complete our project work.It is indeed a great pleasure and moment of immense satisfaction for us to express our sense of gratitude towards our **H.O.D, Prof. Mahadik**, and **Principal, Dr. P.K.Shrivastav** who encouraged us in this venture. Finally we would thank our entire friend and the staff of Mechanical Engineering Department who indirectly help us in completing our project.

REFERENCE

1] R.S.KURMI, "Machine Design", Eurasia Publication, 1st edition, (2005).

[2] V.B.BHANDARI, Design of Machine Element, Tata McGraw Hill Education, 3rdEdition, 2010.

[3] N. G. Ltd, Product Catalogue.

[4] I. A. CHIRONIS, Mechanisms & Mechanical Linkages, McGraw Hill Publication,4th edition., 1965.

[5] PSG Technology, Design Data Book, PSG Collage of Technology, 1966.

[6] M. Boehm, Flexible Options with Flexible Shafts.

[7] http://wikipedia.org.in/flexibleshaft.