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Automation of Lubrication System

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Abstract: In engines, frictional losses are mainly due to slide as Well as rotating parts Engine friction is expressed in terms of frictional power Friction all losses is mainly attributed to the following mechanical losses.

- ***Direct frictional losses***
- ***Pumping losses***
- ***Power loss to drive the components to change and scavenge Power loss to drive other auxiliary components***

A good engine design should not the total frictional losses to be more than 30%of energy input in Reciprocating engine. It should be the aim of a good designer to reduce friction and wear of the parts subjected to relative motion. This is achieved by proper lubrication system.

1. Direct Frictional Losses:

It is the power absorbed due to the relative motion of different bearing surfaces such as Piston rings, Main bearings, Cam shaft bearings etc.

2. The frictional losses are comparatively higher in the reciprocating engine.

3. Pumping Loss For4-stroke engines Considerable amount of energy is spent during the exhaust

Processes. The pumping loss is the net power spent by the engine (piston) on the working medium (gasses) during intake and exhaust strokes. For2-stroke engines this is negligible since the incoming fresh mixture is used to scavenge the exhaust gasses Power Loss to drive the components to change and scavenge 4-strokeengine. In turbo/supercharged engines the intake charge is supplied at a higher pressure than the aspirated engines. For this purpose mechanically driven compressor or turbine driven compressor used accordingly the engine is called Supercharged or turbocharged engine.

Keywords: Oil System. Grease system, Dispenser Actuator Dispenser, Actuator mechanism MQL system.

1. INTRODUCTION

Automation lubrication has increasingly found its way into the area of metal cutting machining and in many areas, has already been established as an alternative to conventional wet processing. In contrast to flood lubrication, minimum quantity lubrication uses only a few drop of lubrication (approx. 5ml to 50 ml per hour) in machining. Today, the enormous cost-saving potential resulting from doing almost entirely without metal working fluid in machining production is recognized and implemented by many companies, primarily in automotive industry. While in the early 1990s small applications (sawing, drilling) were done "Dry", today we are able to produce cylinder heads, crankcase, camshaft and numerous other components made of common materials – such as steel, cast iron and aluminum using MQL in the framework of highly automated large volume production.

The advantages of this new technology are clear. With respect to occupational safety, MQL offers numerous advantages over water-mixed metal working fluid. A major advantage is a substantially better compatibility concerning skin care. Minimum quantity lubrication is a total loss lubrication method rather than the circulated lubrication method used with emulsions. This means using new, clean lubricants that are Fatty-alcohol or ester based. Additive against pollution, e.g. biocides and fungicides are not necessary at all since microbial growth is possible only in an aqueous phase. The extreme reduction of lubrication quantities results in nearly dry workpieces and chips. This greatly reduces health hazards caused by emissions of metal working fluid in the breathed-in air and on the skin of employees at their workplace. Metal working fluids do not spread throughout there around the machine, thus making for a cleaner workplace. Cost generated by conventional flood lubrication (e.g. maintenance, inspection, preparation, and disposal of metal working fluids) are no longer an issue with minimum quantity lubrication.

The development of tribology and its application in machine elements and systems, in general, began in early 70's of last century with a suddenly increase in exploitation mode machines. The development of technical progress required an increased strength, speed, and load, to maximize the productivity of labor. Mechanical systems and components are working in sharper models of labor. At this stage, and time

Distance began with attention to the causes of failure, and sometimes to the sudden shortening of their projected labor resources. The nature of tribology processes is natural and inevitable is that mechanical elements hackney out during operation. In some cases, the problem of increasing resistance to abrasion was solved by selecting the higher hardness of steel. For a long time steel is considered, by analogy, resistance to hackney out, and was later replaced by lubricant materials, thus reducing hackney out and tear problems long solved by selecting the appropriate lubricant. From the

An aspect of improving lubrication in recent years more and more emphasis is on the constant increase in materials and lubricants performance. The lubrication can be defined as a procedure by which introduces a layer of lubricant to reduce friction and detrition of materials between the two surfaces, which are in relative motion.

This Process includes the following activities:
• The permanently cleaning of lubricants,
• The checking a number of lubricants,
• Refilling lubricants if is necessary,
• Replacement of lubricants, and others.

Choosing the proper lubricant, in the first place, depends on load, speed, temperature, and conditions in the work environment. The appropriate lubricant with the right lubrication system ensures consistency and dispensing lubricants are best for a particular use. The emission of machines will be avoided and the cost of system maintenance will be drastically reduced.

Frequent delays in production caused by inadequate lubrication can be largely prevented by applying some of the units for the automatic lubrication system. The lubrication systems constantly and reliable dosing appropriate lubricant and quantity to the required system components. At the same time, it protects against corrosion and external contamination, and with the selection of proper lubricants extend the service life of machinery and equipment. Lifetime lubricated components, which will be extended and maintenance costs reduced. On systems such as fans, motors, pumps, compressors, blower’s conveyors and other hard to reach places, these systems ensure continuous, without maintenance, long time lubrication for the period from 1 to 24 months. The most common are now in steel making, mining, energy, petrochemical industry, automobile industry, food industry and so on. The fact that 1 g of excess oil or grease which is spill out, as a result of improper lubrication or incompetence, can pollute the water sank, indicating only to the environmental aspect of the seriousness of the process of lubrication. Properly designed lubrication systems can greatly contribute to reduce these losses and preserve our environment and economic resources.

In Fig. 1 was shown the economic aspect of an automatic lubrication savings compared to manual, for the period of lubrication of about ~ 1 year for 100 lubrication points. Savings lubrication for the specified period ranging up to 25 %, which means that the investment cost of installing such systems can be compensated through annual maintenance.

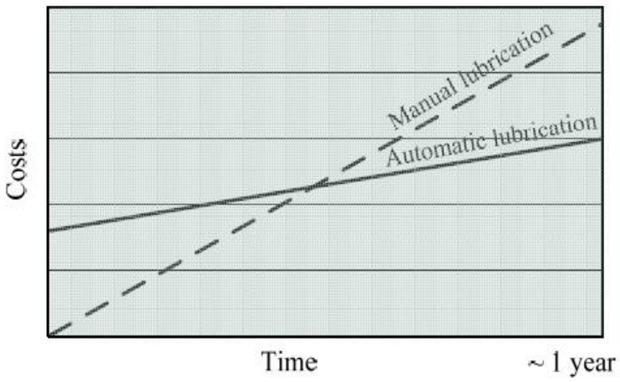

Fig1. The automatic lubrication savings compared to manual on annual basis points to 100 lubrication points

2. LITERATURE REVIEW / RELEVANCE

Bruce L. Taiaet.al. [1] – There are many claims to the invention of the lubrication system but it is likely that it was known, at least in some places, in ancient times.Some historical milestones of the lubrication include: Two Chinese Buddhist monks and engineer create South Pointing Chariots for Grease is a semi-solid lubricant. It generally consists of a soap emulsified with mineral or vegetable oil. The characteristic feature of greases is that they possess a high initial viscosity, which upon the application of shear, drops to give the effect of an oil lubricated bearing of approximately the same viscosity as the base oil used in the grease. This change in viscosity is called 'Thixotropy' Grease is sometimes used to describe lubricating materials that are simply soft solids or high viscosity liquids, but these materials do not exhibit the shear-thinning (Thixotropic) properties characteristics of the classical grease For example petroleum jellies such as Vaseline are not generally classified as greases. Comparison of manual and automatic greasing.

E.R. Booser and A.E. Bakeret.al. [2] – Documented Chinese productions of the South Pointing Chariot by Yan Su and then Wu Deren, which described in detail the mechanical functions and lubrication of the device much more so than earlier Chinese record used an Automatic lubrication in a clock in the year.There are certainly advantages to the automatic application when compared to the manual application. Theoretically, it is preferable to apply small amounts of grease at short interval rather than large amounts of grease at long intervals.

T. Kawamuraet.al. [3]- Germany invented a four-wheel steering system for carriages, which some later writers mistook reported as a lubrication l in the year 1810.Modern automotive Automatic lubrication patented by watchmaker On Siphore Pecqueur in the period1792-1852 of the Conservatoire des Arts Et Mtiersin France for use on a steam carts.With the manual application, the trick is to apply as much grease as possible without causing harm due to over-greasing, thereby maximizing the re-lubrication interval. While this is fine for most grease-lubricated

Ito, H., Koizumi, H. and M. Naka.et.al. [4]- England patented ‘lubrication, for road 'locomotives in 1832. A veling and Porter of Rochester, Kent list a crane locomotive in their catalog fitted with their patent Automatic lubrication differential on the rear axle in the year. The first use of differential on an Australian steam car.

Scarlett, N.Aet.al. [5]-In 1897 Packard introduces the lubrication, which introduces the Automatic lubrication, which cuts gear noise in the year 1913. Packard introduced the hypoid differential, which enables the propeller shaft and its hump in the interior of the car to be lowered in 1926.Vernon Gleasman patented the torsen dual drive differential, a type of limited slip differential that relies solely on the action of gearing instead of a combination of clutch and gear by using Automatic lubrication was introduced in the year 1958.

3. PROPOSED EXPERIMENTAL SETUP

3.1CONSTRUCTION

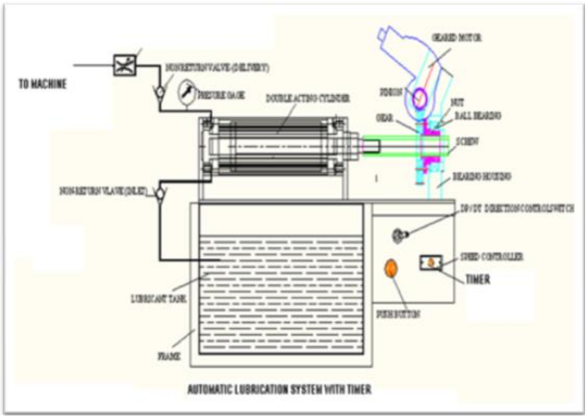

Fig: 2.1 Automation Lubrication System

3.1.1 Lubricant Tank &Frame

These are fabricated structural components of the MQL with primary functions of the tank to hold the MQL lubricant and the frame to support the entire assembly of the MQL system.

3.1.2 Dispenser Actuator

The dispenser actuator is a double acting hydraulic cylinder with 32mm bore and 100mm stroke, thus the dispenser volume is 80 cc, i.e. in one stroke of the dispenser, it is possible to dispense 80 ml of MQL lubricant. The rate of displacement of the dispenser piston is thus important to determine the minimum quantity of oil dispensed per min.

3.1.3 Dispenser Actuator driving mechanism:-

The forward stroke of the displacer piston is used for the dispensing activity whereas the return stroke charges the dispenser. The to and fro motion of the piston is achieved using a power screw and nut arrangement. The power screw is held in a nut supported in a ball bearing in a bearing housing. The nut carries a spur gear driven by a spur pinion mounted on the geared motor. The geared motor under consideration is specified below

The motor is a 12 volt DC motor, with the following specification:

Voltage: 12 Volt DC Power = 20 watt

Mounting: Face-mounted

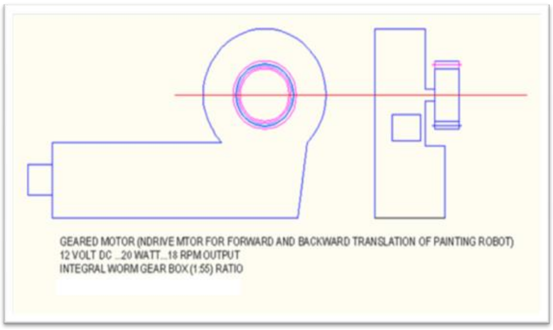

Fig.3.1.3: Construction of Motor

3.1.4 Dispensing Circuit

The dispensing circuit connects the outlet of the cylinder to the mixing chamber. The circuit comprises the non-return valve opening into the mixing chamber side and closing on the cylinder side. This allows lubricant flow from the cylinder to mixing chamber during dispensing stroke whereas prevents reverse air flow from the mixing chamber to the cylinder during the suction stroke. Circuit also has flow control valve for fine adjustments of the flow rate of lubricant to mixing chamber, and pressure gauge indicates the pressure in the delivery line.

3.1.5 Mixing Chamber

Mixing chamber is the device that mixes the MQL lubricant and the compressed to create lubricant mist to be directed onto the cutting action area to serve a threefold purpose;

1. Lubricate the tool tip and job contact area during cutting to minimize the friction between them, thereby reducing the heat produced. Misty nature of the lubricant ensures effective application of lubricant and better heat extraction.

2.The second advantage of using compressed air mist that, it help schip evacuation from the cutting area which is one of the major reasons of development of 'built-up-edges' on tooltip leading to reduced tool life and improper surface finish on the job.

3.The compressed air offers another advantage that fumes that are likely to be developed due to the burning of the lubricant are not developed due to being the high velocity of the lubricant (they do not reach flash point).

3.2 Working

3.2.1 Dispenser Charging Cycle

The motor is rotated in a clockwise direction that rotates the nut in counter clockwise direction due to spur gearing, nut rotates and the screw is constrained to translate hence it moves back thereby moving the piston in backward direction thereby effecting the suction stroke. The inlet circuit to the dispenser uses a non-return valve opening into the cylinder side and closing on the tank side. This allows lubricant flow from the lubricant tank to the cylinder during suction stroke whereas prevents reverse flow from the cylinder to tank during dispensing stroke.

3.2.2 Dispenser Delivery Cycle

The motor is rotated in a counter-clockwise direction that rotates the nut in a clockwise direction due to spur gearing, nut rotates and the screw is constrained to translate hence it moves forward thereby moving the piston in the forward direction thereby effecting the delivery stroke. The dispensing circuit connects the outlet of the cylinder to the mixing chamber. The circuit comprises the non-return valve opening into the mixing chamber side and closing on the cylinder side. This allows lubricant flow from the cylinder to mixing chamber during dispensing stroke whereas prevents reverse air flow from the mixing chamber to the cylinder during the suction stroke. Circuit also has flow control valve for fine adjustments of the flow rate of lubricant to mixing chamber, and pressure gauge indicate the pressure in the delivery line.

CONCLUSION

The concept of group project was included in our engineering syllabus with the view to inculcate within us the application ability of the theoretical concept of design and production engineering to a practical problem. So, it also to help us to learn to work more as a team rather than an individual.

In completing our project titled "Automation Lubrication System" as per our time estimate gives us immense pleasure and a feeling of achievement. During the course of the project we encountered numerous problems which we overcame with the able guidance of our project guide.

This project report presents a brief mention of our effort. Project work has given us good exposure to the practical field which in the future is definitely going to help us.

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