Concept of Automatic Lubrication System and Comparison with Conventional Lubrication System

Agam Kumar Malik[1], Ankit Singh[2], Mohit Hooda[3]
Graduate Student,
Department of Mechanical Engineering,
NCCE Israna,Panipat[1,2,3]

***Abstract*— Lubrication plays a major role in reducing in friction between the piston and shear of moving mechanical components to enhance the engine performance and efficiency. This paper deals with the study and comparison of Automatic Lubrication System with conventional lubrication system. Automatic lubrication systems provide a safer, more accurate form of machine lubrication. An automatic lubrication system (ALS), is defined as a centralized lubrication system, is a system that delivers metered quantity of lubricant to multiple locations on a engine while the engine is operating. The conventional lubrication system composed of manual lubricating to various parts of the engine. This system is usually time consuming. Previously we have to shut down system for greasing. This study includes design and manufacturing of automatic lubrication system, which allows to do greasing at frequent interval of time and in adequate amount. This lubrication also ensures safety to machine components and reduces labour. It ensures proper lubrication to each and every part of the engine.**

Index Terms- Automatic lubrication system, Oil systems, Conventional lubrication system, Engine lubricant

I. INTRODUCTION

The development of lubrication and its application in machine and engine components in general, began in early 70's of last century. From the view of improving lubrication in recent years more and more stress is given on the constant increase in materials and lubricants performance. The lubrication can be defined as a process by which we introduce a layer of lubricant to reduce friction and reduces the wear between the two surfaces, which are in relative motion to each other. This process includes the following activities: -the cleaning of lubricants,- the checking the quantity of lubricants, -refilling lubricants, Choosing the
with the correct lubrication system ensures firmness and allocates lubricants are best for a particular use. The abandonment machines will be avoided and the cost of system maintenance will be drastically reduced.

Automatic lubrication system (ALS), defined as a centralized lubrication system, is a system that provides metered amounts of lubricant to multiple locations on a machine while the machine is operating. Centralized grease lubrication systems are widely used in industrial and heavy-duty mobile equipment applications to lubricate multiple points on a machine. These systems dimensions vary from a simple single-port lubricator to complex dual-line, overturn units employing timers and alarms to deliver grease reliably to hundreds of grease points. The design parameters of centralized grease systems include the volume and frequency of grease required at each point, the number of notch requiring grease, performing conditions, pump pressure, line diameter and span to the grease points. When used and preserved properly, centralized grease systems can help enhance technician productivity and simplify equipment maintenance processes. The following is a complete overview of centralized grease systems and the assistance they offer, the various types, matter to watch out for and tips on how to maintain them properly.

II. AUTOMATIC LUBRICATION SYSTEM

Centralized grease systems are designed principally to make the work environment safer for maintenance personnel by simplifying the process of accessing remote grease points, especially in restricted spaces, when equipment is in operation. However, the primary use is derived from the continuous application of small amounts of grease resulting in improved equipment life, due to the uniform supply of grease. Hand application is typically performed infrequently and may result in uneven amounts of grease being applied, which can lead to over greasing resulting in damaged seals and elevated bearing temperatures caused by grease churn

Components

A typical system consists of controller/timer, pump w/reservoir, supply line, calculating valves, and feed lines. All automatic lubrication systems share these main components:

1. *Controller/Timer* –manages the pressure on the system by turning pressure supply valves on and off on the basis of either time or cycle. It can also receive signals demonstrating restricted or failed grease flow to the bearing.
2. *Reservoir* – provides a total quantity of grease that can be kept clean and readily available to the system.

3. *Pump* – the flow of grease and builds up pressure in the line(s). Pump size will vary banking on the distance between the pump and the farthest injector.
4. *Metering Valves/Injectors*– unit that take the lubricant to the application points.
5. *Feed lines* - line that connects the metering valves or injectors to the application points.

Types

There are numerous different types of automatic lubrication systems including:

- Single Line Parallel systems
- Dual Line Parallel systems
- Single Point Automatics
- Single Line Progressive systems
- Single Line Resistance

The most commonly used Automatic Lubrication System types are:

- Single Line Parallel,
- Dual Line Parallel and
- Single Line Progressive Multi port direct lubricators

Single line progressive

Figure 1- Single Line Progressive Automatic Lubrication System

In a single line parallel system, lubricant can be supplied either manually, with a grease gun, or with the help of a fully automated system using electric or pneumatic pumps and progressive metering valves. More than a drilled manifold block, the SSV metering valve covers a series of metering pistons, which accurately distributes lubricant from each outlet. Observable monitoring is provided with an indicator pin, which certifies a valve has completed a full cycle.

Single line parallel

Figure-2 Single Line Parallel Automatic Lubrication System

A Single Line Parallel Lubrication Systems primarily consist of:

- A Pump with either integral reservoir or with grease barrel mounting option
- Air Maintenance Unit
- Appropriate Injector devices
- Electronic Control Unit (Timer)
- Appropriate Tubing, Fittings, Valves and Gauges

During the operation cycle, the pre-set quantity of lubricant is pumped to the various injector devices, which in turn deliver the pre-set quantities of the lubricant to the connected lubrication points. The injector devices are connected in parallel & operate independent of each other. The sequence of operation can be controlled by the electronic control unit (Timer).

Dual line parallel

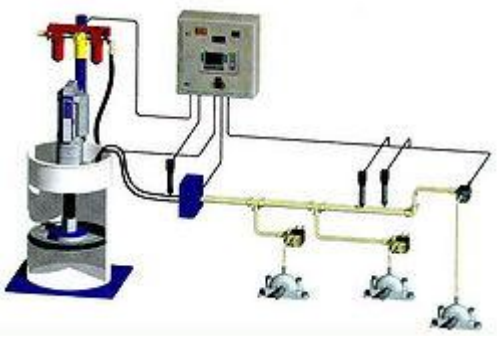

Figure-3 Dual Line Parallel Automatic Lubrication System

A dual line parallel system is similar to the single line parallel system in that it uses hydraulic pressure to cycle adjustable valves to dispense measured shots of lubricant. It has 2 main supply lines which are alternatively used as pressure / vent lines. The advantage of a two-line system is that it can handle hundreds of lubrication points from a single pump station over several thousand feet using significantly smaller tubing or pipe. Operation begins when the controller/timer sends a signal to the pump to start the lubrication cycle. The pump begins pumping lubricant to build up pressure in the first (the pressure) supply line while simultaneously venting the second (vent) return line. Once the required pressure is reached, a predetermined amount of lubricant is dispensed by the metering devices to half of the lubrication points via feed lines. Once the pressure switch monitoring main supply line pressure indicates a preset pressure in the line has been reached, the system is hydraulically closed. The controller shuts off the pump and signals a changeover valve to redirect lubricant to the second main supply line. The next time the controller activates the system, the second main line now becomes the pressure line while the first line becomes the vent line. The second line is pressurized and the entire process is repeated lubricating the remaining lube points.

Multi point direct lubricator

When the controller in the pump or external controller activates the drive motor, a set of cams turns and activates individual injectors or pump elements to dispense a fixed amount of lubricant to each individual lubrication point. Systems are easy to design, direct pump to lube point without added accessories and easy to troubleshoot.

III. LITERATURE SURVEY

Review

There are many claims to the invention of the differential gear but it is likely that it was known, at least in some places, in ancient times. Some historical milestones of the differential include Two Chinese Buddhist monks and engineers create South Pointing Chariots for Emperor Tenji of Japan. Documented Chinese reproductions of the South Pointing Chariot by Yan Su and then Wu Deren, which described in detail the mechanical functions and gear ratios of the device much more so than earlier .Chinese record Joseph Williamson used a differential gear in a clock in the year1720. Rudolph Ackermann of Germany inventeda four wheel steering system for carriages, which some later writers mistakenly reported as a differential in the year 1810. Modern automotive differential patented by watchmaker On Siphore Pecqueur in the period 1792-1852 of the Conservatoire des Arts Et Mtiers in France for use on a steam carts Richard Roberts of England patented gear of Compensation', a differential for road locomotives in1832 Aveling and Porter of Rochester, Kent list a crane locomotive in their catalogue fitted with their patent differential gear on the rear axle in the year 1874 First use of differential on an Australian steam car by David Shearer was done in 1897. Packard introduces the spiral gear differential, which cuts gear noise in the year 1913. Packard introduced the hypoid differential, which enable the propeller shaft and its hump in the interior of the car to be lowered in1926. 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 clutches and gears was introduced in the year 1958

Concept

In project we have to develop the Automatic Lubrication System by using pneumatic cylinder and grease gun. It is less costly than the LINCOLN. It is less costlier than automatic lubrication system based on hydraulics which was developed by LINCOLN The double acting pneumatic cylinder connected to handle of grease gun and its other end is connected to compressor. When compressor starts which deliver pressure at about 3 bar, it moves the handle of grease gun to downward. And it actuates the secondary piston of grease gun which delivers grease to required greasing point through nozzles provided. When handle reaches to limit switch, it get actuated. Actuation of limit switch makes the pneumatic cylinder operated oppositely. . Hence grease handle occupies its original position. The whole process continues up to the time provided by digital timer.

IV. CONVENTIONAL LUBRICATION SYSTEM AND COMPARISON WITH AUTOMATIC LUBRICATION SYSTEM

Lubricate

Reduces Friction by creating a thin film(Clearance) between moving parts (Bearings and journals).

Purpose of Lubrication System

•*Seals* The oil helps form a gastight seal between piston rings and cylinder walls (Reduces Blow-By) Internal oil leak (blow-by) will result in BLUE SMOKE at the tale pipe.

•*Cleans* As it circulates through the engine, the oil picks up metal particles and carbon, and brings them back down to the pan.

. •*Cools* Picks up heat when moving through the engine and then drops into the cooler oil pan, giving up some of this heat.

Absorbs shock When heavy loads are imposed on the bearings, the oil helps to cushion the load. •*Absorbs Contaminants* The additives in oil helps in absorbing the contaminants that enter the lubrication system.

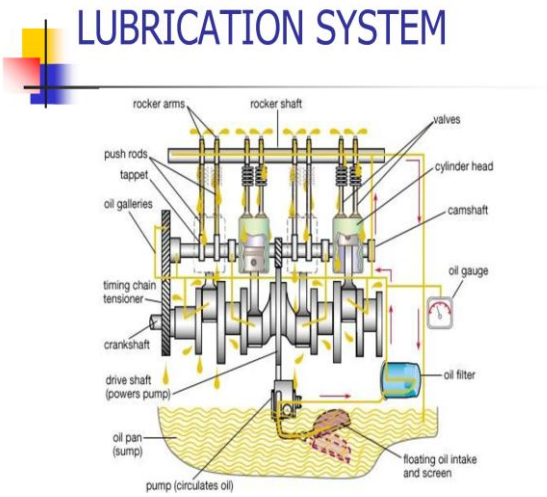

Figure-4 Conventional lubrication system

The Engine lubrication system is considered to give a flow to the clean oil at the accurate temperature, with a appropriate pressure to each part of the engine. The oil is sucked out into the pump from the sump, as a heart of the system, than forced between the oil filter and pressure is fed to the main bearings and also to the oil pressure gauge. The oil passes through the main bearings feed- holes into the drilled passages which is in the crankshaft and on to the bearings of the connecting rod. The bearings of the piston-pin and cylinder walls get lubricated oil which dispersed by the rotating crankshaft. By the lower ring in the piston the excess being scraped. Each camshaft bearing is fed by the main supply passage from a branch or tributary. And there is another branch which supplies the gears or timing chain on the drive of camshaft. The oil which is excesses then drains back to the sump, where the heat is being transferred to the surrounding air.

Comparison of manual and automatic greasing: There are certainly advantages to automatic application when compared to manual application. Theoretically, it is preferable to apply small amounts of grease at short intervals rather than large amounts of grease at long intervals. With 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 components, there are many applications that may benefit from more frequent application or could be harmed by large application volumes. There are lots of problems with manual greasing such as 1) There is excessive loss of grease. 2) Equipment getting harmed due to over greasing. 3) Excess time lost in lubrication. 4) Requiring variable labours

Benefits

Auto lube systems have many advantages over conventional methods of manual lubrication:

1. All critical components are lubricated, regardless of position or ease of access
2. Lubrication occurs while the machinery is in operation causing the lubricant to be equally distributed within the bearing and increasing the machine's availability.
3. Proper lubrication of critical components ensures safe operation of the machinery.
4. Less wear on the components means extended component life, fewer breakdowns, reduced downtime, reduced replacement costs and reduced maintenance costs
5. Measured lubrication amounts means no wasted lubricant
6. Safety - no climbing around machinery or inaccessible areas (gases, exhaust, confined spaces, etc.)
7. Lower energy consumption due to less friction
8. Increased overall productivity resulting from increase in machine availability and reduction in downtime due to breakdowns or general maintenance

V. CONCLUSION

From the Automatic Lubrication system it is concluded that the cost and man power require for the lubricating the various grease points can be eliminated. The loss of grease during greasing reduces as compared with the manual greasing. The system provides safety to the lubricating component and the operator. This system enables the greasing to the points which are not reachable to operator and down time also reduces.

REFERENCES

[1] Gavaerts, R.: The World of Automatic Lubrication PERMA, 2009.
[2] Scarlett, N.A. (1967), "Use of Grease in Rolling Bearings," Proc. IMechE. Part 3A, 182, pp 167-171.
[3] H. Mikami: "Latest Trends in Lifespan Prediction for Lubrication Grease and Grease," Hydraulics & Pneumatics (Japan).
[4] Ito, H., Koizumi, H., and M. Naka. (1995), "Grease Life Equations for Sealed Ball Bearing.