“UNIQUE COMBINATION OF PALLET TRUCK & CRANE MACHINE FOR REDUCING HUMAN EFFORT IN INDUSTRIES”

[1] Amit Tiwari , [2] Mahendra Labana, [3] Dr. Neeraj Kumar, [4] Himanshu Vasnani

[1, 4] Assistant Professor, M.E Department, Suresh Gyan Vihar University, Jaipur [Raj] India. [2] MC Nally Bharat Engineering Company Ltd Zawar Mines Udaipur Rajasthan India [3] Professor & HOD, M.E Department, Suresh Gyan Vihar University, Jaipur [Raj] India.

ABSTRACT:

In this Paper we used Machine for small scale industries as well as in domestic purpose. this is having a very low initial and maintenance cost. the main important part of our paper is there are rollers or wheels which can be move from one place to another and also it is light in weight this paper is very useful as is reduces human effort also thus overall the paper is having a great advantages thus can be used in domestic purpose in future it is the combination of both pallet truck and crane machine our paper can also lift the load of 100kg.

Key Words: Calculation , Types and Mechanism.

INTRODUCTION

1.1 MECHANICAL PALLET TRUCK

A pallet jack, also known as a pallet truck, pump truck, or jigger is a tool used to lift and move pallets. The front wheels are mounted inside the end of the forks, and as the hydraulic jack is raised, the forks are separated vertically from the front wheels, forcing the load upward until it clears the floor. Powered pallet jacks, also known as electric pallet trucks, walkies, single or double pallet jacks, or power jack, are motorized to allow lifting and moving of heavier and stacked pallets. Some contain a platform for the user to stand while moving pallets. The powered pallet jack is generally moved by a throttle on the handle to move forward or in reverse and steered by swinging the handle in the intended direction. Some contain a type of dead man's switch rather than a brake to stop the machine should the user need to stop quickly or leave the machine while it is in use. Others use a system known as ``plugging`` where in the driver turns the throttle from forward to reverse (or vice-versa) to slow and stop the machine, as the dead man's switch is used in emergencies only.

1.2 MECHANICAL CRANE

A crane is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a man. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the construction industry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment.

Cranes exist in an enormous variety of forms – each tailored to a specific use. Sometimes sizes range from the smallest jib cranes, used inside workshops, to the tallest tower cranes, used for constructing high buildings. For a while, mini - cranes are also used for constructing high buildings, in order to facilitate constructions by reaching tight spaces. Finally, we can find larger floating cranes, generally used to build oil rigs and salvage sunken ships.This article also covers lifting machines that do not strictly fit the above definition of a crane, but are generally known as cranes, such as stacker cranes and loader cranes.For many centuries, power was supplied by the physical exertion of men or animals, although hoists in watermills and windmills could be driven by the harnessed natural power. The first 'mechanical' power was provided by steam engines, the earliest steam crane being introduced in the 18th or 19th century, with many remaining in use well into the late 20th century. Modern cranes usually use internal combustion engines or electric motors and hydraulic systems to provide a much greater lifting capability than was previously possible, although manual cranes are still utilised where the provision of power would be uneconomic.

LITERATURE REVIEW

A crane is a type of machine, generally equipped with a hoist, wire ropes or chains, and sheaves, that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. It uses one or more simple machines to create mechanical advantage and thus move loads beyond the normal capability of a man. Cranes are commonly employed in the transport industry for the loading and unloading of freight, in the constructionindustry for the movement of materials and in the manufacturing industry for the assembling of heavy equipment.

2.1 MECHANICAL CRANE HISTORY

The crane for lifting heavy loads was invented by the Ancient Greeks in the late 6th century BC. The archaeological record shows that no later than c.515 BC distinctive cuttings for both lifting tongs and lewis irons begin to appear on stone blocks. Ancient Greek of Greek temples. Since these holes point at the use of a lifting device, and since they are to be found either above the center of gravity of the block, or in pairs equidistant from a point over the center of gravity, they are regarded by archaeologists as the positive evidence required for the existence of the crane. The introduction of the winch and pulley hoist soon lead to a widespread replacement of ramps as the main means of vertical motion. For the next two hundred years, Greek building sites witnessed a sharp drop in the weights handled, as the new lifting technique made the use of several smaller stones more practical than of fewer larger ones. In contrast to the archaic period with its tendency to ever-increasing block sizes, Greek temples of the classical age like the Parthenon invariably featured stone blocks weighing less than 15-20 metric tons. Also, the practice of erecting large monolithic columns was practically abandoned in favour of using several column drums.

Although the exact circumstances of the shift from the ramp to the crane technology remain unclear, it has been argued that the volatile social and political conditions of Greece were more suitable to the employment of small, professional construction teams than of large bodies of unskilled labour, making the crane more preferable to the Greek polis than the more labour-intensive ramp which had been the norm in the autocratic societies of Egypt or Assyria. The first unequivocal literary evidence for the existence of the compound pulley system appears in the *Mechanical Problems* (*Mech*. 18, 853a32-853b13) attributed toAristotle (384–322 BC), but perhaps composed at a slightly later date. Around the same time, block sizes at Greek temples began to match their archaic predecessors again, indicating that the more sophisticated compound pulley must have found its way to Greek construction sites by then.

2.2 ANCIENT ROME

Reconstruction of a 10.4m high Roman *Polyspastos* powered by a treadwheel at Bonn, Germany The heyday of the crane in ancient times came during the Roman Empire, when construction activity soared and buildings reached enormous dimensions. The Romans adopted the Greek

crane and developed it further. We are relatively well informed about their lifting techniques, thanks to rather lengthy accounts by the engineers Vitruvius(*De Architectura* 10.2, 1-10) and Heron of Alexandria (*Mechanica* 3.2-5). There are also two surviving reliefs of Roman treadwheel cranes, with the Haterii tombstone from the late first century AD being particularly detailed. The simplest Roman crane, the *trispastos*, consisted of a single-beam jib, a winch, a rope, and a block containing three pulleys. Having thus a mechanical advantage of 3:1, it has been calculated that a single man working the winch could raise 150 kg (3 pulleys x 50 kg = 150), assuming that 50 kg represent the maximum effort a man can exert over a longer time period. Heavier crane types featured five pulleys (*pentaspastos*) or, in case of the largest one, a set of three by five pulleys (*Polyspastos*) and came with two, three or four masts, depending on the maximum load. The *polyspastos*, when worked by four men at both sides of the winch, could readily lift 3,000 kg (3 ropes x 5 pulleys x 4 men x 50 kg = 3,000 kg). If the winch was replaced by a treadwheel, the maximum load could be doubled to 6,000 kg at only half the crew, since the treadwheel possesses a much bigger mechanical advantage due to its larger diameter. This meant that, in comparison to the construction of the Egyptian Pyramids, where about 50 men were needed to move a 2.5 ton stone block up the ramp (50 kg per person), the lifting capability of the Roman *polyspastos* proved to be *60 times*higher (3,000 kg per person).

However, numerous extant Roman buildings which feature much heavier stone blocks than those handled by the *polyspastos* indicate that the overall lifting capability of the Romans went far beyond that of any single crane. At the temple of Jupiter at Baalbek, for instance, the architrave blocks weigh up to 60 tons each, and one cornercornice block even over 100 tons, all of them raised to a height of about 19 m. In Rome, the capital block of Trajan's Column weighs 53.3 tons, which had to be lifted to a height of about 34 m (see construction of Trajan's Column). It is assumed that Roman engineers lifted these extraordinary weights by two measures (see picture below for comparable Renaissance technique): First, as suggested by Heron, a lifting tower was set up, whose four masts were arranged in the shape of a quadrangle with parallel sides, not unlike a siege tower, but with the column in the middle of the structure (*Mechanica* 3.5). Second, a multitude of capstans were placed on the ground around the tower, for, although having a lower leverage ratio than treadwheels, capstans could be set up in higher numbers and run by more men (and, moreover, by draught animals). This use of multiple capstans is also described by Ammianus Marcellinus (17.4.15) in connection with the lifting of the Lateranense obelisk in the Circus Maximus (ca. 357 AD). The maximum lifting capability of a single capstan can be established by the number of lewis iron holes bored into the monolith. In case of the Baalbek architrave blocks, which weigh between 55 and 60 tons, eight extant holes suggest an allowance of 7.5 ton per lewis iron, that is per capstan. Lifting such heavy weights in a concerted action required a great amount of coordination between the work groups applying the force to the capstans

3. PROBLEM DEFINATION

In our paper there is not a more problem.but the problem we find is that as our paper is a combination of pallet truck and crane machine we have made pallet truck and their arises a problem of speed we were not getting a higher speed which we want and the lifting capacity was also less thus in paper we overcome the problem by making crane machine and we get the speed and our lifting capacity also increases. thus now the problem is only that the combination of pallet truck and crane machine is not working.

4. METHODOLOGY

4.1 ELEMENTS OF MECHANICAL CRANE

4.1.1 REDUCTION GEAR BOX

A machine consists of a power source and a power transmission system, which provides controlled application of the power. Merriam-Webster defines *transmission* as an assembly of parts including the speed-changing gears and the propeller shaft by which the power is transmitted from an engine to a live axle. Often transmission refers simply to the gearbox that uses gears and gear trains to provide speed and torque conversions from a rotating power source to another device. In British English, the term transmission refers to the whole drive train, including clutch, gearbox, prop shaft (for rear-wheel drive), differential, and final drive shafts. In American English, however, the distinction is made that a gearbox is any device which converts speed and torque, whereas a transmission is a type of gearbox that can be “shifted” to dynamically change the speed-torque ratio such as in a vehicle. A reduction gear box is used to reduce an input speed to a slower output speed and more output torque. It is a wheel work consisting of a connected set of rotating gears by which power is transmitted or motion or torque is changed. We can manufacture and supply single stage, double stage or multistage gear boxes having Single and multiple.

FIG.1.0:REDUCTION GEAR BOX

From Low Speed to High Speed, technicalities of our Reduction Gear Boxes are:-

Casing / Housing / Structure Material	Steel Fabricated
Gear Material	Forged and forged blank EN-9, EN-19, EN-24 Steel
Gear Type	Spur, Single & Double Helical Gears upto 2500mm Dia
Normal Input Load Range	From 200 H.P. upto 2000 H.P. Drives
Maximum Peak Load	6000 H.P.

Size Range	150mm PCD upto 750mm PCD
Speed	50 RPM to 1500 RPM
All Shafts Material	Forged Class-IV
Anchor / foundation bolts	Carbon Steel

4.1.1.1 SPECIAL FEATURES: -

- Gear boxes are designed as per ASTM/DIN/ Indian standards
- Heavy duty and sturdy design of gear box and gears which is suitable to bear overloads
- Complete structure of Gear Box is MIG Welded which is tested by non-destructive weld testing
- Complete casing / housing / structure of the Gear Box is Stress relieved and fully aligned
- Casing / housing / structure of the Gear Box is horizontal split type
- All Gears are Ultrasonic Tested, duly hardened ground
- Rated torque, rated speed, torsional stiffness, and backlash are some of the points considered while designing a gear box
- All Pitches of the gears are precisely checked and trialed
- Genuine and Branded Heavy Duty Antifriction Spherical Roller Bearings are installed after thorough calculation
- Double Oil Seals complete with Internal & External Pipeline for lubrication of Gears & Bearings is provided
- Forced cooling arrangement / duplex type with inter locking system is provided
- Inspection window at various levels is provided for proper viewing of gears inside the gear box
- Flow indicator, temperature indicator and proper interlocking with mill is done
- Vent Pipes are provided for release of heat and oil from inside the Gear Box
- 72 Hour Non-stop trial of gear box is done on various speeds before dispatch
- Vibration, voice and lapping levels are thoroughly checked on trial before dispatch

4.1.2 ELECTRIC MOTOR

An electric motor is an electromechanical device that converts electrical energy into mechanical energy.Most electric motors operate through the interaction of magnetic fields and current-carrying conductors to generate force. The reverse process, producing electrical energy from mechanical energy, is done by generators such as an alternator or a dynamo; some electric motors can also be used as generators, for example, a traction motor on a vehicle may perform both tasks. Electric motors and generators are commonly referred to as electric machines.Electric motors are found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives. They may be powered by direct current, *e.g.*, a battery powered portable device or motor vehicle, or by alternating current from a central electrical distribution grid or inverter. Small motors may be found in electric wristwatches. Medium-size motors of highly standardized dimensions and characteristics provide convenient mechanical power for industrial uses. The very largest electric motors are used for propulsion of ships, pipeline compressors, and water pumps with ratings in the millions of watts.

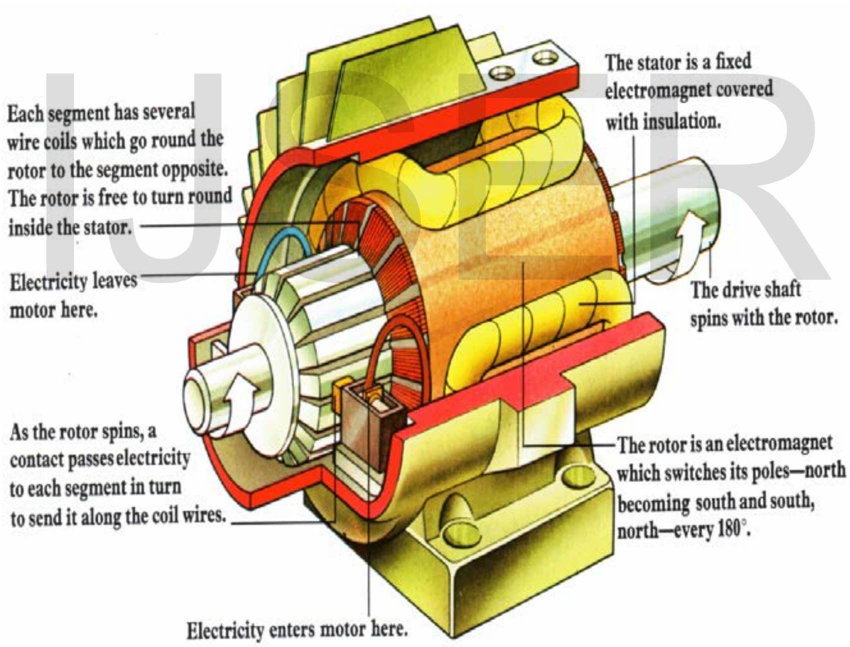

FIG.2.0: ELECTRIC MOTOR

4.1.3 BEVEL GEAR

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. Two important concepts in gearing are pitch surface angle and pitch. The pitch surface of a gear is the imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the shape of a cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis.The most familiar kinds of bevel gears have pitch angles of less than 90 degrees and therefore are cone-shaped. This type of bevel gear is called external because the gear teeth point outward. The pitch surfaces of meshed external bevel gears are coaxial with the gear shafts; the apexes of the two surfaces are at the point of intersection of the shaft axes.Bevel gears that have pitch angles of greater than ninety degrees have teeth that point inward and are called internal bevel gears.Bevel gears that have pitch angles of exactly 90 degrees have teeth that point outward parallel with the axis and resemble the points on a crown. That's why this type of bevel gear is called a crown gear.

FIG.3.0:BEVEL GEAR

4.1.4 LEAD SCREW

A screw is a mechanism that converts rotational motion to linear motion, and a torque (rotational force) to a linear force. It is one of the six classical simple machines. The most common form consists of a cylindrical shaft with helical grooves or ridges called *threads* around the outside. The screw passes through a hole in another object or medium, with threads on the inside of the hole that mesh with the screw's threads. When the shaft of the screw is rotated relative to the stationary threads, the screw moves along its axis relative to the medium surrounding it; for example rotating a wood screw forces it into wood. In screw mechanisms, either the screw shaft can rotate through a threaded hole in a stationary object, or a threaded collar such as a nut can rotate around a stationary screw shaft. Geometrically, a screw can be viewed as a narrow inclined plane wrapped around a cylinder. Other mechanisms that use the same principle, also called screws, don't necessarily have a shaft or threads. For example, a corkscrew is a helix-shaped rod with a sharp point, and an Archimedes' screw is a water pump that uses a rotating helical chamber to move water uphill. The common principle of all screws is that a rotating helix can cause linear motion.A screw can amplify force; a small rotational force (torque) on the shaft can exert a large axial force on a load. The smaller the pitch, the distance between the screw's threads, the greater the mechanical advantage, the ratio of output to input force. Screws are widely used in threaded fasteners to hold objects together, and in devices such as screw tops for containers, vises, screw jacks and screw presses.

FIG.4.0: LEAD SCREW

4.1.5 PULLEY

A pulley is a wheel on an axle that is designed to support movement of a cable or belt along its circumference. Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power.A pulley is also called a sheave or drum and may have a groove between two flanges around its circumference. The drive element of a pulley system can be a rope, cable, belt, or chain that runs over the pulley inside the groove.Hero of Alexandria identified the *pulley* as one of six simple machines used to lift weights. Pulleys are assembled to form a block and tackle in order to provide mechanical advantage to apply large forces. Pulleys are also assembled as part of belt and chain drives in order to transmit power from one rotating shaft to another.

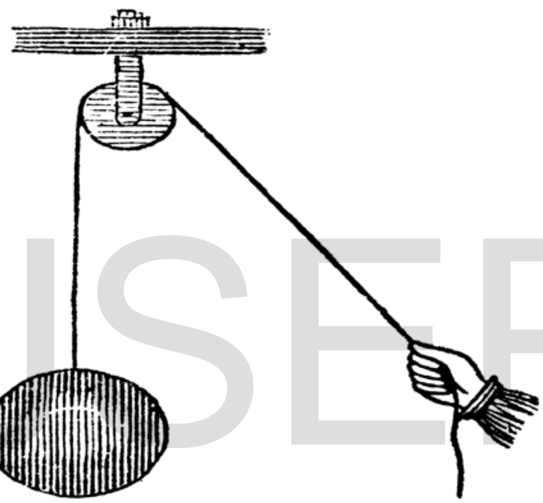

FIG.5.0: PULLEY

4.1.6 BELT AND ITS TYPES:

BELT: Power transmitted between a belt and a pulley is expressed as the product of difference of tension and belt velocity

$$P = (T_1 - T_2)v$$

where, T_1 and T_2 are tensions in the tight side and slack side of the belt respectively. They are related as:

$$\frac{T_1}{T_2} = e^{\mu\alpha}$$

where, μ is the coefficient of friction, and α is the angle subtended by contact surface at the centre of the pulley.

TYPES OF BELT:

FLAT BELT

The drive belt: used to transfer power from the engine's flywheel. Here shown driving a threshing machine. Flat belts were widely used in the 19th and early 20th centuries in line shafting to transmit power in factories.[2] They were also used in countless farming, mining, andlogging applications, such as bucksaws, sawmills, threshers, siloblowers, conveyors for filling corn cribs or haylofts, balers, water pumps (for wells, mines, or swampyfarm fields), and electrical generators.

ROUND BELT

Round belts are a circular cross section belt designed to run in a pulley with a 60 degree V-groove. Round grooves are only suitable for idler pulleys that guide the belt, or when (soft) O-ring type belts are used. The V-groove transmits torque through a wedging action, thus increasing friction. Nevertheless, round belts are for use in relatively low torque situations only and may be purchased in various lengths or cut to length and joined, either by a staple, a metallic connector (in the case of hollow plastic), glueing or welding (in the case of polyurethane). Early sewing machines utilized a leather belt, joined either by a metal staple or glued, to great effect.

V-BELT

A belt is a loop of flexible material used to link two or more rotating shafts mechanically. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys. In a two pulley system, the belt can either drive the pulleys in the same direction, or the belt may be crossed, so that the direction of the shafts is opposite. As a source of motion, a conveyor belt is one application where the belt is adapted to continuously carry a load between two points. Vee belts (also known as V-belt or wedge rope) solved the slippage and alignment problem. It is now the basic belt for power transmission. They provide the best combination of traction, speed of movement, load of the bearings, and long service life.

ISSN 2229-5518

They are generally endless, and their general cross-section shape is trapezoidal(hence the name "V"). The "V" shape of the belt tracks in a mating groove in the pulley (or sheave), with the result that the belt cannot slip off. The belt also tends to wedge into the groove as the load increases—the greater the load, the greater the wedging action—improving torque transmission and making the V-belt an effective solution, needing less width and tension than flat belts. V-belts trump flat belts with their small center distances and high reduction ratios. The preferred center distance is larger than the largest pulley diameter, but less than three times the sum of both pulleys. Optimal speed range is 1000–7000 ft/min. V-belts need larger pulleys for their larger thickness than flat belts.

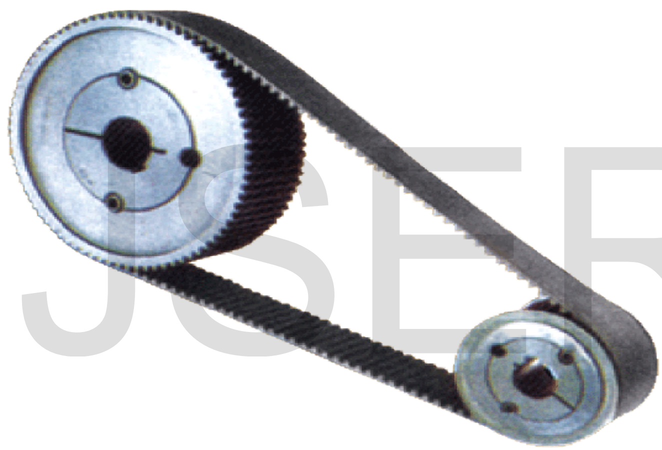

FIG.6.0:V-BELT

BELT FRICTION

Belt drives depend on friction to operate, but excessive friction wastes energy and rapidly wears the belt. Factors that affect belt friction include belt tension, contact angle, and the materials used to make the belt and pulleys.

BELT TENSION

Power transmission is a function of belt tension. However, also increasing with tension is stress (load) on the belt and bearings. The ideal belt is that of the lowest tension that does not slip in high loads. Belt tensions should also be adjusted to belt type, size, speed, and pulley diameters.

Belt tension is determined by measuring the force to deflect the belt a given distance per inch of pulley. Timing belts need only adequate tension to keep the belt in contact with the pulley.

BELT WEAR

Fatigue, more so than abrasion, is the culprit for most belt problems. This wear is caused by stress from rolling around the pulleys. High belt tension; excessive slippage; adverse environmental conditions; and belt overloads caused by shock, vibration, or belt slapping all contribute to belt fatigue.

SPECIFICATIONS

To fully specify a belt, the material, length, and cross-section size and shape are required. Timing belts, in addition, require that the size of the teeth be given. The length of the belt is the sum of the central length of the system on both sides, half the circumference of both pulleys, and the square of the sum (if crossed) or the difference (if open) of the radii. Thus, when dividing by the central distance, it can be visualized as the central distance times the height that gives the same squared value of the radius difference on, of course, both sides. When adding to the length of either side, the length of the belt increases, in a similar manner to the Pythagorean theorem. One important concept to remember is that as D_1 gets closer to D_2 there is less of a distance (and therefore less addition of length) until its approaches zero.

On the other hand, in a crossed belt drive the *sum* rather than the difference of radii is the basis for computation for length. So the wider the small drive increases, the belt length is higher.

FIG.7.0 COMPOUND BELT

WIRE ROPE

Wire rope is a type of rope which consists of several strands of metal wire laid (or 'twisted') into a helix. Initially wrought iron wires were used, but today steel is the main material used for wire ropes.Historically wire rope evolved from steel chains which had a record of mechanical failure. While flaws in chain links or solid steel bars can lead to catastrophic failure, flaws in the wires making up a steel cable are less critical as the other wires easily take up the load. Friction between the individual wires and strands, as a consequence of their twist, further compensates for any flaws. Steel wires for wire ropes are normally made of non-alloy carbon steel with a carbon content of 0.4 to 0.95%. The tensile forces and to run over sheaves with relatively small diameters.

STRANDS

In the so-called cross lay strands, the wires of the different layers cross each other. In the mostly used parallel lay strands, the lay length of all the wire layers is equal and the wires of any two superimposed layers are parallel, resulting in linear contact. The wire of the outer layer is supported by two wires of the inner layer. These wires are neighbours along the whole length of the strand. Parallel lay strands are made in one operation. The endurance of wire ropes with this kind of strand is always much greater than of those (seldom used) with cross lay strands. Parallel lay strands with two wire layers have the construction Filler, Seale or Warrington.

STEEL WIRE ROPE

Steel Wire Rope Ltd, part of the SWR group is one of the UK's largest supplier of stainless steel and galvanized wire ropes and cables. Since 1989, SWR have focused on providing high quality wire ropes backed with an enthusiastic approach to customer service which in itself, forms an integral Part of country ethos.SWR are proud to offer an extensive product range of wire ropes, cables and fittings for a variety of markets including: Construction, Offshore rigging, The Marine Industry and Ministry of Defence divisions. You will find our high quality steel cables and fittings on structures such as Wembley Stadium, Emirates stadium and The Hong Kong Bridge. Our customers include BAE systems, Ferrari, Maclaren and BSi.

OUR PRODUCT RANGE INCLUDES :

- General engineering Galvanised Wire Ropes 7X7, 7X19, 6X36 and non rotating.
- AISI 316 stainless steel wire ropes for Architectural, Yacht Rigging and Balustrade Systems.
- AISI 316 stainless steel fittings for use with our steel cables.
- Galvanised wire rope fittings.
- A comprehensive range of Lifting Gear products including hooks, hoists, hoist and pulley systems and a large range of Crosby shackles.
- Crane ropes from the world's leading brands such as: Casar, Teufelberger, and Python.

THE SWR DIFFERENCE

We at SWR Ltd believe in providing our customers with value for money, high quality wire rope products. We are committed to providing high levels of customer service, whilst constantly looking at ways in which we can improve your experience in dealing with us. Our dedicated sales team are on hand to offer bespoke solutions for a wide variety of applications and can provide full product advice along with guidance on the most suitable materials for any application.

SAFETY OF WIRE ROPE

The wire ropes are stressed by fluctuating forces, by wear, by corrosion and in seldom cases by extreme forces. The rope life is finite and the safety is only given by inspection for the detection of wire breaks on a reference rope length, of cross-section loss as well as other failures so that the wire rope can be replaced before a dangerous situation occurs. Installations should be designed to facilitate the inspection of the wire ropes.

Lifting installations for passenger transportation require that a combination of several methods should be used to prevent a car from plunging downwards. Elevators must have redundant bearing ropes and a safety gear. Ropeways and mine hoistings must be permanently supervised by a responsible manager and the rope has to be inspected by a magnetic method capable of detecting inner wire breaks.The lay of a wire rope describes the manner in which either the wires in a strand, or the strands in the rope, are laid in a helix.

FIG.8.0: WIRE ROPE

4.1.7 ROPE DRUM

Rope Drums, which are available in different models, shapes & sizes. These Rope Drums are precision engineered and manufactured using optimum grade raw material to ensure toughness, corrosion resistance and high durability. These Rope Drums are made from high quality of raw material which ensure durability. Avail from us a comprehensive range of precision engineered Rope Drum Hoists. These products are especially designed to meet the challenging operational and safety constraints for industrial crane applications. Our range of Rope Drum Hoists finds its application in typically every type of cranes and suitable for numerous industrial environments as well. We offer our range at the economical prices in different specifications required by the clients.

Features:

- Highly efficient
- Premium quality material
- High strength

ISSN 2229-5518

FIG.9.0: ROPE DRUM

4.1.8 ELECTIC SWITCH

Range of Reverse Forward Switches is made of premium quality raw material. Precision engineered, these switches are finished with rational designing that makes the units easy to operate and install. Our range of Reverse Forward Switches undergoes a series of quality tests at every stage to ensure that it conforms to the Industry quality standards. These Reverse Forward Switches are used in many Industrial applications due to their superior quality and features. The Reverse Forward Switches are available in a wide range.

SPECIFICATIONS

RANGE : 16A, 25A & 32A

RATED VOLTAGE: 415V AC 50Hz

ATTRIBUTES

1.Long Mechanical and Electrical life

2. High making and breaking capacity

3.Unbreakable inner plate

FIG.10: ELECTRIC SWITCH

4.1.9 BEARING

A bearing is a machine element that constrains relative motion between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may *prevent* a motion by controlling the vectors of normal forces that bear on the moving parts. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

The term "bearing" is derived from the verb "to bear" a bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise devices; their manufacture requires some of the highest standards of current technology.

PRINCIPLES OF OPERATION:

There are at least six common principles of operation:

- Plain bearing, also known by the specific styles: bushing, journal bearing, sleeve bearing, rifle bearing
- Rolling-element bearing such as ball bearings and roller bearings
- Jewel bearing, in which the load is carried by rolling the axle slightly off-center
- Fluid bearing, in which the load is carried by a gas or liquid

- Magnetic bearing, in which the load is carried by a magnetic field
- Flexure bearing, in which the motion is supported by a load element which bends.

SERVICE LIFE:

Fluid and magnetic bearings can have practically indefinite service lives. In practice, there are fluid bearings supporting high loads in hydroelectric plants that have been in nearly continuous service since about 1900 and which show no signs of wear.Rolling element bearing life is determined by load, temperature, maintenance, lubrication, material defects, contamination, handling, installation and other factors. These factors can all have a significant effect on bearing life. For example, the service life of bearings in one application was extended dramatically by changing how the bearings were stored before installation and use, as vibrations during storage caused lubricant failure even when the only load on the bearing was its own weight;[14] the resulting damage is often false brinelling. Bearing life is statistical: several samples of a given bearing will often exhibit a bell curve of service life, with a few samples showing significantly better or worse life. Bearing life varies because microscopic structure and contamination vary greatly even where macroscopically they seem identical.

4.1.9 LIFTING HOOK

Hook is used to lift any object in upward dirention

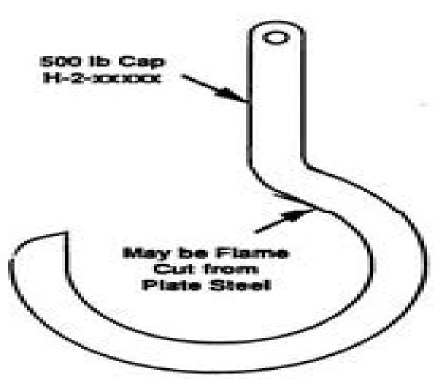

FIG.11: LIFTING HOOK

ISSN 2229-5518

4.2 MECHANICAL PRINCIPLE

Broken crane in Sermetal Shipyard, former Ishikawajima do Brasil - Rio de Janeiro. The cause of the accident was a lack of maintenance and misuse of t he equipment.Cranes can mount many different utensils depending on load (left). Cranes can be remote-controlled from the ground, allowing much more precise control, but without the view that a position atop the crane provides (right).The stability of a mobile construction crane can be jeopardized when outriggers sink into soft soil, which can result in the crane tipping over.There are three major considerations in the design of cranes. First, the crane must be able to lift the weight of the load; second, the crane must not topple; third, the crane must not rupture.

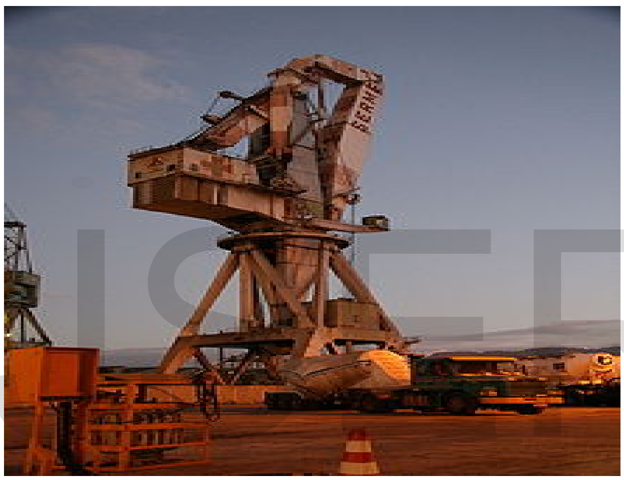

FIG.12.0: CRANE MACHINE

4.2.1 LIFTING CAPACITY

- Cranes illustrate the use of one or more simple machines to create mechanical advantage.
- The lever. A balance crane contains a horizontal beam (the *lever*) pivoted about a point called the *fulcrum*. The principle of the lever allows a heavy load attached to the shorter end of the beam to be lifted by a smaller force applied in the opposite direction to the longer end of the beam. The ratio of the load's weight to the applied force is equal to the ratio of the lengths of the longer arm and the shorter arm, and is called the mechanical advantage.
- The pulley. A jib crane contains a tilted strut that supports a fixed pulley block. Cables are wrapped multiple times round the fixed block and round another block attached to the load. When the free end of the cable is pulled by hand or by a winding machine, the pulley system

ISSN 2229-5518

delivers a force to the load that is equal to the applied force multiplied by the number of lengths of cable passing between the two blocks. This number is the mechanical advantage.

- The hydraulic cylinder. This can be used directly to lift the load or indirectly to move the jib or beam that carries another lifting device.
- Cranes, like all machines, obey the principle of conservation of energy. This means that the energy delivered to the load cannot exceed the energy put into the machine. For example, if a pulley system multiplies the applied force by ten, then the load moves only one tenth as far as the applied force. Since energy is proportional to force multiplied by distance, the output energy is kept roughly equal to the input energy (in practice slightly less, because some energy is lost to friction and other inefficiencies).
- The same principle can operate in reverse. In case of some problem, the combination of heavy load and great height can accelerate small objects to tremendous speed. Such projectiles can result in severe damage to nearby structures and people. Cranes can also get in chain reactions; the rupture of one crane may in turn take out nearby cranes. Cranes need to be watched carefully.

STABILITY

For stability, the sum of all moments about any point such as the base of the crane must equate to zero. In practice, the magnitude of load that is permitted to be lifted (called the "rated load" in the US) is some value less than the load that will cause the crane to tip (providing a safety margin). Under US standards for mobile cranes, the stability-limited rated load for a crawler crane is 75% of the tipping load. The stability-limited rated load for a mobile crane supported on outriggers is 85% of the tipping load. Standards for cranes mounted on ships or offshore platforms are somewhat stricter because of the dynamic load on the crane due to vessel motion. Additionally, the stability of the vessel or platform must be considered.For stationary pedestal or kingpost mounted cranes, the moment created by the boom, jib, and load is resisted by the pedestal base or kingpost. Stress within the base must be less than the yield stress of the material or the crane will fail.

4.3 CALCULATION:

Given data: N1=1440 rpm, P=1hp=0.7457kw,D1=0.078m,r1=0.039,D2=.15m,r2=0.075m

Wire length=20ft=6.1m, diameter of wire(dw)=8mm, type of wire rope=(6*7)

1.velocity ratio :N1/N2=D2/D1,using values in formula we get,N2=748.8rpm say 750 rpm.

2.Length of the belt:

L= Π (r1+r2)+2 Π +(r2-r1)^2/x. using values in formula we get,

L=0.718m.

3.Drum speed=speed ratio of reduction gear* input speed to reduction gear in rpm

(1/40)*(750)=18.75rpm

4.Average weigth=0.0347dw^2=2.2208*10^(-6)N/m

5.Tensile strength=(1600mpa)=530d^2=0.03392N,(1800mpa)=600mpa=0.0384N

6.Direct stress= σ d=(W+w)/A using values in formula we get,

σ d=19.66mpa

7.Bending stress= σ b =(Er*dw)/D using values in formula we get,

σ b=4480mpa

8.Acceleration of wire=(v/60t)=4.45*10^-3m/s^2

9.Accelerated weigth=wa=((W+w)/g)*a=0.448N

10.Accelerated stress= σ a =((W+w)/g)*(a/A)=8.919*10^-3 N

4.4 ADVANTAGES OF A PALLET TRUCK

Advantage lubricating or for using a pallet truck is the maintenance cost is much cheaper than a forklift. Since there are two types of pallet truck to be choose whether manual or electric powered, both will require siple service such as changing the battery which only a few dollar. The pallet truck also requires only small space for storage and do not require lots of training to use it.A great idea is the adjustable width pallet jack, as it will save you money and space. Pallet truck is a device widely used in industrial sector and some supermarket to lift and move packages. The device works by lifting the packages using a hydraulic system installed at the front of the jack to raise your package slightly above the ground to be moved. There are lots of pallet trucks for you to choose made available in the market nowadays depending on the type of package you are handling and their weight.

4.5 ADVANTAGES OF MECHANICAL CRANE

Cranes are widely used these days. There is no doubt that in every construction site or even in the complex movie productions, the use of crane is highly a machine that is well-designed and efficient to use in carrying or lifting objects from one place to another. There are different forms and shapes of cranes for sale Chicago which is use for various kinds of work.Can be use in terrain areasIt can travel well either on public highways or in rough-terrain roads. Both its engine and rubber tires are intended for long travels and heavy works. It is very safe to use whenever you are trying to move weighty and bulky recommended. In situation *where heavy lifting is involved it is more likely that equipment like cranes need to be an option.* Crane is a universal equipment or things around. It doesn't choose whether it is of tons or just in kilos, its advanced safety way or carrying and loading things make it the best option for constructions or simple workloads at home. This amazing feature of cranes makes it very accessible for any situations. It can be maneuvered and used in confined and small areas. It is much the same of a robot just like we have seen on fiction movies. However, it doesn't make any difference to how it works, though it's small and miniature it still continue to function the way it supposed to be.This can be one of the best features of these are in a remote place and having a hard time looking for a gasoline station, using a battery is very cranes because it can be operated with the use of electricity, battery and gas or diesel. Whether you well applicable. It won't disappoint you in every possible situation. It can work for you any time and in anywhere.

REFERENCES:

[1] J. C. Centena, “Diseño de una grúa automontable de 8.000 N y 22 m de flecha”. Escola Tècnica Superior d’Enginyeria Industrial de Barcelona. B. Sc.Thesis Industrial engineering.

[2] M. Z. Othman, “A new approach for controlling overhead travelling crane using rough controller” International Journal of Intelligent technology, Vol. 1, No. 3, 2006.

[3] R. Toxqui Toxqui. “Control con anti-oscilación para una Grúa en tres dimensiones en tiempo real”. Ph.D. Thesis Automatic Control CINVESTAV, México, D. F. 2006.

[4] R. Toxqui , Wen Yu, Xiaoou Li. “PD Control of Overhead Crane with Velocity Estimation and Uncertainties Compensation”. Proceedings of the 6th World Congress on Control and Automation, June 21 - 23, 2006, Dalian, China.

[5] J. Rubio, J. Jaimes P. and R. Alcántara R., “Sliding Mode Control for a New Crane System”, unpublished 2007.

[6] Nally M. J. and M. B. Tarbia, “Design of a Fuzzy Logic Controller for Swing-Damped Transport of an Overhead Crane Payload,” in Proceedings of the ASME Dynamic Systems and Control Division, DSC Vol. 58, 1994.

[7] Mahfouf M., Kee C.H., and Linkens D.A., “Fuzzy Logic-Based AntiSway Control Design for Overhead Cranes,” Neural Computing and Applications, Vol. 9, 2000.

[8] Ho-Hoon Lee and Sung-Kun C. “A Fuzzy-Logic Antiswing Controller for Three-Dimensional Overhead Cranes”, Tulane University, USA, 2002.

[9] Chunshien Li and Chun-Yi Lee. “Fuzzy Motion Control of an AutoWarehousing Crane System”. IEEE Trans. on Ind. Electronics, Vol. 48, No. 5, October 2001.

[10] Hanafy M. Omar. “Control of Gantry and Tower Cranes”. Dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Engineering Mechanics.

[11] Ho-Hoon Lee. “A New Motion-Planning Scheme for Overhead Cranes With High-Speed Hoisting”. Journal of Dynamic Systems, Measurement, and Control June 2004, Vol. 126.

[12] Joaquín Costa Centena, “Diseño de una grúa automontable de 8.000 N y 22 m de flecha”. Escola Tècnica Superior d’Enginyeria Industrial de Barcelona. Tesis para obtener el título de Ingeniero Industrial.

[13]Mazin Z. Othman. A New Approach for Controlling Overhead Traveling Crane Using Rough Controller - INTERNATIONAL JOURNAL OF INTELLIGENT TECHNOLOGY VOLUME 1 NUMBER 3 2006 ISSN 1305-6417.

[14] Rigoberto Toxqui Toxqui. “Control con anti- oscilación para una Grúa en tres dimensiones en tiempo real”. CINVESTAV. Tesis para obtener elgrado de Doctor en Ciencias en la especialidad de Control Automático. Agosto del 2006.

[15] Rigoberto Toxqui , Wen Yu, Xiaoou Li. “PD Control of Overhead Crane with Velocity Estimation and Uncertainties Compensation”. Proceedings of the 6th World Congress on Control and Automation, June 21 - 23, 2006, Dalian, China.

[16] J. de Jesus Rubio, J. Jaimes P. y R. Alcántara R., “Sliding Mode Control for a New Crane System”, paper aceptado (# IS 2 - 09) para ser presentado en forma oral en la sesión Sliding mode control de la 13th IEEE International Conference on Methods and Models in Automation and Robotics, Szczecin, Poland, August 2007.