SCRAP HANDLING BY OVERHEAD ELECTROMAGNETIC CRANE

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Abstract –***The main aim of this paper is to study various manufacturing industry a large fraction of the work is repetitive and judicious application of automation will most certainly result in optimum utilization of machine and manpower. Electromagnetic overhead Crane has been developed to achieve automation in applications where the great sophistication is not needed and simple tasks like picking up of scraps at one location and placing them at another location can be done with great ease. Overhead Electromagnetic Crane as a machine of risky metal scraps dumping on truck and best handling machine. Electromagnetic crane through work totally safe against human accident and next main advantage sound and smoke less pollution free work. This machine most use ship breaking yard steel scrap merchant and metal industries.***

1. INTRODUCTION

As we see in the many industries that the movement of heavy equipment or metals sheet is very tedious task and a huge laboursand a lot of time is required to move from one place to desire place. So it’s complicated, uneconomical and also risky

.To overcome this problem a machine is used which is called CRANE.Crane is a mechanical device in which lever, pulley, rope, hook & engine are used like as hydraulic crane, electromagnetic crane etc.By the help of electromagnetic crane we can move heavy metals (mainly metal scrap) from one place to another place very easily, it reduce working time, force and money. it can be operated by a single person so its reduce the need of labours.

It uses simple machines to create mechanical advantage which helps to move loads beyond the normal capability of a human. Cranes are commonly used in the transport industry, in the construction industry and in the manufacturing industry. The overhead cranes handle and transfer heavy loads from one position to another.

Electric overhead travelling cranes are widely used in many industries for lifting the safe working load. The escalating price of structural material is a global problem. Many small scale industries purchase the existing electric overhead cranes from bigger industries and make the required modification to suit their requirement.

Many small scale industries purchase the existing electric overhead cranes from bigger industries and make the required modification to suit their requirement. The magnetic strength of an electromagnet depends on the number of turns or wire and the current through the wire, and the size of the iron core. This allows electromagnets to be made much larger and stronger than a natural magnet, such that they can pick up very large objects. Also, when you turn off the electricity to an electromagnet, the magnetism is also turned off. Thus, an electromagnet can be used to pick up a piece of iron and then drop it someplace.

2. TYPESOF OVERHEAD CRANES

There are various types of overhead cranes with many being highly speciali zed,
but the great majority of installations fall into one of four categories

1 Single Girder Cranes - The crane consists of a single bridge girder supported on two end trucks. It has a trolley hoist mechanism that runs on the bottom flange of the bridge girder.

2. Double Girder Bridge Cranes - The crane consists of two bridge girders supported on two end trucks. The trolley runs on rails on the top of the bridge girders.

3. gantry Cranes - These cranes are essentially the same as the regular overhead cranes except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runways. These “legs” eliminate the supporting runway and column system and run on a rail either embedded in, or laid on top of the floor.

4. Monorail - For some applications such as production assembly line or service line, only a trolley hoist is required. This type of crane is designed using I-beams like those found in ceiling structures of many factories. The trolleys run along the flat surface on the bottom horizontal bars of the beam. The hoisting mechanism is similar to a single girder crane with the difference that the crane doesn't have a movable bridge and the hoisting trolley runs on a fixed girder.

Based on the CMAA (Crane Manufacturers Association of America) specifications, both single and double girder cranes are equally rigid, strong, and durable. The principle difference between single and double girder cranes is hook height (how far above the floor your hoist will lift). Double girder cranes typically allow 18-36 inches higher lift, because the hoist is placed between the cross girders rather than under them. Therefore, the depth of the cross girder is gained in switching to double girders

3. BASIC COMPONENTS OF OVERHEAD CRANE

Girders

Besides the obvious variation of span and capacity, crane girders of various designs are in common use. The most frequently used designs are wide flange beams, capped structural beams, box girders and lattice girders. Box girder is the most popular girder design used in overhead travelling crane because of its design efficiency. Box type girders constructed from structural steel plate. Full depth stiffeners and additional partial depth stiffeners welded to webs and bearing on cover plates contribute to the internal strength of the girders. The trolley travels on the cross travel rails mounted on the girders.

These girders are designed so that they will take the vertical load and the deflection of these girders is within the permissible limit. These girders provide assess for mounting electric panels and platforms are welded to them. The girders are designed with positive pre-camber and the vertical deflection due to the working load and the trolley weight in the central position shall not exceed 1/900 of the span.

End Carriage

End carriages are located on both sides of the girder. They house the wheels on which the entire crane travels. It consists of structural members, wheels, bearings, axles, etc., which supports the bridge. Wheel base of the end carriage assembly shall be not less than 1/7 of the bridge span.

Hoist Machinery

The Hoist Mechanism is an assembly of motor, gearbox, brake, coupling, drum, wire rope and bottom block. The bottom block consists of sheave assembly which supports a swivelling hook. The hook block is suspended from drum through wire rope. Selection of wire rope size depends on load to be lifted and the number of rope falls. Depending upon rope reeving arrangement either rope balancer or equalizer sheave may be provided on the trolley frame.

Long Travel Machinery

The long travel mechanism is a unit consisting of a motor drive, coupling, brakes, gearing & wheels designed to travel the whole crane in either direction. Crane wheels are generally double flanged. However Flange-less wheels with guide rollers are also used. Long travel mechanism is mounted to the bridge assembly.

4 BASIC ELECTROMAGNETIC DESCRIPTION

Magnetization

The magnetization of an object is the local value of its magnetic moment per unit volume, usually denoted M, with units A/m. It is a vector field, rather than just a vector (like the magnetic moment), because the different sections of a bar magnet generally are magnetized with different directions and strengths (for example, due to domains, see below). A good bar magnet may have a magnetic moment of magnitude 0.1 A•m² and a volume of 1 cm³, or 0.000001 m³, and therefore an average magnetization magnitude is 100,000 A/ m. Iron can have a magnetization of around a million A/m. Such a large value explains why magnets are so effective at producing magnetic fields.separate the north and south poles, the result will be two bar magnets, each of which has both a north and south pole.

Physics of paramagnetism

In a paramagnetic material there are unpaired electrons, i.e. atomic or molecular orbitals with exactly one electron in them. While paired electrons are required by the Pauli exclusion principle to have their intrinsic ('spin') magnetic moments pointing in opposite directions, causing their magnetic fields to cancel out, an unpaired electron is free to align its magnetic moment in any direction. When an external magnetic field is applied, these magnetic moments will tend to align themselves in the same direction as the applied field, thus reinforcing it.

5. LITERATURE REVIEW

YogiRaval, in "Design analysis and improvement of EOT crane", analyzed the crane wheel for optimum size. Using FE as a optimization tool, the optimization of the crane wheel size is carried out. [1]

AbhinaySuratkar and Vishal Shukla, "3D Modeling and finite element analysis of EOT crane" made a comparison between the analytical calculations and FE analysis. As a result of study they have proposed the design optimization method for overhead crane. [2]

Patil P. and Nirav K. in "Design and analysis of major components of 120T capacity of EOT crane" analyzed various components of crane like wheels, pulleys, rope drum and girder. They have done the manual calculations using Indian standards and on the basis of these calculations 3D modeling and analysis has been carried out. For modeling they have used Creo software and ANSYS as analysis software.[3]

Rudenko N, in the book of Material Handling Equipment briefed the structure of overhead travelling crane. The structure of an overhead travelling crane with a plate girder is composed of two main longitudinal girders assembled with the two end carriages which accommodate the travelling wheels. The main factors in the solution of plate girders are the safe unit bending stress and the permissible girder deflection. The vertical loads on the girders are dead weights and the force exerted by the wheel of the trolley carrying the maximum load.[5]

In IS: 4137- 1985 various factors are mentioned which are helpful in the design of crane components. The preferred wheel diameters and the formula for obtaining the wheel sizes are also stated in this Indian standard.[6]

IS 13834 (Part 1) provides a general classification of cranes based on the number of operating cycles to be carried out and a load spectrum factor.[8]

In IS: 807 [2006] Design, erection and testing (structural portion) of crane and hoist- code of practice, various design parameters for structure of overhead cranes are mentioned.[10]

In IS: 3177-1999, various factors like drive efficiency, average acceleration, friction factors for anti-friction bearings etc. are mentioned which is very important in calculating the required mechanical power.[11]

6.COMPONENTS UNDER STUDY

The components which depend on span are long travel wheel, long travel machinery which includes motor brake gearbox rating. Also the structural members like girder and end carriage are depending on span of crane. In order to calculate the sizes of components and power required basic data are collected

Data Collected for Crane Components

The most important criteria in selecting the magnet for your application are:

- Type of Material to be Handled
- Physical and Electrical Capabilities
- Material Temperature
- Duty Cycle

Magnets and their related power equipment are interdependent on one another and, properly matched and maintained, work together to offer high
productivity and long life. Therefore, selecting the magnet controller, generator, or DC power supply that are right for your magnet is quite important. Ohio Magnetics power equipment is alldesigned for the toughest applications, and therefore, can bematched to your magnet selection by simply knowing the volts,
amperes, and kilowatt requirements.

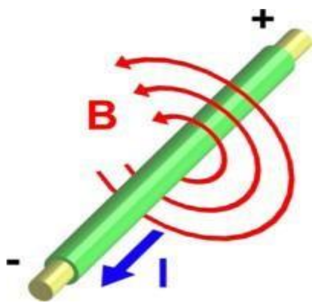
MAGNET CONTROLLERS

Most magnets operate at 230 VDC which is the optimum DC voltage for magnet designs. For selecting the proper controller, youneed only select a size that will accommodate the cold amperagedraw of the magnet. Other voltages are available upon request fromthe Ohio Magnetics' factory and would be based upon the voltage
and amperes specified for your

CONSTRUCTION OF ELECTROMAGNET

Electromagnet construction for required MS (Metal of Still) rods or plates. Still rod on winding electrical copper wire different -different gravity for winding will change of type. An electromagnet is a type of magnet in which the magnetic field is produced by the flow of an electric current. The magnetic field disappears when the current ceases. British electrician William Sturgeon invented the electromagnet in 1825. The first electromagnet was a horseshoe-shaped piece of iron that was wrapped with a loosely wound coil of several turns. When a current was passed through the coil; the electromagnet became magnetized and whenmagnetic field established between them. Magnets are found in nature in all sorts of shapes and chemical constitution. Magnets used in industry are artificially made. Magnets that sustain their magnetism for long periods of time are denominated "permanent magnets." These are widely used in several types of electric rotating machines, including synchronous machines the current was stopped the coil was de-magnetized. Sturgeon displayed its power by lifting nine pounds with a seven-ounce piece of iron wrapped with wires through which the current of a single cell battery was sent. type of core material being used, and if we increase either the current or the number of turns we can increase the magnetic field strength, symbol H.

Previously, the relative permeability, symbol μ) r was defined as the product of the absolute permeability μ) and the permeability of free space μ) o (a vacuum) and this was given as a constant. However, the relationship between the flux density, B and flux density, H can be defined by the fact that the relative permeability, μ) r is not a constant but a function of the magnetic field intensity thereby giving magnetic flux density as: B = μ) H. Then the magnetic flux density in the material will be increased by a larger factor as a



result of its relative permeabilityfield strength (B/H) is not constant but varies with flux density. However, for air cored coils or any non-magnetic medium core such as woods or plastics, this ratio can be considered as a constant and this constant is known as μ) o, the permeability of free space, (μ) o = 4.π.10-7 H/m). By plotting values of flux density, (B) against the field strength, (H) we can produce a set of curves called Magnetisation Curves, Magnetic Hysteresis Curves or more commonly B-H Curves for each type of core material .

7.STRUCTURE OF ELECTRO MEGNET

Electromagnetic is use in different industries like medical use, appliances and good manufacturing, heavyengineering
and crane industries electromagnet is a operate on electricalsupply AC or DC.

PRINCIPLE OF ELECTROMAGNET

First electromagnet has discovered since 1800 Centre
old doctor J.J. Thomson from America he decide electrons atom road in same path up MS material will convert magnet. So according to J.J.Tomson electric atom rotated MS material than electrical atom rotated to magnetic energy.
So electro magnetic principle is a electrical energy is a covert to magnetic energy is a electro magnet.

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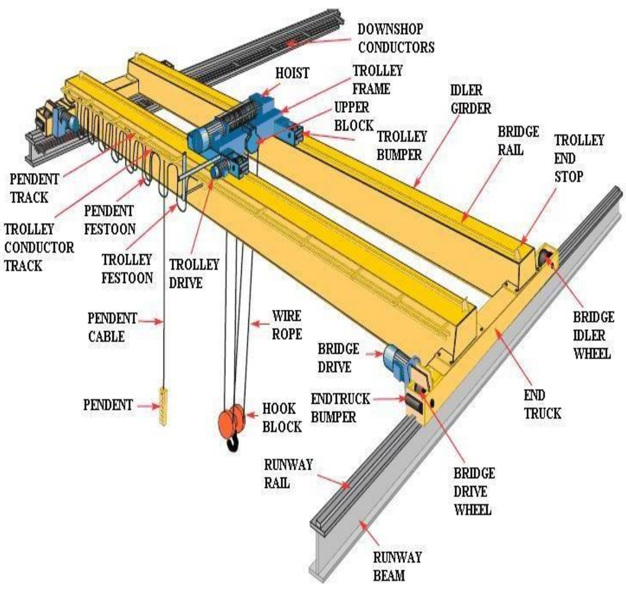
Much stronger magnetic fields can be produced if a "core" of paramagnetic or ferromagneticmaterial (commonly soft iron) is placed inside the coil. Thecore concentrates the magnetic field that can then be muchstronger than that of the coil itself.

Current (I) flowing through a wire produces a magnetic field.
(B) around the wire. The field is oriented according to the left-hand rule.
Magnetic fields caused by coils of wire follow a form of the left-hand rule. If the fingers of the left hand are curled in the direction of current flow through the coil, the thumb points inthe direction of the field inside the coil. The side of themagnet that the field lines emerge from is defined to be theNorth Pole.

ELECTROMAGNET AND PERMANENT MAGNET

The main advantage of an electromagnet over a permanent magnet is that the magnetic field can be rapidly manipulated over a wide range by controlling the amount of electriccurrent. However, a continuous supply electrical energy isrequired to maintain the field.As a current is passed through the coil, small magneticregions within the material, called magnetic domains, alignwith the applied field, causing the magnetic field strength to increase.
As the current is increased, all of the domainseventually become aligned, a condition called saturation.Once the core becomes saturated, a further increase in current will only cause a relatively minor increase in the magnetic field. In some materials, some of the domains mayrealign themselves. In this case, part of the original magnetic field will persist even after power is removed, causing the core to behave as a permanent magnet. This phenomenon, called remnant magnetism, is due to the hysteresis of the material. Applying a decreasing AC current to the coil, removing the core and hitting it, or heating it above its Curie point will reorient the domains, causing the residual field to weaken or disappear. In applications where a variable magnetic field is not required, permanent magnets are generally superior. Additionally, permanent magnets can be manufactured to produce stronger fields than electromagnets of similar size.



TOP RUNNING DOUBLE GIRDER CRANE

1. Bridge - The Bridge is the principal structural component of an overhead crane. It spans the width of the building and comprises one or more load bearing beams or girders. These may be fabricated steel box -girders or rolled-steel joists. The bridge carries the hoist trolley, which travels along the length of the girders during operation.

2. Runway - The track and support system on which the crane operates. The runway girders are usually considered a part of the building structure and are designed accordingly.

3. Runway Rail - The rail supported by the runway beams on which the crane travels.

4. End trucks - Located on either side of the bridge, the end trucks house the wheels on which the entire crane travels. It is an assembly consisting of structural members, wheels, bearings, axles, etc., which supports the bridge girder(s) or the trolley cross member(s). Electric drive motors typically two- speed or variable-speed units power the wheels and move the crane into the required position. Brakes are mounted on the drive motors and are essential to prevent uncontrolled loads becoming dangerous, and are often electrically operated. Electrical limit switches cut power to the drive motors and prevent the crane from colliding with the building structure at the end of the travel range.

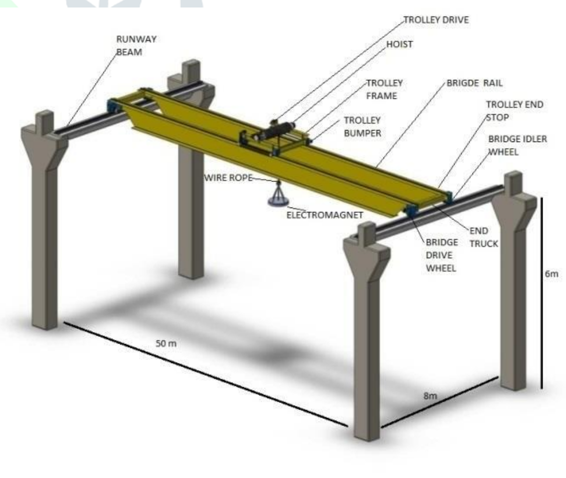
5. Hoist - The hoist mechanism is a unit consisting of a motor drive, coupling, brakes, gearing, drum, ropes, and load block designed to raise, hold and lower the maximum rated load. The hoist mechanism is mounted to the trolley.

6. Trolley or Crab - The 'crab' is the 'cross travel unit' from which the hook is lowered and raised. A top-running trolley on a double girder crane runs on rails fitted to the top of the crane bridge. An underhung trolley on a single-girder crane runs on the bottom flange of the crane beam, with drive units connected directly to the trolley. The trolley carries the electric wire rope hoist that supports the load block and hook through a system of pulleys. A variable-speed AC motor on the hoist drives the load up or down. Limit switches prevent the load block from colliding with the trolley.

7. Bumper (Buffer) - An energy absorbing device intended for reducing impact when a moving crane or trolley reaches the end of its permitted travel, or when two moving cranes or trolleys come into contact. This device may be attached to the bridge, trolley or runway stop.

8. Controls - Controls for an EOT crane are usually mounted in an operator pendant or remote console and comprise various push buttons and switches that operate relays and contactors mounted on the crane. Drive motors and the hoist motor draw substantial currents during operation and require appropriately rated contactors to switch them on and off.Variable frequency inverters provide speed control for motors where accurate positioning is essential. A master contactor is triggered by a main switch and cuts off all power to the crane if a dangerous situation occurs.

Other features on specialized cranes may include: end stops, provision of a full length platform on both girders, provision of under bridge lighting, and provision of a closed, glazed or air conditioned cabin, specialized controls, etc.



CAD MODEL

Advantage

- Easy operated
- No pollution of the media
- Maintenance free
- Easy designing
- Smooth operation
- With very much exception the crane use in any installation.

8 .CONCLUSION

Scrap handling by overhead electromagnetic crane is successfully completed. Our goal was to build a system that can handling by metallic scrap in a specific area in industry. We demonstrated the working of this system using a set of experiments. Finally, this modular system can be extended to handle different types of waste.

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