Elevator Operated Pump System

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Abstract— In this research, it has been attempted to show that some elevators work with water and their energy consumption could be reduced because of water pump usage instead of powerful gear motor of the present day elevators. Power of gear motor elevators is between 3.7 to 7.5 kw and the power of water pump elevator is 1.5 kw. Water, a tank of counter weight and water pumps operate this elevator. Consequently, it can save energy especially when two or more elevators are placed adjacent to each other. The discussion of this study concentrates on the dynamic simulation and physics of this type of elevators Elevator was worked by Water and Water Pump.

Key words: Elevator, Pump System

I. Introduction

An elevator (US and Canada) or lift (UK, Australia, Ireland, New Zealand, and South Africa, Nigeria is a type of vertical transportation that moves people or goods between floors (levels, decks) of a building, vessel, or other structure. Elevators/lifts are generally powered by electric motors that either drive traction cables and counterweight systems like a hoist, or pump hydraulic fluid to raise a cylindrical piston like a jack. In agriculture and manufacturing, an elevator/lift is any type of conveyor device used to lift materials in a continuous stream into bins or silos. Several types exist, such as the chain and bucket elevator, grain auger screw conveyor using the principle of Archimedes' screw, or the chain and paddles or forks of hay elevators. Languages other than English may have loanwords based on either elevator or lift. Elevator lobby at the Forest Glen Washington Metro station in Silver Spring, Maryland Because of wheelchair access laws, elevators/lifts are often a legal requirement in new multistory buildings, especially where wheelchair ramps would be impractical. The latest surveys have shown that the world population is constantly increasing. In addition to that following the current occupation trends, the percentage of people moving to urban areas is exponentially increasing [1, 2].Today, 54 % of the world’s population lives in urban areas [1, 2], this percentage is expected to exceed the 66% in 2050. To accommodate this huge number of people, the modern world is expecting a vast growth of urbanization. It means more and more buildings and skyscrapers will appear in coming days. Currently there are several elevators companies, which play a huge part in these buildings. Elevators are becoming an essential part of our lives. People all over the world use elevators every day in order to move in their companies, business offices.., etc. In this project the focus is to build an elevator model. It will allow studying different elevator scenarios. To grasp the in depth system principle each system part will be developed individually. The targeted elevator model will be designed by our team members in collaboration with the KONE, a Finnish elevator company. The idea is to employ the designed elevator system in future, by KONE and by the EFFAT students, as a test bed for future elevator systems studies and safety developments. This project will be as well the answer to many people and clients who want to learn more about elevators and its safety system.

II. Literature review

A. Elevator

An elevator is a transport device used to move goods or people vertically. In British English and other Commonwealth English, elevators are known more commonly as lifts, although the word elevator is familiar from American movies and television shows.

B. History of Elevator

Elevators began as simple rope or chain hoists. An elevator is essentially a platform that is either pulled or pushed up by a mechanical means. A modern day elevator consists of a cab (also called a "cage" or "car") mounted on a platform within an enclosed space called a shaft or more correctly a hoist way. In the past elevator drive mechanisms were powered by steam and water hydraulic pistons. (Wikipedia, 2 August 2005) During the middle ages, the elevator operated by animal and human power or by water-driven mechanisms. The elevator as we know it today was first developed during the 1800s and relied on steam or hydraulic plungers for lifting capability. In the latter application, the cab was affixed to a hollow plunger that lowered into an underground cylinder. Liquid, most commonly water, was injected into the cylinder to create pressure and make the plunger elevate the cab, which would simply lower by gravity as the water was removed. Valves governing the water flow were manipulated by passengers using ropes running through the cab, a system later enhanced with the incorporation of lever controls and pilot valves to regulate cab speed. The granddaddy of today's traction elevators first appeared during the 19th century in the United Kingdom, a lift using a rope running through a pulley and a counterweight tracking along the shaft wall. (Elevator Info, 1992) In the 1800s, with the advent of electricity, the electric motor was integrated into elevator technology by German inventor Werner von Siemens. With the motor mounted at the bottom of the cab, this design employed a gearing scheme to climb shaft walls fitted with racks. By 1903, this design had evolved into the gearless traction electric elevator, allowing hundred-plus story buildings to become possible and forever changing the urban landscape. Multi-speed motors replaced the original single-speed models to help with landing-leveling and smoother overall operation. Electromagnet technology replaced manual rope-driven switching and braking. Besides, Push-button controls and various complex signal systems modernized the elevator even further. Safety improvements have been continual, including a notable development by Charles Otis. (Charles Otis, 1996) Today, there are intricate governors and switching schemes to carefully control cab speeds in any situation. Buttons have been giving way to keypads. Virtually FINAL REPORT ECE492, Capstone Design Project I Spring 2016 4 all 5 commercial elevators operate automatically and the computer age has brought the microchip-based capability to operate vast banks of elevators with precise scheduling, maximized efficiency and extreme safety. Elevators have become a medium of architectural expression as compelling as the buildings, in which they are installed, and new technologies and designs regularly allow the human spirit. (Elevator Info, 1992)

C. Types of Elevator

There are three main types of elevators: traction elevators, Hydraulic elevators and climbing elevators. The Hydraulic elevator Hydraulic elevators were firstly developed throughout (1960) to (1970) and are still in use today. They were improved to lift both passengers and goods with a velocity of 0.125 m/s but mostly for a limited distance that does not exceed 6 floors.

III. CONCEPT OF PROJECT

Elevators consist of complex structural, mechanical, and electrical components. Janovsky's monograph (1993) gives a description of the engineering detail of elevator systems.

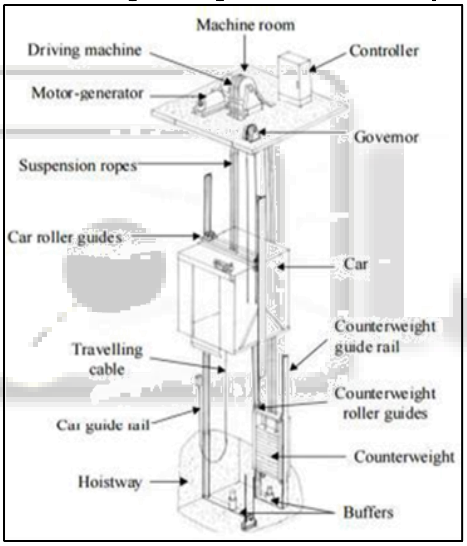

Fig. 1: Main Type of Typical Component of Traction Type Passenger Elevator

The main components of a typical traction elevator are shown in Figure.

A. Parts of System

1) Elevator,
2) Suspension rope,
3) Governor,
4) Travelling cable,
5) Buffers,
6) Controller

The car frame consists of the upper crosshead beam, two vertical uprights (stiles) joining upper and lower members, and lower safety plank, provides the supporting structure for the car. The suspension ropes are attached to the crosshead beam. The safety plank supports the car platform, on which passengers or other loads rest during travel. A pair of guide rails is placed on two opposite sides of the car, guiding the car during its vertical motion.

IV. WORKING PRINCIPLE

A. Working Principle

The energy required to make a Ram lift water to a higher elevation comes from water falling downhill due to gravity. As in all other water powered devices, but unlike a water wheel or turbine, the ram uses the inertia of moving part rather than water pressure and operates in a cycle based on the following sequences.

B. Mechanical Parts Modeling

The elevator and the counterweight are attached together by cables, that some of these cables can guide the electric current to the counterweight. The counterweight contains two parts, a tank on the top and weights on the bottom of the counterweight. The weight mass was equaled half of the Ma and Ma was assumed as the mass of elevator and half of its capacity (passenger's mass). The tank volume when filled by water completely equals the mass of elevator. Whole mass of counterweight approximately equaled one and half of Ma. The counterweight's gear wheels connected with angle profiles which look like rails for enhanced moving and brakes placed on gear wheels due to stopping while elevator car stopped. Two special pipes were placed beside the counterweight along its length. One of pipes was full of water because it was connected to the upper water reservoir and another pipe was connected the lower reservoir to Weights Small box acting as the elevator Rope Bottle Weights Iron pulley Pipe for water inlet Framework Pipe for water outlet Fig. The counterweight operation Fig. Water gate and magnetic gate before electromagnetic induction Fig. Water gate and magnetic gate after electromagnetic induction collect water from the tank of counterweight then water was pumped to the upper reservoir by the water pump. Amount of water moved from the upper reservoir to the lower reservoir had to be equal the water pumped to the upper reservoir. Mostly the upper reservoir filled by water, in contrast of the bottom reservoir often was empty. On the two pipes some gates have been placed which should be adhered to the magnetic gates of counterweight.

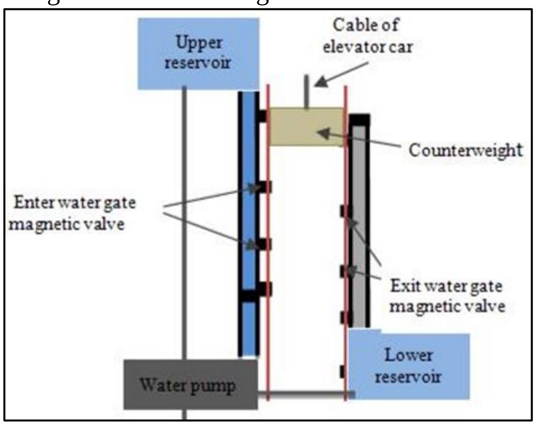

Fig. 2: The Counterweight Operation

Number of gates equaled number of stories. For each story where the elevator stopped besides gates, the counter-weight was stopped by brakes. Thus everywhere the counterweight stops, the counterweight's gates must adhered to the pipe gates, i.e., when the counterweight stops, it could connect to the special pipes to prepare for enter or exit water.

The magnetic gates of counterweight were adhered to special pipes. One magnetic gate was placed above the tank due to adhere to the full water pipe for water entered and another is bottom to exit or convey water to the lower reservoir. When the counterweight has to be heavier thus the amount of water could increase then the upper magnetic gate has to adhere to the water pipe to enter water in the tank. Water gates work as one-way faucet while in output a metal rig was placed to connect the magnetic gate of the tank.

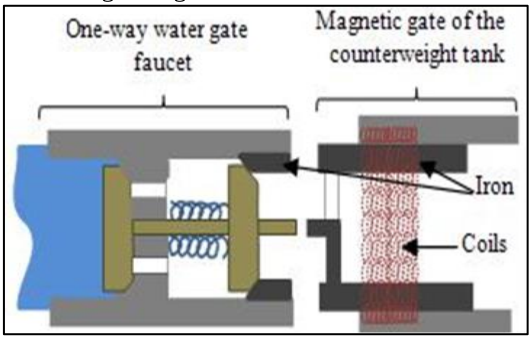

Fig. 3: Water Gate and Magnetic Gate Before Electromagnetic

The magnetic gate has coils around the iron pipe which moves, to electromagnetic induction then iron changed to magnet temporary and connected to water gate. In the other pipe, just an iron ring has been placed on output of faucet but without one-way faucet because this pipe conveys water to the lower reservoir. The distance between pipe gate and magnetic gates of tank approximately was considered less than 0.5cm. increasing and decreasing the water of the tank may take several seconds and can be controlled by increasing the diameter of gates and increasing volume flow rate too, so process time decreases, the elevator is prepared to move earlier.

C. Electrical Parts Modeling

The water elevator is equipped with sensors that have been placed in the counterweight tank of calculate the amount of water inside and a load cell to calculate the loads on the elevator floor. On the counterweight gear wheels sensors have been placed to control moving and stopping and especially the adhering of the magnetic gates to the pipe gates.

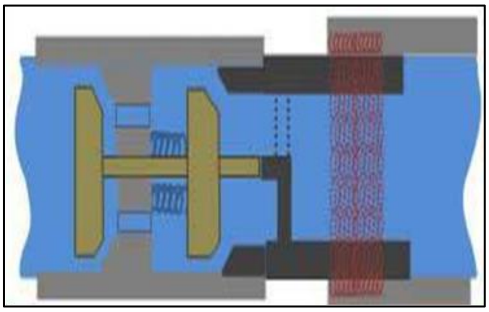

Fig. 4: Water Gate and Magnetic Gate after Electromagnetic Induction

Increase and decrease of water amount depends on load cell and vertical moving direction of the elevator, which command to the magnetic gates of the tank. If the counterweight moves up, it has to be lighter so the bottom gate starts working or if the elevator moves from the first story to third story, the counter weight has to be heavier, so the upper magnetic gate starts working (opens then water comes into the tank) and amount of water entrance is calculated by set (such as indicators) that connects to the load cell and water while entering is controlled by the sensor inside the tank. Acceleration is considered for the elevator movement which ranges between 1.25 to 1.5 m/s2.

REFERENCES

[1] http://www.libertypumps.com
[2] Ambrose, H.S. and R.S. Leroy, 1936. Load distribution and strength of elevator cable equalizers. J. Res. Natl. Bur. Stand., 17(2): 291.
[3] Halliday, R., 2008. Fundamentals of Physics Extended. 8th Edn, Wiley India Pvt. Ltd., India, and pp: 1224, ISBN: 8126514426.
[4] Jerry, C. and A.C. Whitaker, 2007. Power Systems Handbook. 3rd Edn, Morgan Hill, Taylor and Francis Press Group, California.
[5] Jon, B.H., 2010. The Vertical Transportation Handbook. George, R.S. and S.C. Robert (Eds.), 4th Edn. John Wiley and Sons, New York, pp: 624, ISBN: 0470404132.

