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Regenerating the Energy from Building Lift

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ABSTRACT: In the existing system the new design is used for converting unutilized mechanical energy into electrical energy and it is compactly fitted into headroom. This new design is specific to the regenerate the electrical energy from mechanical energy of the lift which is stored in battery and it will use whenever the light is off, this design is easily compile with the existing system. This design content two rolling part and a reciprocating part which is used to convert circular motion into reciprocating motion and vice versa. The lift is moving up and down, the mechanical energy converts that's specific system into electrical energy.

KEYWORDS: Electrical Energy, Reciprocating, Rolling.

I. INTRODUCTION

1.1 INTRODUCTION

An elevator system, elevator providing a self generating power source. The system converts kinetic energy of an elevator cab movement into electrical energy used to regulate the speed of descent. The elevator system can be structured in numerous ways and includes either a generator or a motor in generator mode, driven by a system to the elevator cab. The present invention relates to a self-powered for elevator systems. More particularly, the present invention pertains to the use of the kinetic energy of an elevator cab movement to generate electrical energy to regulate the speed level.

1.2 BACKGROUND OF THE INVENTION

Systems and controls use a wide variety of designs to achieve numerous objectives, and the basic principle of balancing an elevator cab against assembly driven by a motor. Building designers authorities have recognized the necessity of emergency power in buildings to ensure that elevator cabs. Moreover, most elevator systems currently require building power distribution systems to provide transfer switches and emergency feeders for elevators and main distribution emergency switchboards and emergency generators sufficiently large to cover elevator loads, all of which result in additional costs and inefficiencies. Thus, it would be advantageous to have an elevator system that during a power outage or any other occasion when needed accomplishes the controlled descent of the elevator cab without a battery or fossil fuel based generator to drive the elevator motor, but rather accomplishes the initial descent of the elevator cab due to gravitational forces and the heaviness of the elevator cab relative to an attached counterweight, and which then converts kinetic energy of the movement elevator cab into electrical energy used to control the speed of descent of the elevator cab.

The present invention is based on utilizing the kinetic energy of an elevator cab movement due Reciprocating action of the elevator cab. The movement elevator cab attached to a mechanical system of shafts and pulleys drives either a separate generator or an elevator motor operating in generating mode, converting the kinetic energy of the movement elevator cab into electrical energy. The torque generated by a separate generator or elevator motor in generating mode is directed against torque produced by movement elevator cab and when controlled, a controllable speed of descent to a preset or selected floor can be achieved which provides braking power for a controlled speed of descent to a preset or selected floor, comprising: an a building distribution system electrical supply panel, an elevator controller with an integral battery to support control during power loss or interruption, an electrical drive motor, a load bank, a transistor switch or similar operative device, a summing device to sum all control signals and to generate a resultant control signal, a tachogenerator speed feedback device, a dedicated emergency descent controller with pulse width modulation

(PWM) output, a mechanical system of shafts and pulleys and respectively, an elevator cab, an alternating or direct current electrical generator, a cable, a permanent counterweight, a detachable counterweight, electrically held spring release locks, detachable counterweight free fall catchers, elevator brakes, a counterweight rail system, and an elevator cab rail system. The elevator controller with an integral battery to support control during power loss receives power from a building distribution system via the electrical power supply panel. The elevator controller drives the elevator drive motor. The elevator drive motor is connected to the elevator cab via the mechanical system of shafts, pulleys and drives the elevator cab up and down guided by the elevator cab rail system. The elevator controller also is connected to electrically held spring release locks. The bottom part of the spring release locks is coupled to the detachable counterweight, and the top part of the spring release locks is coupled to the permanent counterweight, such that when the permanent counterweight and detachable counterweight come together the locking mechanisms of the spring release locks on each of the two counterweights and engage and thereby join the permanent counterweight and detachable counterweight together to act as a single counterweight. Both the permanent counterweight and the detachable counterweight are guided by a counterweight rail system. Free fall catchers are coupled to the detachable counterweight. When the spring release locks are engaged during normal operation, the spring release locks lock the permanent counterweight to the detachable counterweight, comprising the total weight offsetting the weight of the elevator cab through the connecting cable and counterweight pulley system. When the elevator controller senses a power loss in the electrical supply panel, the elevator controller cuts off control voltage to the electrically held spring release locks, causing the spring release locks to disengage the detachable counterweight from the permanent counterweight upon detachment, the detachable counterweight descends under its own weight until the speed of the detachable counterweight exceeds a preset value, at which point the free fall catchers stop the descent of the detachable counterweight by clamping onto the counterweight rail system. The elevator controller is also connected to the elevator brakes, and when the elevator controller senses a power loss in the electrical supply panel, the elevator controller causes the elevator brakes to be released and held in a released position.

Due to the heavier weight of the elevator cab relative to the permanent counterweight, and due to the elevator brakes being held in the released position, the elevator cab begins movement under its own weight after detachment of the detachable counterweight. The movement elevator cab is connected to the alternating or direct current electrical generator through the cable, and mechanical system of shafts and pulleys and respectively, and the descent of the elevator cab thereby causes the cable to rotate the counterweight pulley, thereby through the mechanical system of shafts and pulleys driving the electrical generator. The alternating or direct current generator is connected to the load bank via the transistor switch or similar operative device. The dedicated emergency descent controller with pulse width modulation (PWM) output is connected to the transistor switch or similar operative device, and thereby regulates the generator current through the load bank.

The elevator controller directs the elevator drive motor to rotate the counterweight pulley to raise the elevator cab and correspondingly cause the attached permanent counterweight to descend until the top half of the release locks coupled to the bottom of the permanent counterweight engages the top half of the release locks coupled to the top of the detachable counterweight, at which point the release locks engage and thereby couple the permanent counterweight to the detachable counterweight, restoring the elevator system to normal operation. In an alternative embodiment, an elevator system, instead of using the electrical generator of to generate electrical energy during power loss or interruption, the system uses the elevator drive motor with a motor mode operation switching contactor. The elevator controller is connected to the motor mode operation switching contactor.

In an alternative embodiment, an elevator system, instead of using the electrical generate electrical energy during power loss or interruption, uses the elevator drive motor with a motor mode operation switching contactor. Further, rather than using the detachable counterweight with release locks and free fall catchers, the system uses the permanent counterweight that is lighter than the elevator cab so that when the elevator controller after sensing power loss directs that the elevator brakes release and be held in a released position, the elevator cab begins movement due to its heaviness relative to the permanent counterweight. In yet another embodiment, a counterweight device is comprised of the permanent counterweight and the detachable counterweight with free fall catchers, the permanent counterweight and detachable counterweights being coupled together by electrically held spring release locks or other like devices when the locks are engaged. The bottom part of the spring release locks is coupled to the detachable counterweight, and the top part of which spring release locks is coupled to a permanent counterweight.

When the permanent counterweight and detachable counterweight come together, the locking mechanisms of the spring release locks on each of the two counterweights engage and thereby join the permanent counterweight and detachable counterweight together to act as a single counterweight. Both the permanent counterweight and the detachable counterweight are guided by the counterweight rail system. Free fall catchers are coupled to the detachable counterweight. A power loss to the electrically held spring release locks, whether by direction of an elevator controller or otherwise, causes the spring release locks to disengage. Upon detachment, the detachable counterweight descends under its own weight until the speed of the detachable counterweight exceeds a preset value, at which point the free fall catchers stop the descent of the detachable counterweight by clamping onto the counterweight rail system. After return of normal power and upon the permanent counterweight being lowered to the detachable counterweight, or upon the detachable counterweight being raised to the permanent counterweight, the electrically held spring release locks engages and thereby couples the permanent counterweight to the detachable counterweight. This new design is specific to the regenerate the electrical energy from mechanical energy of the lift which is stored in battery and it will use whenever the light is off This design is easily compile with the existing system this design content two rolling part and a reciprocating part which is used to convert circular motion into reciprocating motion and vice versa. The lift is moving up and down that's the mechanical energy converts that's specific system into electrical energy.

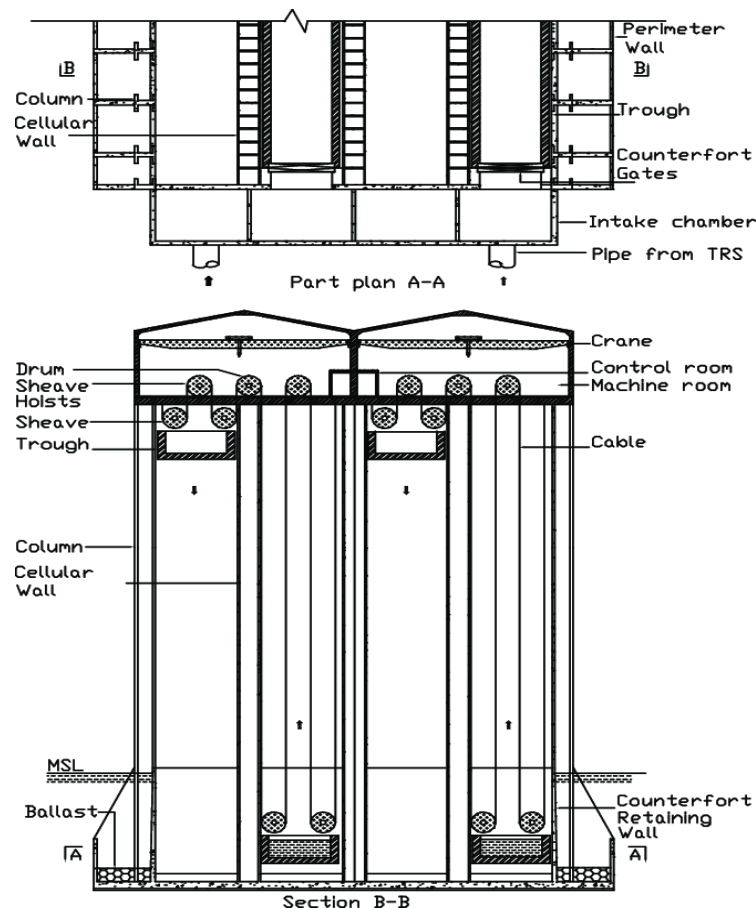


Figure 1.1: Basic Diagram of Building Lift

II. LITERATURE REVIEW

1. David W. Stroup

The machine room less lift is to utilize permanent magnet, synchronous gearless drive technology powered by a variable frequency inverter unit matched to the machine to deliver and control the necessary torque throughout the full speed range of the machine provided. All drive equipment is to be mounted in the lift shaft without the need for separate plant rooms. Where the control panel is required to be mounted outside of the lift shaft.



2. Cheah Siew Hoon

Lift or elevator is transport devices that are used to move goods or peoples vertically. In this project, the Motorola MC68CH11 A1 microcontroller based lift control system is constructed to simulate as an actual lift in the real life. This project dissertation documents the findings and results of a research on a microcontroller based lift control system. It provides useful information to those who wish to carry out a lift control system research or project.

3. Mr.Sittichai Kantawong

This paper presents Power Generation for Permanent Magnet Motor Elevator by Energy Regenerative Unit (ERU). The study reveals that permanent magnet motors with rated 5.5 kW in elevators which is working by transferring mechanical energy into electricity when the motor is rotating without power therefore the motor is capable of producing electrical energy back into the grid system. This situation is call "Regenerative mode" which is the wasted energy can be used once again. This investigated ERU and inverter in this study can be applied for future use of in existing elevator system. The Proposed ERU is used to convert DC voltage to AC voltage for gird synchronization. The investigated ERU is operating as three-phase module. From experiment, it is observed that when the motor operates as a generator then ERU will receive DC voltage from the elevator inverter system then convert to AC voltage that can be fed into the grid system.

III. OBJECTIVES

In this entire course of project our major objective is to change the obsolete methods being currently followed in Indian elevator systems. The objectives of the project are outlined as below:

- This project work is mainly focused on regeneration of power by adapting the lift power regeneration technology, using reclaiming energy for a useful purpose rather than wasting it has heat is an effective from of overall energy conservation.
- To find the properties and analysis of power generation.
- Cost reduction of maintenance for existing operation .
- To meet the challenge of energy conservation, one of the latest technologies adopted in lift regenerative function.
- Regenerative lifts are 20% to 30% more energy efficient.
- Implementation of software based electronic system

IV. PROPOSED METHODOLOGY

Tbale 4.2 :LIST OF THE COMPONENTS ARE USED

SR.NO.	COMPONENT NAME
1	Electrical Motor
2	Pulley (CW & CCW Rotation)
3	Lever (Small in Length)
4	Slider
5	Lever (Long in Length)
6	Pulley (CCW Rotation)
7	Belt
8	DC Generator
9	Charging Circuit
10	Battery



STATISTICAL ANALYSIS

1. ENERGY CALCULATION

Energy = Total work of lift system + Total standby losses _____[1]

Where the total work of the lift system can be approximated by the total distances lifts (i.e. work = displacement*force) assumption is made based on the findings of the project that working lift energy consumption trip is dominated by the flat peak lift motion (up trip) and not of the short acceleration/deceleration windows challenge is then to find a method to estimate the whole lift system workload using relationship.

2. TOTAL WORK OF THE LIFT SYSTEM TOTAL WORK OF THE LIFT SYSTEM

Total work of the lift system = Σ (no. of trips by lift * distance travelled per by lift)____[2]

An important assumption can be made here that the average number of trips per lift constant throughout the office assumption is based on the premise that designed to service a fixed level of NLA per lift car Total NLA vs. The sample data can be used to reliably estimate that on average there is 1 lift car servicing every 2,500m of NLA. Furthermore, the data correlation between number of occupants and NLA ($R^2 = 0.85$), indicating that NLA is a good predictor for the expected number of building occupants. Useful conclusion here is that in design, the average number of building occupants serviced (and the average number of trips each lift) over the course of a year comparable, Equation 2 is therefore equivalent to,

Total work of the lift system = $a * \Sigma$ (distance travelled per trip per lift)_____ [3]

Where a is a constant (e.g. average number of trips per year)

To simplify matters further, the sum of distances travelled per trip per lift can be represented by the total Lift Floors of the building (defined earlier), i.e.

Total work of the lift system = $a * \text{Lift Floors}$ _____ [4]

The total standby losses are largely dependent on the number of lift motors. Since NLA is directly proportional to the number of lifts

3. TOTAL STANDBY LOSSES

Total standby losses = $b * \text{No. of Lifts}$

Total standby losses = $b * \text{NLA}$ _____ [5]

Where b is a constant, By combining equations 3 and 4, the total energy consumption of a lift system is given by,

Energy = $a * \text{Lift Floors} + b * \text{NLA}$ _____ [6]

The equation 5 presents the model numerically

4. ANNUAL LIFT ENERGY

Annual Lift Energy (kWh) = $528 * \text{Lift Floors} + 5.47 * \text{occupied NLA (m}^2\text{)}$ _____ [7]

5. POWER CALCULATION

Power Considerations, There is the transfer of power throughout the elevator system.

Electrical power put into the motor : **$P = (IV)/\sqrt{2}$** _____ [8]

Where, V is voltage and $1/\sqrt{2}$ is AC current source.

This power is then transferred through the output of the motor shaft : **$P = T\omega$** _____ [9]

Where, T is the torque and ω is the rotational speed.

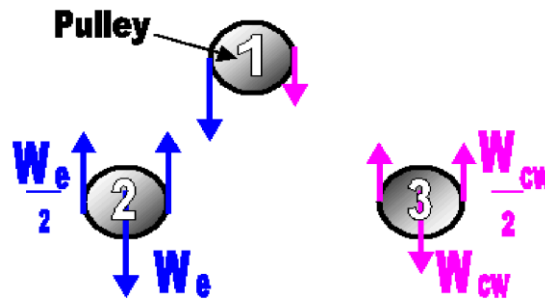


Figure 4.0: Forces on Pulley

Once the power is transferred through the gear reducer the output speed will be reduced and the torque will be greater. The overall power will be slightly lower as the system is not 100% efficient. Tension on the rope from the elevator pulley is equal to the weight of the elevator, W_e . The tension on the rope from the counter weight is W_{cw} .

6. FORCE CALCULATION

The following analysis has been done for steady state (no acceleration) operation. The force on the driving pulley is equal to the difference of the two exerted tension on each side. On one side, this force is equal to W_e and on the other side, it is W_{cw} therefore, the net force exerted on pulley 1 (drive pulley) is

$$F = (W_e - W_{cw}) / 2 \quad [10]$$

In order to find the power required for elevator movement, either the rotational speed of the drive shaft (attached to pulley 1) or the velocity of the elevator must be known. The out power is (assuming 100% efficiency)

$$P = (W_e - W_{cw}) V / 2 = (W_e - W_{cw}) r \omega / 2 \quad [11]$$

Building characteristics – occupancy hours, building height, fire stairs accessibility and building quality (PCA grade). This information was provided by the building facility managers.

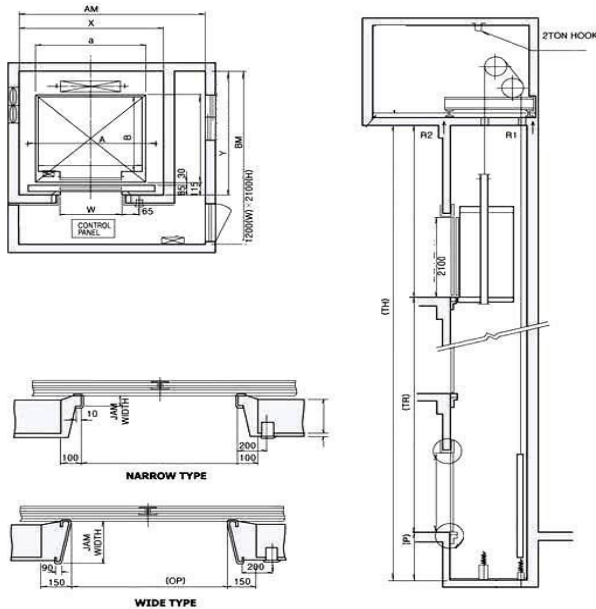
Lift characteristics – such as hoist mechanism, drive type, rise height, floors serviced and other technology related information. This information was provided by the lift contractors, which was usually the equipment manufacturers or vendors.

Metered building and lift energy consumption – This was a mix of third party utility metered data, on site sub metered data and temporary logging.

The Hypothetical Model Occupied and Lift Floors are directly related to building size for this reason, they are good first order indicators for the scale of lift services provided by the base building and likely its energy consumption.

Table 4.2 : SPECIFICATION AND DESIGN CALCULATION

SR.NO	COMPONENT NAME	SPECIFICATION	ACTUAL IMAGE
1	Electrical Motor	- DC motor 12v 15 rpm (CCW Rotation)	
2	Pulley or Gear (ccw & cw Rotation)	- Outer Diameter : 40 mm - Inner Diameter : - Material : Fiber	
3	Lever	- Length : 150 mm - Diameter : 3 mm - Material : GI	
4	Slider	- Length : 230 mm - Width : 18 mm - Material : GI	
5	Lever	- Length : 175 mm - Diameter : 3 mm - Material : GI	
6	Pulley (ccw Rotation)	- Outer Diameter : 100 mm - Inner Diameter : 10 mm - Material : Fiber	
7	Belt	- Thickness:2 mm - Radius : 190 mm - Material : Rubber	
8	DC Generator	12 V DC CCW - Gear Diameter : 40 mm (Inside the cover) - No of Teeth : 25	
9	Charging Circuit	6v	
10	Battery	6v	



A schematic diagram of a two-link mechanism. The first link, of length L , is connected to a fixed ground (represented by a horizontal line) at one end and has a revolute joint at the other end. The second link, of length $L/2$, is connected to the first link at the revolute joint and has a prismatic joint (sliding joint) at the other end, which moves along the horizontal ground line. The diagram is labeled with $D1-X$ at the first revolute joint, $D2-X/4$ at the second prismatic joint, and L and $L/2$ for the link lengths.

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V. CONCLUSION

Lift energy consumption has been correlated against key input variables in order to develop a predictive benchmark equation which can be used in simulation models to assist in the prediction of total building energy. lift energy consumption has been correlated against key input variables in order to develop a predictive benchmark equation which can be used in simulation models to assist in the prediction of total building energy.

The importance of lift energy in total energy use is confirmed by the finding that in the buildings surveyed, (i.e. all consumption other than tenant light and power) energy bill was attributable to lifts. The results also indicate significant potential for energy efficiency in lift consumption, particularly through selection of lift technology. . In the existing system the new design is used for converting unutilized mechanical energy into electrical energy and it is compactly fitted into headroom. This new design is specific to the regenerate the electrical energy from mechanical energy of the lift which is stored in battery and it will use whenever the light is off. This design is easily compile with the existing System.

VI. FUTURE SCOPE

- Modeling lift movement and corresponding energy consumption as a means of reducing the energy consumption associated with lift trips.
- Review current lift traffic design criteria, so systems can be designed to reduce energy usage based on actual traffic flow as opposed to hypothetical peak traffic flow.
- Developing an approach to writing lift control algorithms which incorporate ways of reducing energy-consumption associated with transporting passengers.
- Motor models could be used to investigate the energy savings associated with varying performance (rated acceleration, jerk and velocity) for specified trips, which would not be prohibitive if introduced by the lift control system during periods of light traffic.
- It is intended that this and other motor models, systems and that refinements and developments be made as required. Suggested improvements for the DC static converter drive include investigation of the energy consumed by DC field magnet and a review of DC system harmonics. The motor models will be implemented in a lift system simulation to aid development and testing of 'green' control strategies.

VII. ACKNOWLEDGMENTS

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