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90 Degree Steering Mechanism

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***Abstract*: This paper presents the implementation of 90-degree steering mechanism.**

***Keywords*: 90-degree, steering mechanism.**

1. Introduction

A. *Preface*

In country like INDIA where 55% of economy is based on service industry and production industries. Thus, material transport inside the plant becomes very important. Because it directly affects productivity of system. Therefore, it is important to have efficient material transport system. Today's material transport system mainly uses mini fork lift for medium and large size plants. And for small size plants it is done by labors. Mini fork lift steering electric power train. We will use chain drive to steer the system.

B. *Aim of the Project*

- To help in small transportation
- In industry
- To be eco friendly
- To save fuel
- To do work fast

2. Working Principle

This project works on the principle that the two alternate diagonal wheels i.e., the front left and back right will steer together to give the turning motion to the vehicle and similarly with the other two wheels through chain drive arrangements. In this vehicle all the four wheels will be independently working & the battery provided which is connected to the control unit will provide the necessary power supply.

A. *Ackerman Steering Mechanism*

- Ackerman Steering Mechanism is a simple four bar chain used for turning. It does use turning pairs. It is the most basic steering mechanism used for steering.
- Many modifications of Ackerman steering Mechanism are possible by Rack and Pinion, Tie rod etc. This kind of steering mechanism generally used in cars.

B. *Davis Steering Mechanism*

- It is similar to Ackerman Steering Mechanism but it uses sliding pairs instead of turning pairs.
- Due to sliding pairs it generates frictional losses. That's why it is not in use.

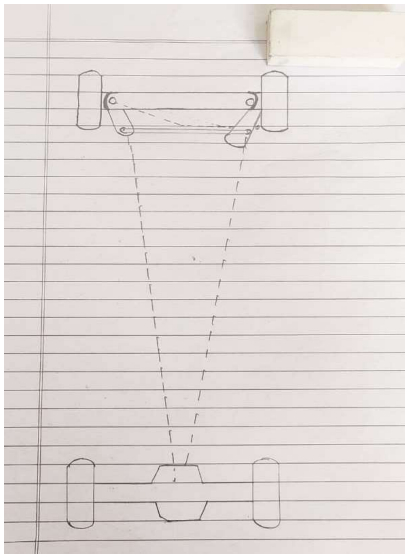

Fig. 1.

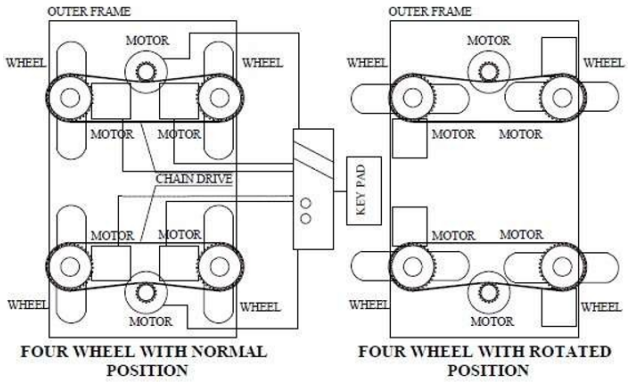

Fig. 2. Four-wheel drive with 90-degree rotation

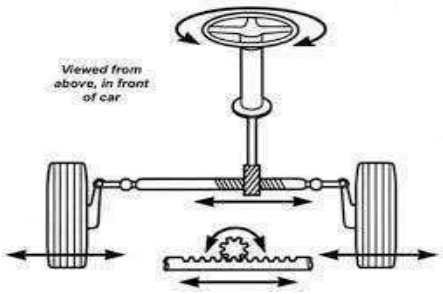

Fig. 3. Conventional steering system

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3. Construction

A. Chassis Board

- Chassis Board is a rigid construction on which parts of the steering system will rest. It is the base of the whole steering system.
- It also provides protection to internal parts of the steering system.
- For example, as seen from the figure the main parts of the toy like motors, electric circuits etc. will rest upon the chassis board.
- Mild Steel will be used for our frame construction.

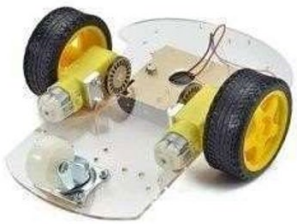

Fig. 4. Chassis board of a toy

B. L Clamp

L Clamp is a fastening device used to hold or secure objects tightly to prevent movement or separation through the application of inward pressure.

Fig. 5. L clamp

C. Chain Drive

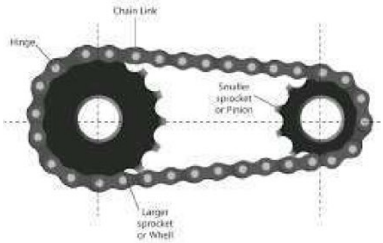

Fig. 6. Chain drive

- Chain Drive is used to transmit rotational motion between two by means of a sprocket and chains.
- Power is transmitted by means of a roller chain or conveyor chain through the sprocket gears most often. The gear turns this puts mechanical force into the system.
- Conveyor type of chain drive will be used in our steering system.
- 100mm

Size	Pitch	Maximum Roller Diameter	Minimum Ultimate Tensile Strength	Measuring Load
25	0.250 in (6.35 mm)	0.130 in (3.30 mm)	780 lb (350 kg)	18 lb (8.2 kg)

D. DC Motor

- As requirement is constant torque D. C. Shunt Motors will be used. Fours D. C. Motors will be used.
- D. C. Motors will require a power supply. Thus, Lead-Acid Battery will be used as D.C. power supply.
- This motor is of 12V.
- This motor is having RS-775 7000RPM.

Fig. 7. DC motor

E. Fiber Wheel

- Fiber is a reinforced carbon material. UTS of carbon fiber i6370 MPa (fiber alone). Thus, it is very strength full material.
- Four fiber wheels will be used for the construction of model.
- Size of the fiber wheel is 3.5-10.
- Load capacity 5000kg.

Fig. 8. Rim of the carbon fiber wheel

F. Bearing

- Rolling contact bearings are available in many size and shapes. They have their distinct feature and advantages as compared to sliding contact bearings.
- Ball Bearing will be used in making of the model. They have following advantages.
- Interchangeable, Easy to lubricate, Readily available, Bearing rigidity can be improved with preloading.
- Bearing companies: 1. Schaeffler India Ltd., 2. SKF India Ltd.

Table 1

Size	Inner dimension	Outer dimension	Width	Dynamic (Cr)	Static (Cor)	Weight (lb)
6000	10	26	8	1030	445	0.042

Fig. 9. Rolling contact ball bearing

G. Electronic Control Unit (ECU)

- In automotive Electronic Control Unit is a generic term for any embedded controls one or more of the electrical system or subsystems.
- It consists of no. of transducers and actuators.

Table 2

CPU	8 BIT/8 MHz
MASK ROM	32
RAM	1.0
CONNECTOR	22 PIN

Fig. 10.

4. Functioning

A. Working

In this system battery provides power to the control unit. System consists of four motors. Two motors couple with the front left and right side and two motors couples with the rear left and right side of the model. The four motors are used to run the model. Two motors out of four will be used to rotate the wheels by 90 degrees. The keypad in the control unit has six keys and they are left, right, forward, reverse, park left and park right.

If we press left key, vehicle turns left side in required angle. If we press right key, vehicle turns right side at some angle. Similarly, forward and reverse key will perform its function.

When the left key or right key is being pressed, the electrical signal transmitted by the control unit to the motors via wires and motors in result response.

Here, chain drive is used for turning. If one of the wheel turns, then in result the other three wheel will also turn because it is connected by means.

B. Arc Welding

Arc welding is a type of welding process using an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct (DC) or alternating (AC) currents.

Welding arc temperature usually ranges between 6000-8000 degrees Celsius which converted to Fahrenheit would be roughly between 10000-15000 degrees, but the exact temperature depends on a lot of factors like the current type, shielding gas type, amperage, etc.

Table 3

Power voltage	220 volts
Frequency	50/60
Output current	30-400

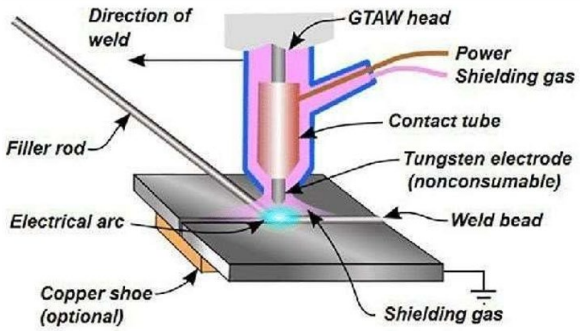

Fig. 11.

C. Gas Welding

Gas welding with an oxyacetylene flame was developed in France at the end of the 19th century. The first torch suitable for welding was made by Edmund Fouche and Charles Picard in about 1900. The use of acetylene and oxygen made it possible to produce a comparatively high flame temperature, 3100 °C, which is higher than that of other hydrocarbon-based gases. The torch became the most important tool for welding and cutting of steel.

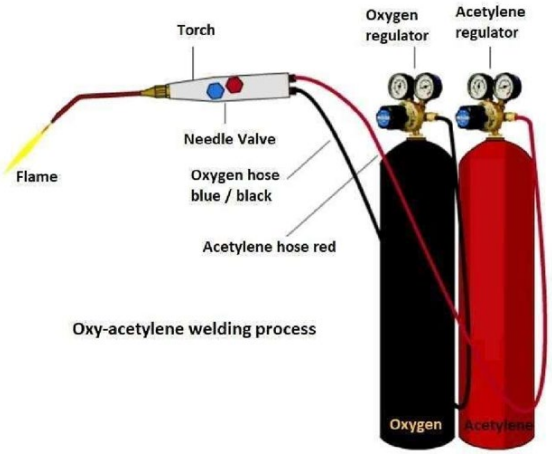

Fig. 12.

D. Hammer

A hammer is a tool, most often a hand tool, consisting of a weighted "head" fixed to a long handle that is swung to deliver an impact to a small area of an object. This can be, for example, to drive nails into wood, to shape metal (as with a forge), or to crush rock. Hammers are used for a wide range of driving, shaping, breaking and non-destructive striking applications. Traditional disciplines include carpentry, blacksmithing,

warfare, and percussive musicianship (as with a gong).

Hammer sizes used: 08 Ounces and 10 Ounces.

Fig. 13.

E. Hacksaw Machine

A hacksaw is a hand-powered, small-toothed saw used for cutting metal pipes, rods, brackets, etc. Hacksaws can also cut through plastic. The hacksaw has a U-shaped frame and a handle at one end. Hacksaws have small pins at each end of the frame that receive a blade.

Table 4

Cutting cap (Round)	175mm
Cutting cap(square)	150mm
Blade size	350mm/25mm
Electric motor	1hp(1000RPM)

Fig. 14.

F. Tinner Snips

Tinner's snips, also known as tinner snips or tin snips, are one of the most popular type of snips. They are defined by their long handles and short blades. They usually have extra wide jaws and are made of drop forged carbon steel. Depending on the size of the blade, tin snips can cut between 24 and 16 gauge cold rolled low-carbon tin. They can be ranged in length from 7 to 14 in (180 to 360 mm) long. There are two main types: straight-pattern and duckbill-pattern. Straight pattern is best for straight cuts, but can handle gentle curves. Duckbill- pattern snips, also known as trojan-pattern snips, have blades that taper down from the pivot to the tip of the blades. The blade edges are also beveled to more easily cut curves and circles or shapes. They are a lighter duty snip that can only cut up to 25-gauge mild steel.

Other common blade patterns include the circle pattern or curved pattern and the hawk's-bill pattern. Circle pattern snips have a curved blade and are used to cut circles. Hawk's-bill snips are used to cut small radii on the inside and outside of a circle. The shape of the blades allows for sharp turns without buckling the sheet metal.

Fig. 15.

Table 5
Cost estimation

Parts	Quantity	Price
Chassis Board	1	500/-
L Clamp	4	250/-
D.C Motor	4	3600/-
Fiber Wheel	4	1000/-
Nut and Bolts	20	150/-
Mild Steel Pipes	1	200/-
Rocker Switch	3	200/-
Battery	1	2000/-
Wiring and fitting		2500/-
Chain Drive	2	1200/-
Total		11600

G. Advantages, Disadvantages & Limitations

1) Advantages

- It is more flexible than conventional steering mechanism because it can turn about 90 degrees.
- Driver requires lesser efforts to steer because it is operated by four motors.
- It is easy to maneuver in narrower regions.
- Steering response is high.
- Easy to operate.
- Suitable for electric vehicles.

2) Disadvantages

- Unsuitable for engine powered vehicle.
- Only used in individual drive system.
- Requires four motors.
- Individual drive system.

3) Limitations

- Power requirement is high because it requires four motors.
- Not suitable for engine powered vehicles.
- Individual drive system.
- It uses chain drive for power transmission therefore frictional losses are high.
- It is not very to design.
- It requires more number of parts than conventional steering system.
- It is costly.

4) Applications

- Electric vehicles
- Mini fork lift

- Mini race car (Go kart)

5. Conclusion

The project carried out by us made an impressing task in the field of automobile industries. It is very useful for driver while driving the vehicle. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task, which has also been provided.

The purpose of developing this project is to avoid parking problem, minimize the space between two parked cars to minimize the time required for parking reduces the problem of accidents during parking and to improve the design of existing vehicles.

A. Future Scope

- Due to small size and remote-control sensor may be used in small industry like in transportation.
- In the future it will be used industry also commercial way.
- In future it will available in everywhere.

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