DESIGN AND FABRICATION OF ARI (AIR ENERGY REPLENISHING INSTRUMENT)

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***Abstract*:** ARI is an acronym for air energy replenishing instrument. Whenever vehicles travel, they experience resistance to their movement by air. This air resistance is called air drag and is the main reason why vehicles cannot achieve high speeds while travelling in open air. ARI is a device which harnesses energy from this air drag and this energy can be stored in a power bank from where power can be used whenever required. ARI can also function as a study lamp and an emergency fan. It can be mounted onto both cars and bikes. After the charging is done, the battery case can be separated from the device which enhances the flexibility of the device. ARI is very compact in size and can be dissembled when not in use with ease.

***Index Terms* – Air Energy Replenishing Instrument, Air drag, harness, Power bank, Flexibility.**

I. INTRODUCTION

After the ***discovery*** of electricity and its properties to be stored in a battery, mankind made a shift from mechanical concepts and theories to electrical world. Electricity blended into human lives to such an extent that without electricity the civilization takes a pause. The quest for ways to generate electricity is a never ending phenomenon and in fact there will always be a dearth in this aspect. Renewable energy sources like the wind, sun, geothermal, water etc quench this energy thirst to a certain extent. But the shortcoming of these methods is that their efficient use is yet a dream. With this, we had invented ARI, an air energy replenishing instrument to give the solution for energy generation crisis in our way. We are pleased to present to the world today, ARI.

ARI is a small, portable instrument, a miniature wind turbine of sorts which can be fitted on to vehicles. When these vehicles move, the air drag hitting them can aid in the rotation of ARI propeller which in turn rotates the shaft of the generator, generating power. This energy generated can be applied across batteries as voltage potential hence charging them for further use. ARI is one of a kind and its design is very unique compared to the regular power banks available in the market. These unique features, design considerations and the details which make ARI so special are discussed further in the report.

II. KEY FEATURES OF ARI

In this project, there are two main design aspects which distinguish ARI from the rest of power banks available and make this project stand out. They are electrical switching and angle adjustment mechanisms.

2.1 Switching mechanism

We know that for batteries connected in series, the resultant voltage is the sum total of individual voltages whereas in the case of parallel connection, the resultant voltage is the individual voltage itself. This means, it would be beneficial if the batteries are connected in parallel while charging as the potential needed to be generated is less. And it would be beneficial to connect them in series while discharging as the time for complete discharge increases. To favor from both these aspects, we made a switching mechanism which is nothing less than an invention. To explain the previous sentence in simple terms, our batteries are connected in parallel while charging and they can be switched to series connection while discharging by just twisting of a shaft.

We are using 5 li-ion batteries in this project. They are held together in a circular fashion by the battery holder. This holder is mounted on a shaft which can be rotated. Battery contact points are 20 in number, i.e. 10 for each side. At one instance, 5 batteries can maintain contact with 5 points at a side. When the shaft is twisted, these batteries make contact with the other 5 points. In this way, parallel to series and vice versa switching is done. More technical and design details regarding this switching mechanism is elaborated further in the report.

2.2 Angle adjustment mechanism

As mentioned earlier, ARI needs to be mounted onto vehicles so that it can face the air drag. For cars, it can be mounted on window glass and for bikes, on the front hood. The point that needs to note is that for car and bike, the direction in which the air hits propeller is 90^0 apart. There are many ways to address this angle shift. The method that we chose is as follows.

Generator casing is fitted onto the stand with the help of side locks. On one of them, we have provided slots at different angles. This part can be held a particular position by pressing a key into these slots through the stand. In this way, when ARI is fitted onto cars it can be arranged at o0 and while placing it on bikes, angle can be shifted to 90^0.

III. DESIGN OF MECHANICAL COMPONENTS

3.1 Design of Generator Casing

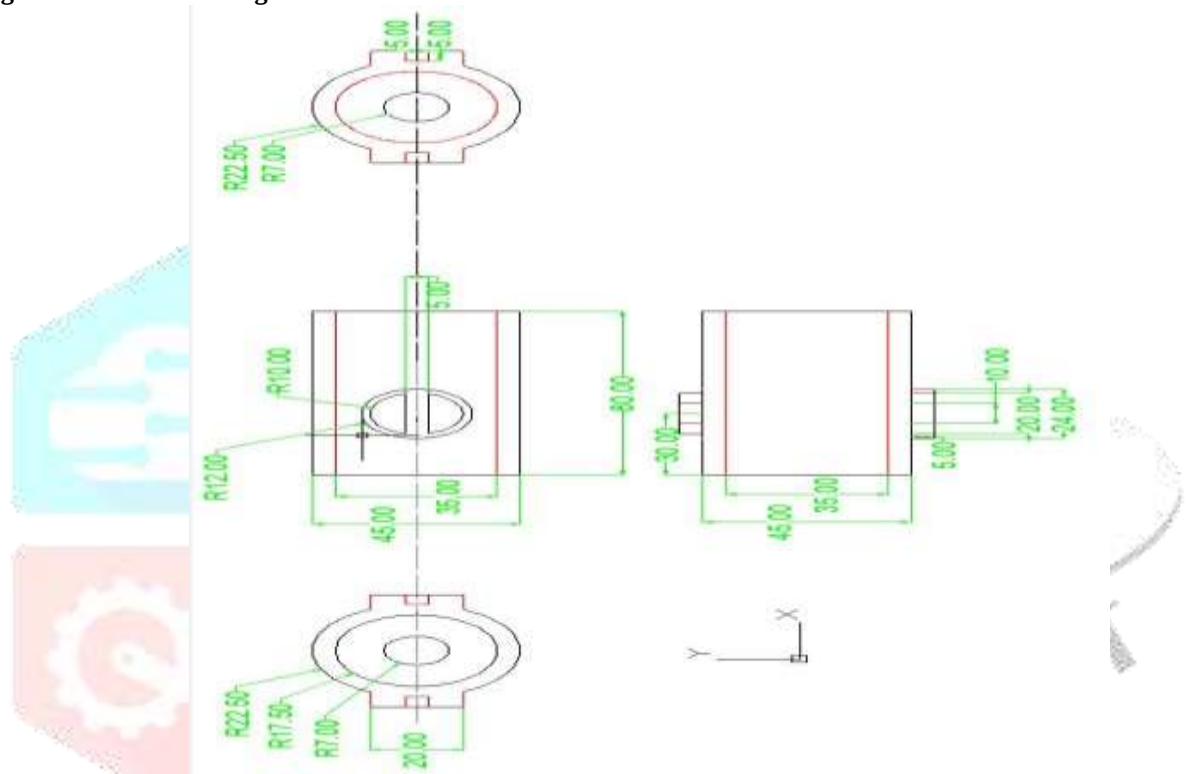

Fig: 3.1 Generator Casing

Generator casing is employed so that a generator can be placed inside and protected from external stimuli. It ensures that the generator is placed in desired position safely and aids in attaching to the stand.

3.2 Design of stand

A stand is generally described as a medium to hold or give support for required components. The stand employed in this project plays a very crucial role as it not only holds the generator case but also aids for gripping to surfaces.

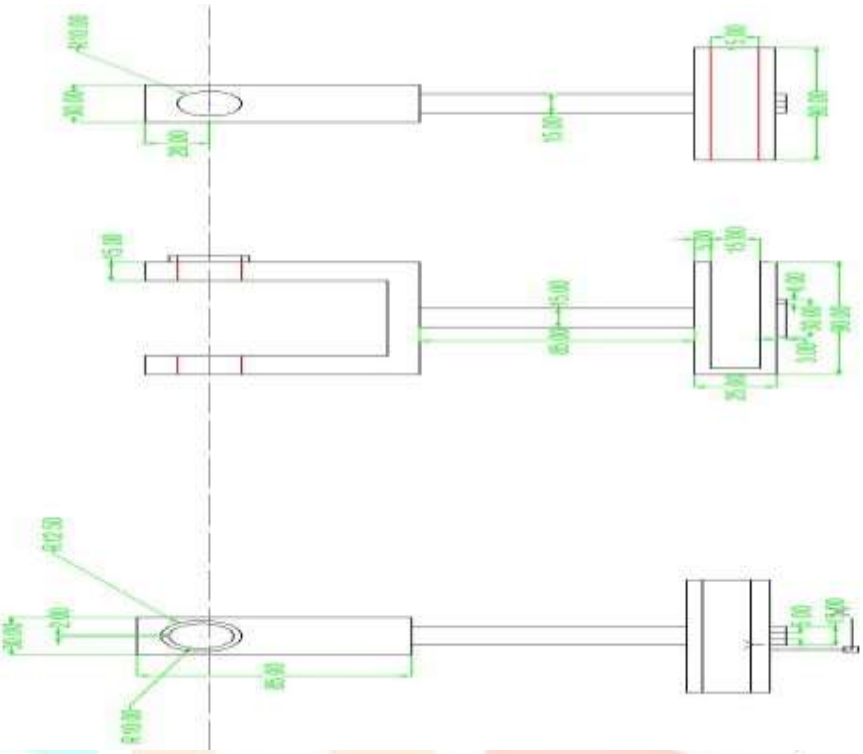

Fig: 3.2 Stand

The vertical rod is used to join the u frame to the base.

3.3 Design of Side Locks

Side locks help the generator casing to be seated in the stand. They are circular rods which perfectly sit in the generator and u frame holes. They help in the aligning of generator to the wind.

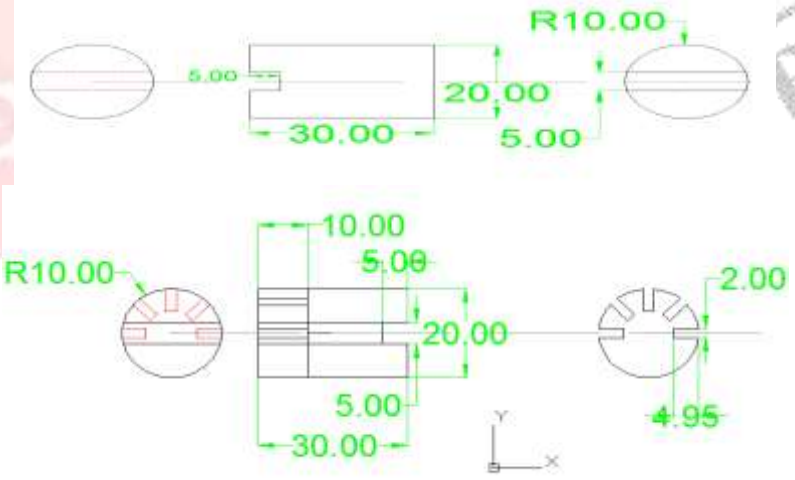

Fig: 3.3 Side locks

3.4 Design of Battery Casing

Battery casing employed in this project is an assembly of different parts such as battery holder, switching mechanism, battery contact points and electrical circuit. All these parts are fabricated together to form the casing. We shall see about these parts in detail.

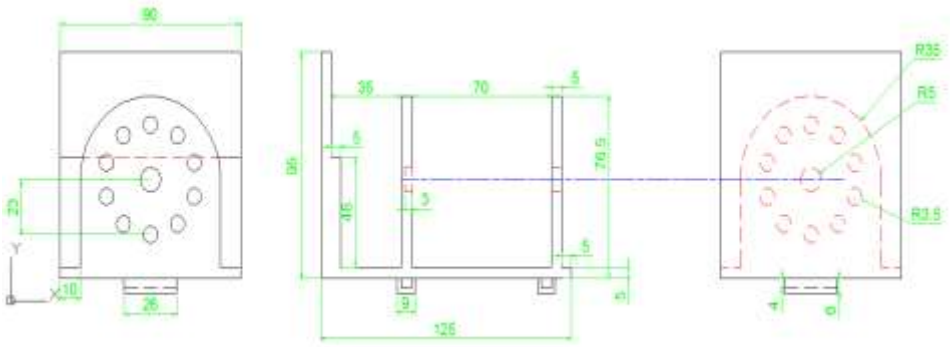

Fig: 3.4 Battery Casing

3.5 Design of Battery holder

Fig: 3.5 Battery holder

It looks similar to a ninja blade as can be seen in the figure 3.5. It holds the batteries in the holes.

3.5 Battery contact points

The schematic representation can be seen in the figure 3.4. These shots act as battery contact points.

3.6 Battery case back plate

It is a rectangular plate which is shown in figure 3.6 helps in closing of the case. The hole in the center is provided for the shaft to protrude out. We can see that there are angular markings on it. These are for aligning the batteries inside to desired connections i.e. parallel or series. Once the position is set, the shaft is locked in the given provision.

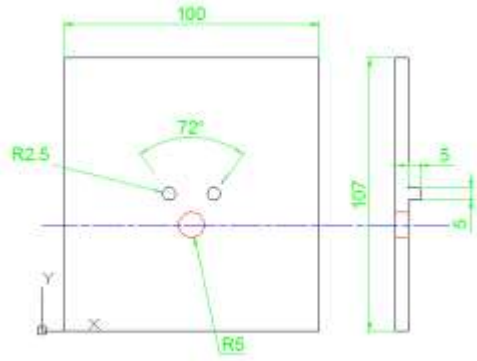

Fig: 3.6 Battery case back plate

3.7 Battery casing manufacture

- Firstly a large plate of 125*95mm base taken and operation is done with the help of electrical hacksaw and kept a side.

- Then a 90*76.5 plate is taken and center of plate is marked, at the center there will be a 10mm diameter hole is drilled with the help of driller.
- Then surrounding it a circle of diameter 46 is drawn it is taken as center and on that differing an angle of 36 degrees a 7mm diameter hole drilled as in number 10 circles are drilled.
- Then with a radius of 35mm the plate is cut in a semi circle ending in a line.
- Then a same identical piece is with same margins and dimensions are made an arranged 75mm far from first plate.
- Finally a 90*95 plate is taken at the last and all these are welded to the base plate with the help of plastic welding.
- After that it is reheated and cooled once again for strong bonding.
- Lastly finishing is done with the help of a face grinder and sharp edges are converted into cuboid.

IV ELECTRICAL COMPONENTS OF ARI

The whole circuit aspects can be divided in three parts namely input, output, fan and battery status indication circuits. The main components used in the circuit are as follows:

- Generator
- Diode (4 amps)
- Zener Diode (5V, 12V, 20V)
- LED
- Li-ion Batteries
- Resistors (300Ω, 1KΩ, 2KΩ, 3KΩ)
- Variable resistance pot

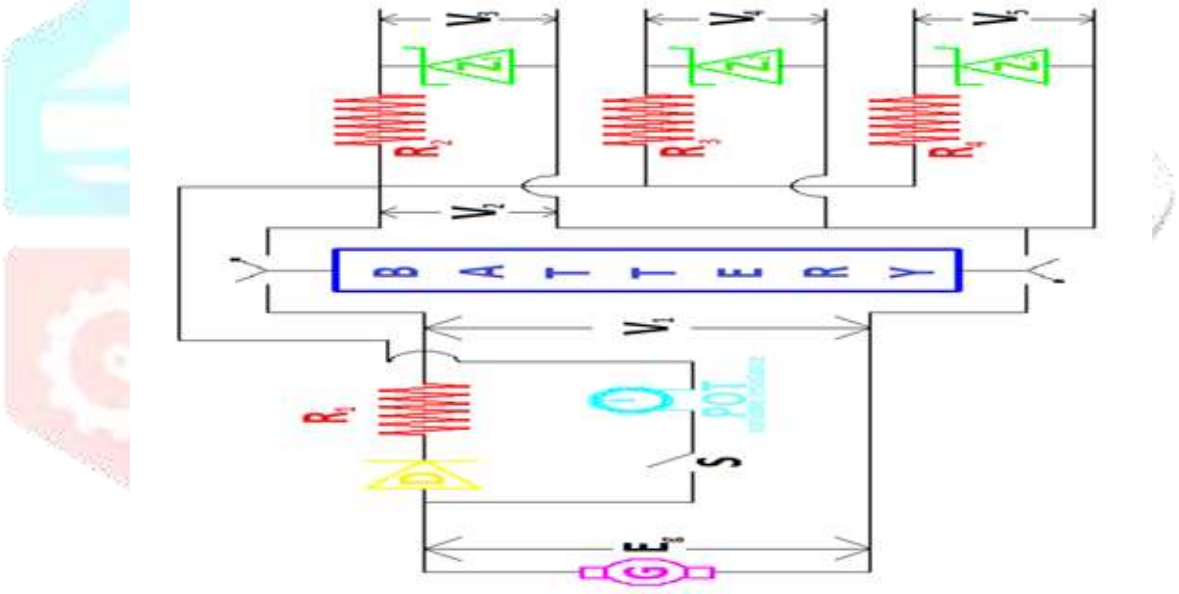

Fig: 4.1 Input and Output circuit

4.1 INPUT CIRCUIT:

Starting from generator, the generated electricity is send through the diode and a resistor.

- Diode is used to block the reverse current flow from the batteries and the resistor is for protective purposes.
- Current generated may vary according to the speed of the vehicle moving and the opposite wind flow.
- From the resistor, current is sent into batteries to store and use for varied purposes.

4.2 OUTPUT CIRCUIT:

- We get three different output ports of voltages V_1=5V, V_2=12V, V_3=20V.
- The different voltages are obtained from the same source by using resistors and zener diodes.
- Current passes through the resistors and diodes before coming to the output port. The 3 zener diodes having capacities z_1=5V, z_2=12V, z_3=20V respectively.

4.3 FAN CIRCUIT:

We know that a generator can function as a motor as well when the current direction is reversed. This principle is exploited in this project to run the generator as a fan.

- Power is supplied to the generator from output of the batteries, through a resistance pot and a switch.
- This resistance pot is used as a speed regulator to the fan and the switch's function is obvious.

4.4 INDICATION CIRCUIT:

The main components in the circuit are

- LM3914 INTEGRATED CIRCUIT
- RESISTORS(4.7K, 18K, 56K)
- PORT(10K)
- LED's(10)
- SWITCH(1)

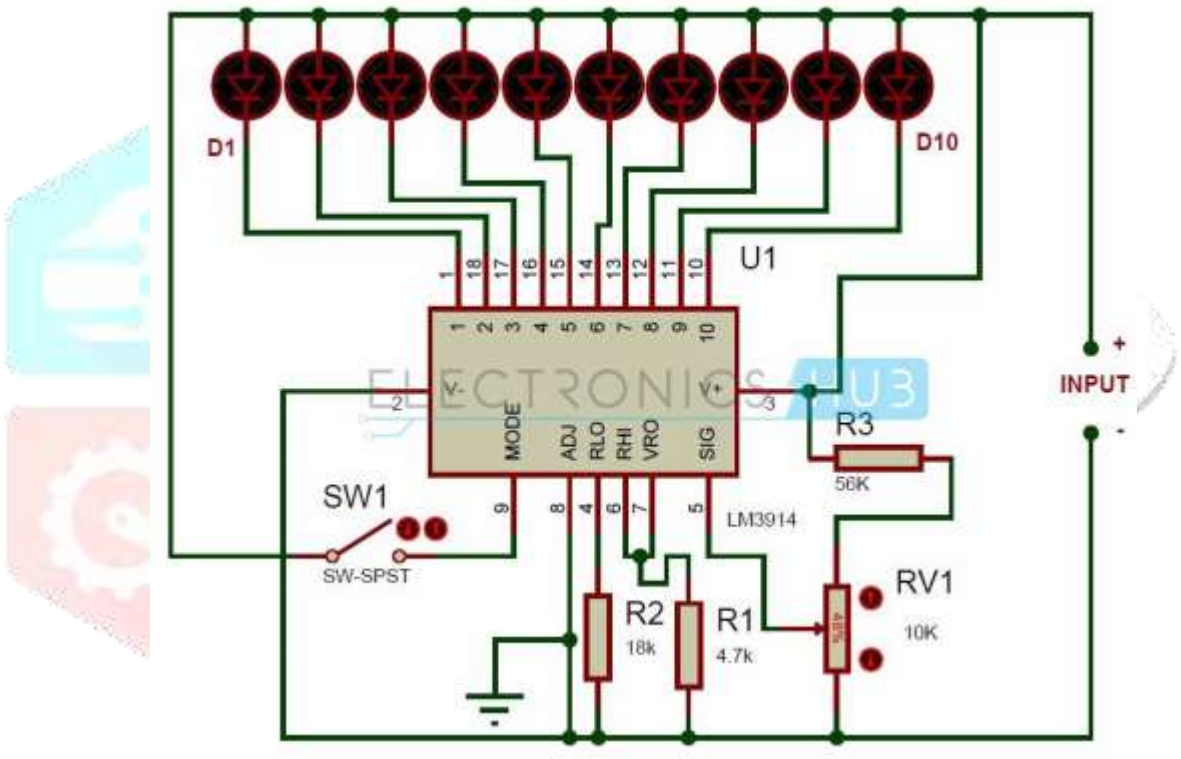

Fig: 4.2 Indication circuit

- The input current for this circuit is from the power bank of this device and the aim of this is to run LED's by varying voltage.
- Current touching all the LED's enters into the integrated circuit and apart from that it IC (LM3914) is joined with resistors.
- The resistors will alter the current up to its capacity and sends it to the LED's.
- One line from IC goes to the 10K port here this port is used as a voltage varying knob.
- As the current enters it passes through resistors and by turning knob here voltage varies and according to the varying voltage number of LED's lights up.

V CONCLUSION

There is a crisis for electricity throughout the world. Project ARI is a concept to compensate this dearth to a minor extent. It generates power from the resistance offered by air, called the air drag. ARI means air energy replenishing instrument. It can be mounted onto vehicles. The main components of ARI are-

- Generator casing

- Side locks
- ARI Stand
- Battery casing
- Batteries
- Switching mechanism

ARI can store power upto 34000mah and can charge laptops, mobile phones and can also be run as a fan. The maximum output voltage that can be obtained from this device is 21volts. It is quite easy to assemble ARI and hence it can be dissembled while carrying it or when not in use. There is a battery status indication setup which insinuates when the batteries are running low. Charging time is quite less when compared to discharging.

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