iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** X **Month of publication:** October 2019

DOI: http://doi.org/10.22214/ijraset.2019.10131

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

Design and Fabrication of Compressed Air Vehicle

Kalvakolu Suryaprakash Reddy[1], Bolledla Vivek[2]
[1, 2]B. Tech., Mechanical Enginering, JNTU, India

Abstract: Compressed air as a source of energy in different uses in general and as a non-polluting fuel in compressed air vehicles has attracted scientists and engineers for centuries. Efforts are being made by many developers and manufacturers to master the compressed air vehicle technology in all respects for its earliest use by the mankind. The present paper gives a brief introduction to the latest developments of a compressed-air vehicle along with an introduction to various problems associated with the technology and their solution. While developing of compressed air vehicle, control of compressed air parameters like temperature, energy density, requirement of input power, energy release and no emission development of a safe, light and cost effective compressed air vehicle in near future.

I. INTRODUCTION

Light weight vehicles are the next advancement in the development of automobiles. Reducing the weight of the vehicle has many advantages as it increases the overall efficiency of the vehicle, helps in improving maneuverability, requires less energy to stop and run the vehicle. The latest researches are going on around the world in order to come up with innovative ideas. But global warming is also one of the problems which is affecting the man. The temperature of the earth is increasing drastically and this in turn is causing climatic changes.

The fossil fuels are widely used as a source of energy in various different fields like power plants, internal & external combustion engines, as heat source in manufacturing industries, etc. But its stock is very limited and due to this tremendous use, fossil fuels are diminishing at faster rate. So, in this world of energy crisis, it is necessary to develop alternative technologies to use renewable energy sources, so that fossil fuels can be conserved

The first compressed air vehicle was established in France by a Polish engineer Louis Mekarski in 1870. It was patented in 1872 and 1873 and was tested in Paris in 1876. The working principle of Mekarski's engine was the use of energy stored in compressed air, another application of the compressed air to drive vehicles comes from Uruguay in 1984, where Armando Regusci has been involved in constructing these machines. He constructed a four-wheeler with pneumatic which travelled 100 km on a single tank in 1992. The Air Car was developed by Luxembourg-based MDI Group founder and former Formula One engineer Guy Negre is which works on compressed air vehicle (CAV).

II. LITERATURE REVIEW

[1]. A particularly well suited application for vehicle operating on compressed air is material handling and for visitors in industry. Compressed air storage energy (CASE) is a promising method of energy storage, with high efficiency and environmental friendliness [2]. Compressed air is regarded as fourth utility, after electricity, natural gas, water and the facilitating production activities in industrial environment [3]. Unfortunately production of compressed air solely for pneumatic vehicle is not affordable but in manufacturing industries compressed air is widely used for many applications such as cooling, drying, actuating and removing metal chips.

In addition, as a form of energy, compressed air represents no fire or explosion hazards; as the most natural substances, it is clean and safe and regarded as totally green [4]. The performance of air car is explain in [8] in which the importance of the impact of the fossil fuels in the present and future generations is explained which led them to design a new vehicle which runs by renewable energy sources. Compressed air vehicle are more suitable for low speed, short range and flammable environment [9, 10].An inventor, JemStansfield, has been able to convert a regular scooter to a compressed air moped [10].

The moped has top speed of about 18 mph and could go 7 miles before its air pressure ran out [10]. During literature survey it is observed that compressed air vehicles has many potential advantages over electric vehicles which includes no degradation problems of batteries, time required for refueling the tank, easy disposal of compressed air tank without causing any pollution as with the batteries [10].Hence in order to overcome the above stated problems there is a need of eco-friendly vehicles using compressed air as a working medium in future. In this work a sincere effort is made to develop Vehicle operating on compressed air by inversion of slider crank mechanism.

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

III. COMPONENTS AND DESCRIPTION

The components that are used in the project COMPRESSED AIR VEHICLE

Are as follows.

1) Air tank
2) Air gun
3) Chain drive
4) Sprockets
5) Frame
6) Pressure gauge

A. Air Tank

Storage can be used to control demand events (peak demand periods) in a compressed air system by reducing both the amount of pressure drop and the rate n of decay. Storage can be used to protect critical pressure applications from other events in the system. Storage can also be used to control the rate of pressure drop in demand while supporting the speed of transmission response from supply. For some systems, it is important to provide a form of refill control such as a flow control valve. Many systems have a compressor operating in modulation to support demand events, and sometimes strategic storage solutions can allow for this compressor to be turned off.

B. Air Tank Safety Measures

1) Each air tank shall be protected by 1 or more safety valves and other indicating and controlling devices that will insure safe operation of the tank. If the tank has a volumetric capacity in excess of 2,000 gallons, it shall be fitted with at least 2 safety valves, the smallest of which shall have a relieving capacity of at least 50 percent of the relieving capacity of the largest valve.
2) Safety relief valves shall Be constructed and installed in accordance with ASME Boiler and Pressure Vessel Code, Be located and installed so that they cannot be readily rendered inoperative. No valve of any description shall be placed between the required safety valve or rupture disc and the air tank. The opening or connection between the tank and safety valve or valves shall have a cross-sectional area at least equal to the combined areas of all attached safety valve inlets. Be of the direct spring-loaded type. The springs shall not be adjusted to carry more than: 10 percent greater pressure than the set pressure stamped on the valve up to and including 250 psig; or 5 percent greater pressure than the set pressure stamped on the valve above 250 psig.
3) Discharge pipes from safety valves and rupture discs installed on air tanks shall, Have a cross-sectional area at least equal to the combined outlet areas of all valves discharging into them. Be designed and installed so that there will be no interference with the proper operation or discharge capacity of the safety valve or rupture disc. Have no valve of any description. Be fitted with open drains which will prevent the accumulation of liquid above the safety valve or rupture disc.

Be installed and supported in a manner that will prevent undue stresses on the safety valve or rupture disc. Be led to a safe place of discharge.

C. Pressure Gauge

Many techniques have been developed for the measurement of pressure and vacuum. Instruments used to measure and display pressure in an integral unit are called pressure gauges *or vacuum gauges.* A manometer is a good example as it uses a column of liquid to both measure and indicate pressure. Likewise the widely used Bourdon gauge is a mechanical device which both measures and indicates, and is probably the best known type of gauge.

D. Frame

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

E. Sprockets

A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

©IJRASET: All Rights are Reserved

F. Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth.

G. Air Gun

A chuck is a specialized type of clamp. It is used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating workpiece. On a lathe the chuck is mounted on the spindle which rotates within the headstock. For some purposes (such as drilling) an additional chuck may be mounted on the non-rotating tailstock. Many chucks have jaws, (sometimes called dogs) that are arranged in a radially symmetrical pattern like the points of a star. The jaws are tightened up to hold the tool or workpiece. Often the jaws will be tightened or loosened with the help of a chuck key, which is a wrench-like tool made for the purpose.[1] Many jawed chucks, however, are of the keyless variety, and their tightening and loosening is by hand force alone.

H. Non Return Valve

A check valve, clack valve, non-return valve or one-way valve is a valve that normally allows fluid (liquid or gas) to flow through it in only one direction. Check valves are two-port valves, meaning they have two openings in the body, one for fluid to enter and the other for fluid to leave. There are various types of check valves used in a wide variety of applications. Check valves are often part of common household items. Although they are available in a wide range of sizes and costs, check valves generally are very small, simple, or inexpensive. Check valves work automatically and most are not controlled by a person or any external control; accordingly, most do not have any valve handle or stem. The bodies (external shells) of most check valves are made of plastic or metal.

IV. PRODUCT DESCRIPTION

A. Air Gun

Technical Specification

Brand name	Golden bullet
Rated voltage	230-240 v
Rated frequency	50 hz
Max. Capacity of chuck	13 mm
No load speed	0-3000 / min
Power consumption	500w
Product name	Impact drill
Drill capacity	13mm
Others	Reverse
Weight	1.7kg
Lpa (sound pressure level)	90 db (a) k = 3db
Lwa (sound power level)	101 db (a) k = 3db

B. Design Of Ball Bearing

Bearing No. 6202

Outer Diameter of Bearing (D) = 35 mm

Thickness of Bearing (B) = 12 mm

Inner Diameter of the Bearing (d) = 15 mm

r_1 = Corner radii on shaft and housing

r_1 = 1 (From design data book)

Maximum Speed = 14,000 rpm (From design data book)

Mean Diameter (d_m) = (D + d) / 2

= (35 + 15) / 2

d_m = 25 mm

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

C. WAHL Stress Factor

Ks = 4C – 1 + 0.65
4C – 4 C
= (4 X 2.3) -1 + 0.65
(4 X 2.3)-4 2.3
Ks = 1.85

$$K_s = \frac{4C-1}{4C-4} + \frac{0.65}{C} = \frac{(4 \times 2.3)-1}{(4 \times 2.3)-4} + \frac{0.65}{2.3}$$

$$K_s = 1.85$$

D. Basic Shaft Design Formula

The drive shaft with multiple pulleys experience two kinds of stresses, bending stress and shear stress. The maximum bending stress generated at the outer most fiber of the shaft. And on the other hand, the shear stress is generated at the inner most fiber. Also, the value of maximum bending stress is much more than the shear stress. So, the design of the shaft will be based on the maximum bending stress and will be driven by the following formula:

Maximum bending stress Tb = (M * r) / I……………….Eqn.1.1

Where,

M is maximum bending moment on the shaft.

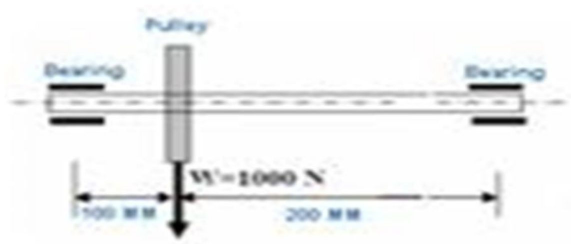
r is the radius of the shaft.

I is area moment of inertia of the shaft.

1) Design Procedure

a) Draw the bending moment diagram to find out the maximum bending moment (M) on the shaft.
b) Calculate the area moment of inertia (I) for the shaft.
c) Replace the maximum bending stress (Tb) with the given allowable stress for the shaft material.
d) Calculate the radius of the shaft.

2) Shaft Design Problem



Refer the above picture, where a steel shaft is supported by two bearings and a pulley is placed in between the bearings. You have to design the shaft. Weight of the pulley is 1000 N.

3) *Input data:* Maximum allowable shear stress for the shaft material= 40 N/mm2

4) Solution

a) From the bending moment diagram, the maximum bending moment (M) is calculated as 66666.67 N/mm2.
b) Area moment of inertia (**I**)of the circular shaft is: I = pi * r^4 *0.25

= 0.785*r^4………………..Eqn. 1.2

c) From Eqn1.1 we can write: 40 = (66666.67 *r)/ (0.785*r^4)

r= 12.85 mm

d) So, the minimum radius of the shaft should be 12.85 or 13 mm.

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

E. Design Of Chain Drive

Power required to run the Compressor	=	1 HP	=	736W
Speed at which compressor run		=		1440 rpm
Average running hrs/day	=	5 hrs/day		
Centre distance between the pulley	=	344 mm		
Transmission ratio (i) = 1440/1400	=	1		

1) Selection of teeth on the driver Sprocket

Consulting table 11.4 recommended value
(From the book design of transmission elements)

$Z_1 = i\, Z_1$
$= 1 \times 30$
$= 30$

Optimum centre distance,
$a = (30\text{-}50)\, P$
$= 344$ mm

$P_{max} = a/30 = 344/30 = 11.46$ mm
$P_{min} = a/50 = 344/50 = 6.88$ mm

Assume a standard pitch closer to Pmax (Larger Pitch is chosen so as to arrive at a quicker solution, but this may not be the best solution, any standard pitch between 6.88 to 11.46 can be chosen and the chain should be checked for strength and bearing pressure).

$P = 12.7$ mm (Standard is chosen)

Assume the chain to be duplex
The details of the chain to be brought is
08B -2 DR 1278 (Table 11.6)

Total load on driving side of the chain
$P_T = P_t + P_c + P_s$
Tangential force (P_t) = 1020 N/V

No. of teeth on the sprocket x pitch x rpm
V = 60 x 1000
$= 9.14$ m/s

$P_t = (1020 \times 0.764) / 9.14$
$= 85.26$N

Centrifugal tension
$P_c = WV^2/g = mv^2$
Here, m = 1.32 (From table 11.6)
$\therefore P_c = 1.32 \times 9.14^2$
$= 110.27$ N

Tension due to sagging
$P_s = K.\, W.\, a$
Where,
K = 6 for horizontal drive
W = mg = 13.2 N/m
a = 0.344 m
$\therefore P_s = 6 \times 13.2 \times 0.344$
$= 27.24$ N

$P_T = P_t + P_c + P_s$
$= 85.26 + 110.27 + 27.24$
$= 222.77$ N

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

Design load = $K_s \times P_T$

Where,

K_s = $K_1 . K_2 . K_3 . K_4 . K_5 . K_6$

K_1 = 1.25 for variable load with mild shocks (Table 11.8) K_2 = 1 for adjustable supports (Table 11.9)

K_3 = 1 because we have taken

a_p = (30 to 50) p (Table 11.10)

K_4 = 1 drive is horizontal (Table 11.11)

K_5 = 1 for droop lubrication (Table 11.12)

K_6 = 1.0 (for 5 hrs/day work) (Table 11.13)

$\therefore K_s$ = 1.25 x 1 x 1 x1 x 1 x 1

= 1.25

Design load = 1.25 x 222.77

= 278.46 N

Factor of safety = Breaking load / Design load

Here, Breaking Load = 31800 N

∴Factor of safety = 31800/278.46

= 11.4

Consulting table 11.1 we find for smaller sprocket speed of 1440 rpm and pitch 12.7 mm, the required minimum factor of safety is 11. We get the actual factor of safety greater and hence the design is safe.

Bearing Stress on rollers induced stress,

σ = $(P_t / K_s) / A$

A = 100 mm² (Table 11.6)

σ = (85.26 x 1.25) / 100

= 1.06 N/mm²

Allowable stress(σ) = 18.5 for small sprocket speed of 1440 rpm and pitch 12.7 mm from table 11.4. We find that the induced stress is less than the permissible value.

Length of the Chain,

$L_p = 2_{ab} + \{(Z_1+Z_2)/Z\} + \{[(Z_2 - Z_1)/Z\Pi]^2/a_p\}$

Where, ap = a_0/p = 344 / 12.7

= 27.08

Lp = $2 \times 27.08 + [(30+30)/2] + \{[(30-30)/2\Pi]^2/27.08\}$

= 84.17

= 86 links (rounded off to an even number)

Since we have to connect three pulleys, so we have to multiply it by 1.5 to get exact number of links

∴ 130 links is required

∴ Actual length of the chain = 130 x P

= 130 x 12.7

= 1.65 mts.

2) Specification of the Chain

The transmission ratio	=	1
Pitch of the chain	=	12.7 mm
Tangential force	=	85.26 N
Centrifugal tension	=	110.27 N
Tension due to Sagging	=	27.24
Total load on chain	=	222.77 N
Breaking Load	=	31800 N
Design Load	=	278.46 N
Bearing stress on rollers	=	1.06 N/mm²
Number of links on the chain	=	86 links

©IJRASET: All Rights Reserved

Length of the chain	=	1.65 mts
Designation ISO Number	=	C8B-2
Rolon chain Number	=	DR 1278

F. WHY?? Mild steel???

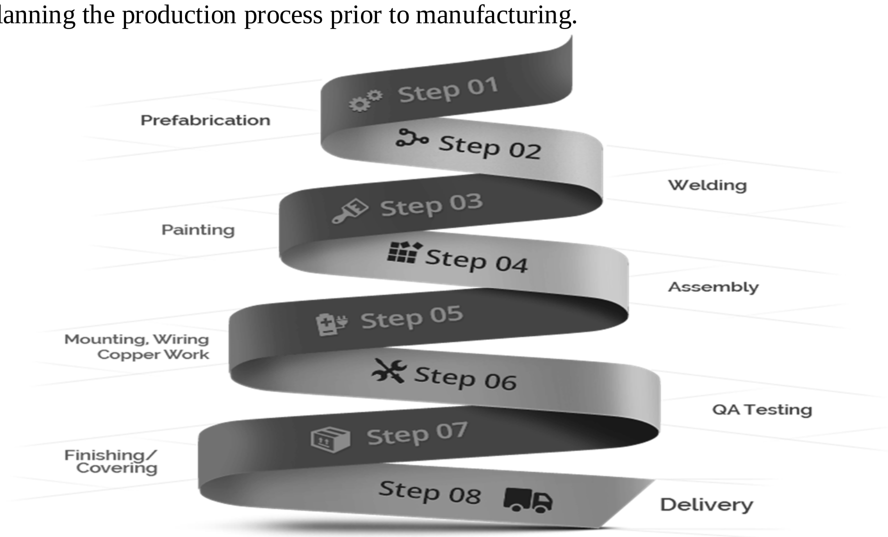
The term 'mild steel' is also applied commercially to carbon steels not covered by standard specifications. Carbon content of this steel may vary from quite low levels up to approximately 0.3%. Generally, commercial 'mild steer' can be expected to be readily weldable and have reasonable cold bending properties but to specify 'mild steel' is technically inappropriate and should not be used as a term in engineering. Mild steel is the most widely used steel which is not brittle and cheap in price. Mild steel is not readily tempered or hardened but possesses enough strength.

G. Mild Steel Composition

1) Mild steel contains –C45
2) Carbon 0.35 to 0.45 % (maximum 0.5% is allowable)
3) Manganese 0.60 to 0.90 %
4) Silicon maximum 0.40%
5) Sulfur maximum 0.04%
6) Phosphorous maximum 0.04%
7) Mildest grade of carbon steel or mild steel contains a very low amount of carbon - 0.05 to 0.26%
8) Tensile strength – 63-71 kgf/mm^2
9) Yield stress -36 kgf/mm^2
10) Izod impact valve min -4.1 kgf m
11) Brinell hardness (HB) - 229

V. FABRICATION PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.



A. Fabrication Processes

These are secondary manufacturing processes where the starting raw materials are produced by any one of the previous manufacturing processes desired. Its assembly involve joining pieces either temporary or permanent. So that they would be perform the necessary function. The joining can be achieved by either or both of heat and pressure joining materials. Many of the steel structure construction, we see are first rolled and then joined together by a fabrication process are

©IJRASET: All Rights are Reserved

1) Gas welding
2) Electric arc welding
3) Electrical resistance welding
4) Thermo welding
5) Brazing welding
6) Soldering welding
7) Cold welding

B. *Material Removal Processes*

These are also a secondary removal manufacturing process, where the additional unwanted material is removed in the form of chips from the blank material by a hard tools so as to obtain the final desired shape.

Material removal is normally a most expensive manufacturing process. Because more energy is consumed and also a lot of waste material is generated in this process. Still this process is widely used because it deliver very good dimensional accuracy and good surface finished. Material removal process are also called machining processes. Various processes in this category are

1) Turning
2) Drilling
3) Shaping and planning
4) Milling
5) Grinding
6) Broaching
7) Sawing
8) Trimming

C. *Welding*

Welding is a process of joining two metal pieces by the application of heat. Welding is the least expensive process and widely used now a days in fabrication. Welding joints different metals with the help of a number of processes in which heat is supplied either electrically or by mean of a gas torch. Different welding processes are used in the manufacturing of Auto mobiles bodies, structural work, tanks, and general machine repair work. In the industries, welding is used in refineries and pipe line fabrication. It may be called a secondary manufacturing process.

D. *Classification of Welding Processes*

There are about 35 different welding and brazing process and several soldering methods, in use by the industry today. There are various ways of classifying the welding for example, they may be classified on the basis of source of heat (flames, arc etc.)

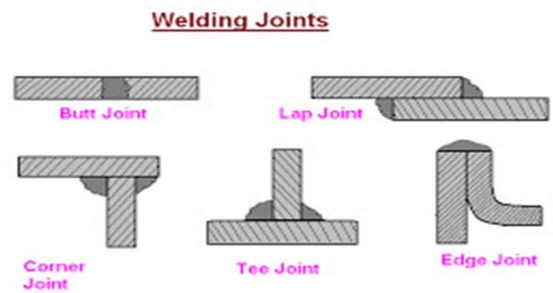
In general various welding processes are classified as follows.

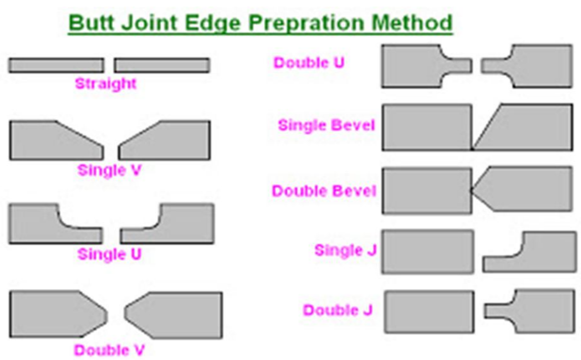
1) *Gas Welding*
   a) Air Acetylene
   b) Oxy Acetylene
   c) Oxy Hydrogen Welding
2) *Arc Welding*
   a) Carbon Arc welding
   b) Plasma Arc welding
   c) Shield Metal Arc Welding
   d) T.I.G. (Tungsten Inert Gas Welding)
3) *Resistance Welding*
   a) Spot welding
   b) Seam welding
   c) Projection welding
   d) Resistance Butt welding
4) *Solid State Welding*
   a) Cold welding

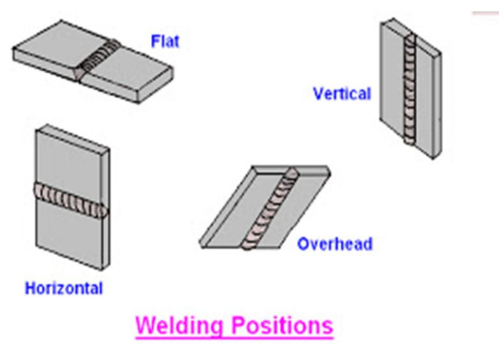
©IJRASET: All Rights are Reserved

b) Diffusion welding
c) Forge welding
d) Fabrication welding
e) Hot pressure welding
f) Roll welding
5) *Thermo Chemical Welding*
a) Thermite welding
b) Atomic welding
6) *Radiant Energy Welding*
a) Electric Beam Welding
b) Laser Beam Welding

Welding Joints







E. Drilling

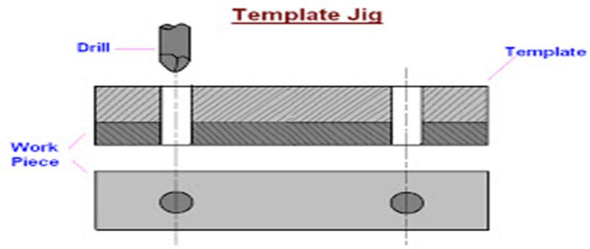
Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.
In rock drilling, the hole is usually not made through a circular cutting motion, though the bit is usually rotated. Instead, the hole is usually made by hammering a drill bit into the hole with quickly repeated short movements. The hammering action can be performed from outside the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH). Drills used for horizontal drilling are called drifter drills.

F. Drilling Process
1) Center drilling
2) Deep hole drilling
3) Gun drilling
4) Trepanning
5) Micro drilling
6) Vibration Drilling

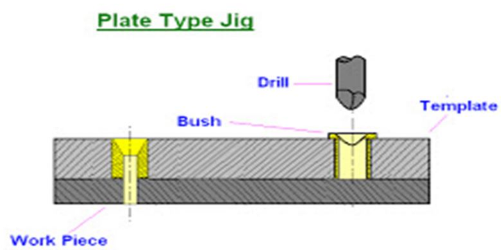
©IJRASET: All Rights Reserved

G. Types of Drilling Jigs

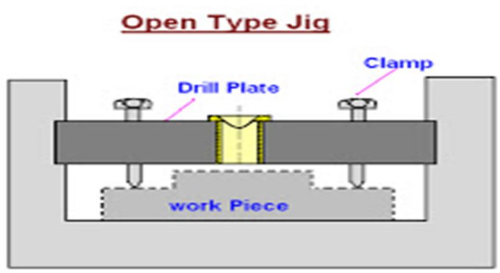
1) *Template Jig:* This is the simplest type of jig; It is simply a plate made to the shape and size of the work piece; with the require number of holes made it. It is placed on the work piece and the hole will be made by the drill; which will be guided through the holes in the template plate should be hardened to avoid its frequent replacement this type of jig is suitable if only a few part are to be made.



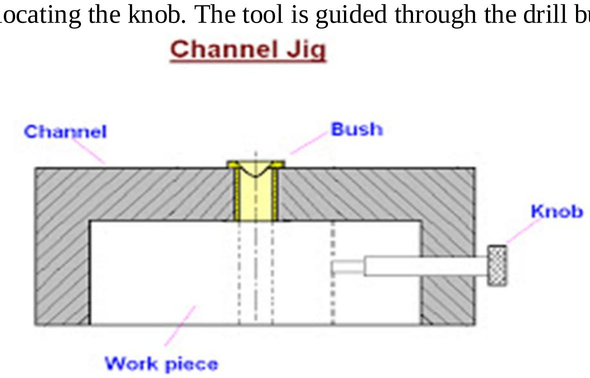
2) *Plate Type Jig:* This is an improvement of the template type of jig. In place of simple holes, drill bushes are provided in the plate to guide the drill. The work piece can be clamped to the plate and holes can be drilled. The plate jig are employed to drill holes in large parts, maintaining accurate spacing with each other.



3) *Open Type Jig:* In this jig the top of the jig is open; the work piece is placed on the top.

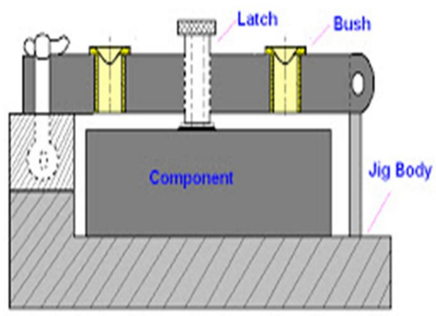


4) *Channel Jig:* The channel jig is a simple type of jig having channel like cross section. The component is fitted within the channel is located and clamped by locating the knob. The tool is guided through the drill bush.



©IJRASET: All Rights are Reserved

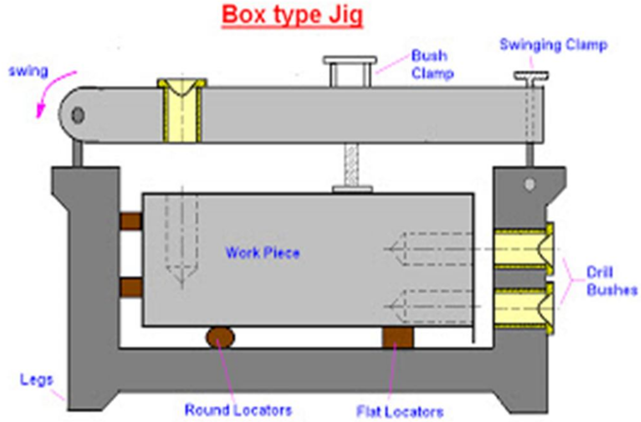
5) *Leaf Jig:* It is also a sort of open type jig , in which the top plate is arrange to swing about a fulcrum point, so that it is completely clears the jig for easy loading and unloading of the work piece.



Leaf Jig

6) *Box Type Jig:* When the holes are to drill more than one plane of the work piece, the jig has to be provided with equivalent number of bush plates. For positioning jig on the machine table feet have to be provided opposite each drilling bush plate. One side of the jig will be provided with a swinging leaf for loading and unloading the work piece, such a jig would take the form of a box.

Box type Jig

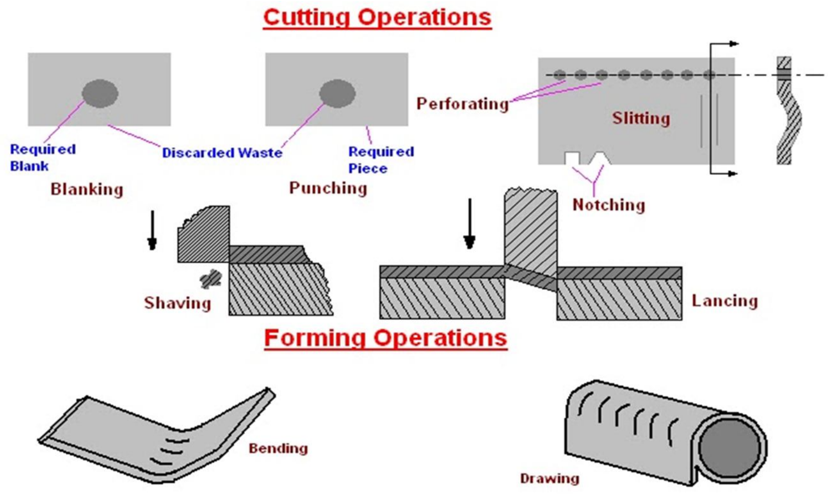


H. *Metal Cutting Operations*

1) *Blanking:* Blanking is the operation of cutting a flat shape from sheet metal. The product punched out is called the “blank” and the required product of the operation the hole and the metal left behind is discarded as waste.
2) *Punching or Piercing:* It is a cutting operation by which various shaped holes are made in sheet metal. Punching is similar to blanking except that in punching, the hole is the desired product. The material punched out from the hole being waste.
3) *Notching:* This is cutting operation by which metal pieces are cut from the edge of the sheet, strip or blank.
4) Perforating: This is a process by which multiple holes are very small and close together are cut in a flat sheet metal.
5) *Trimming:* This operation consists of cutting unwanted excess of material from the periphery of a previously formed component.
6) *Shaving:* The edge of a blanked part are generally rough, uneven and square. Accurate dimensions of the part are obtained by removing a thin strip of metal along the edges.
7) *Slitting:* It refers to the operation of making incomplete holes in a work piece.
8) *Lancing:* This is a cutting operation in which a hole is partially cut and then one side is bent down to form a sort of tab. Since no metal is actually removed and there will be no scrap.
9) *Nibbling:* The nibbling operation, which is used for only small quantities of components, is designed for cutting out flat parts from sheet metal. The flat parts from simple to complex contours. This operation is generally substituted for blanking. The part is usually moved and guided by hand as the continuously operating punch cutting away at the edge of the desired contour.

©IJRASET: All Rights are Reserved

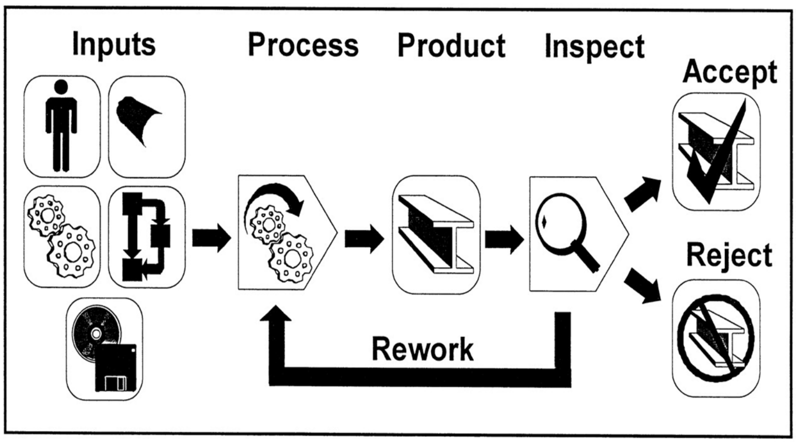
I. Forming Operations



1) *Bending:* In this operation; the material in the form of flat sheet or strip is uniformly strained around a linear axis which lies in the neutral plane and perpendicular it's the length wise direction of the sheet or metal.
2) *Drawing:* This is a process of forming a flat work piece into a hollow shape by means of a punch which cause the blank into a die cavity.
3) *Squeezing:* Under the operation, the metal is caused to flow to all portions of a die cavity under the action of compressive forces.

J. Inspection

Critical appraisal involving examination, measurement, testing, gauging, and comparison of materials or items. An inspection determines if the material or item is in proper quantity and condition, and if it conforms to the applicable or specified requirements. Inspection is generally divided into three categories: (1) Receiving inspection, (2) In-process inspection, and (3) Final inspection. In quality control (which is guided by the principle that "Quality cannot be inspected into a product") the role of inspection is to verify and validate the variance data; it does not involve separating the good from the bad.



K. Assembly

An assembly line is a manufacturing process (most of the time called a progressive assembly) in which parts (usually interchangeable parts) are added as the semi-finished assembly moves from work station to work station where the parts are added in sequence until the final assembly is produced. By mechanically moving the parts to the assembly work and moving the semi-finished assembly from work station to work station, a finished product can be assembled much faster and with much less labor than by having workers carry parts to a stationary piece for assembly.

©IJRASET: All Rights Reserved

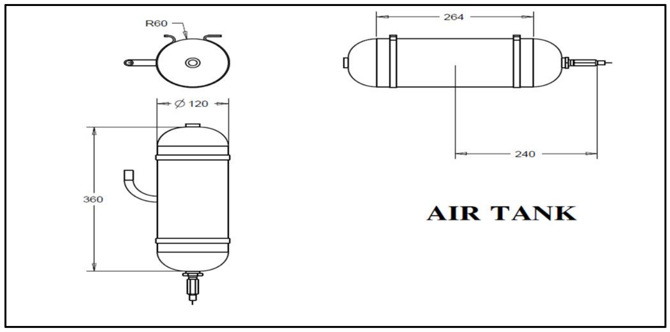
International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue X, Oct 2019- Available at www.ijraset.com

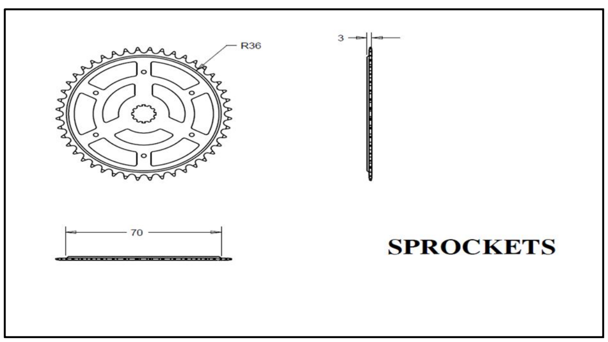
VI. WORKING PRINCIPLE

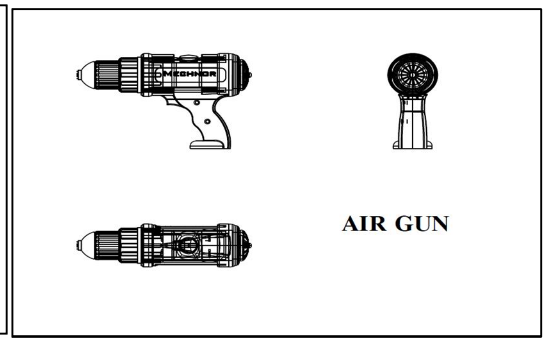
The compressed air vehicle consists of the air storage tank which stores the compressed air inside the tank. Then there is a gate valve for the controlling of the compressed air into the next part of the system. This vehicle also consists of a non-return valve, pneumatic (gun) drill, shafts and chain drive and sprocket mechanism.

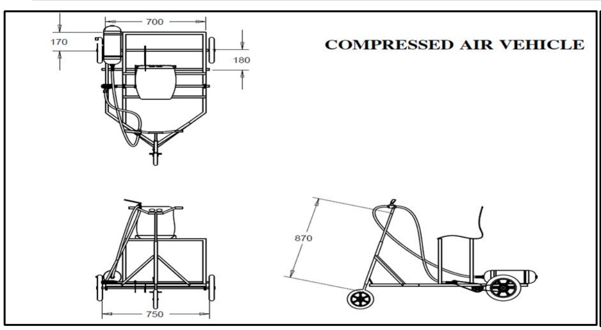
The compressed air stored in the tank enters the gate valve which is placed near the handle for the comfort of the driver, when the gate valve is opened the air enters the pneumatic drill (gun) for the actuation or the motion of the vehicle.

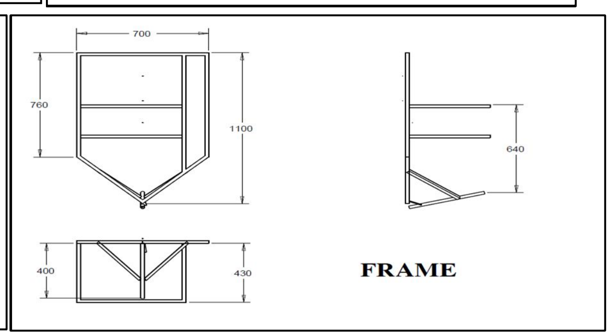
This vehicle is designed as a tri-wheeler for the better comfort and easier handling of the vehicle. The compressed air enters the air gun through a gate valve by which the shaft is driven and by the chain sprocket mechanism the power from a shaft is transmitted to the other shaft or the rear wheel shaft thus making the vehicle driven.

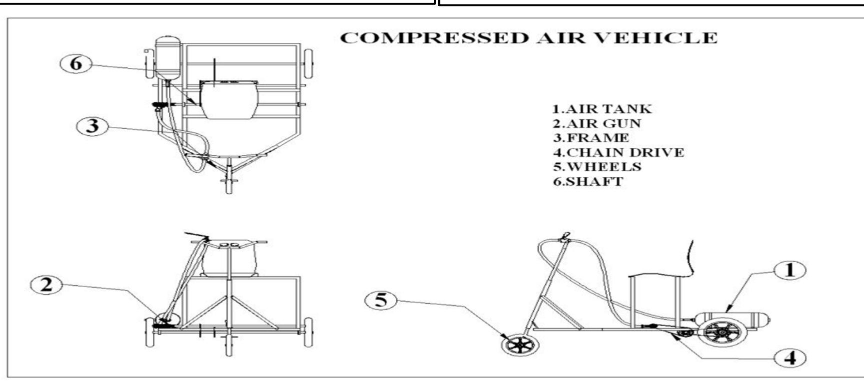












©IJRASET: All Rights are Reserved

VII. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

A. *Advantages*

1) Compressed air to store the energy instead of batteries. Their potential advantages over other vehicles include:
2) Reducing pollution from one source, as opposed to the millions of vehicles on the road.
3) Transportation of the fuel would not be required due to drawing power off the electrical grid. This presents significant cost benefits. Pollution created during fuel transportation would be eliminated.
4) Compressed air technology reduces the cost of vehicle production.
5) There is no need to build a cooling system, fuel tank, Ignition Systems or silencers.
6) The mechanical design of the engine is simple and robust.
7) Low manufacture and maintenance costs as well as easy maintenance.

B. *Disadvantages*

1) Like the modern car and most household appliances, the principal disadvantage is the indirect use of energy.
2) The temperature difference between the incoming air and the working gas is smaller. In heating the stored air, the device gets very cold and may ice up in cool, moist climates
3) Refueling the compressed air container using a home or low-end conventional air compressor may take as long time.
4) Tanks get very hot when filled rapidly. It very dangers it sometime bloused.
5) Only limited storage capacity of the tanks. So we not take drive on long time.

C. *Applications*

1) Two wheeler Application
2) Four wheeler Applications

List of materials.

Sl. No.	PARTS	Qty.	Material
1	Air tank	1	M.S
2	Air gun	1	-
3	Pressure gauge	1	-
4	Chain drive	2	M.S
5	Sprockets	4	M.S
6	Shafts	-	M.S
7	Frame	-	M.S
8	Hoses	-	PU tubes
9	Bearing & bearing cap	6	-
10	Wheels & chair	3	-
11	NRV	1	-

Materials cost

Sl. No.	**PARTS**	**Qty.**	**Amount (Rs)**
1	Air tank	1	1200
2	Air gun	1	2500
3	Pressure gauge	1	550
4	Chain drive	2	900
5	Sprockets	4	950
6	Shafts	-	750
7	Frame	-	2100
8	Hoses	--	300
9	Bearing & bearing cap	6	1200
10	Wheels & chair	3	1250
11	NRV	1	250
12	Labour cost	-	3500
13	Miscellaneous cost	-	1500
14	Machining cost	-	2500

Total cost = 20,000

©IJRASET: All Rights are Reserved

VIII. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries.

We are proud that we have completed the work with the limited time successfully. The DESIGN AND FABRICATION OF COMPRESSED AIR VEHICLE is working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a "COMPRESSED AIR VEHICLE.

REFERENCES

[1] B.R.Singh, O. Singh, Study of Compressed Air Storage System as Clean Potential Energy for 21st Century, Global Journal of researches in engineering Mechanical and mechanics engineering,12(1), 2012

[2] Y.M.Kim, D.Favrat, Energy and energy analysis of a micro compressed air energy storage and air cycle heating and cooling system. Energy, 35 (1), (2010), 13-20.

[3] C.Y. Yuan. T. Zhang, A. Rangarajan, D.Dornfeld, B. Ziemba, R. Whitbeck, A decision-based analysis of compressed air usage patterns in automotive manufacturing, Journal of Manufacturing System, 25 (4) (2006), 293-300.

[4] Cox R. Compressed air- clean energy in a green world, Glass Int. 19(2) (1996), 2. 5. F. Reuleaux, W. Kennedy; Kinematics of Machinery, 268, (1876), pp. 335.

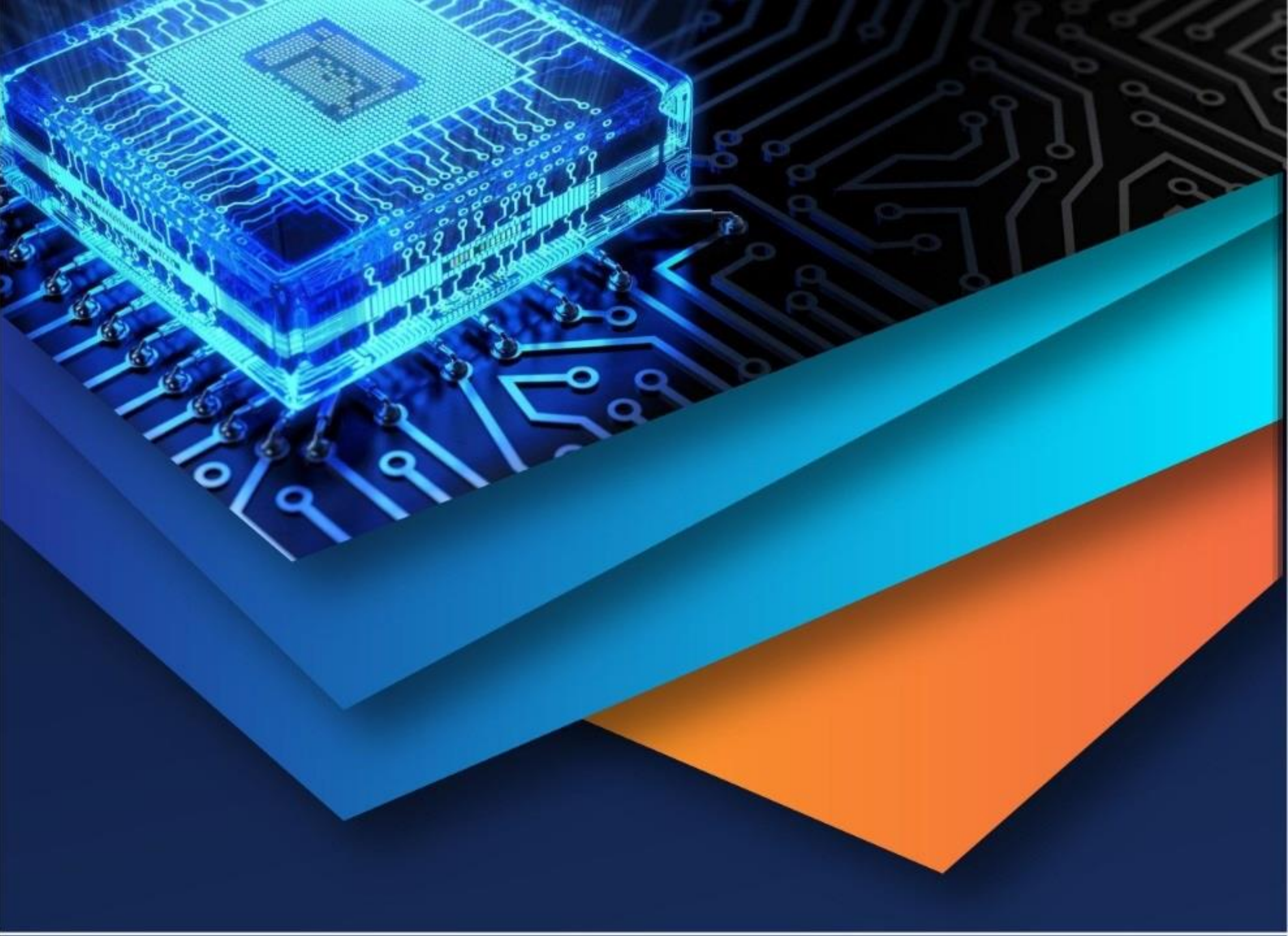
[5] E.C. Fitch, Fluid power and control system, McGraw- Hill Book Company, New York, USA, 1966

[6] S R Majumdar, Pneumatic system (principles and maintenance, Tata McGraw-Hill Education, (1996), Technology & Engineering – 282.

[7] A.Addala & S.Gangada, Fabrication and Testing of Compressed Air Car, Global Journal of Researches in Engineering Mechanical and Mechanics Engineering, 13(1), (2013), 1-9.

[8] A. Papson, F. Creutzig, L. Schipper, Compressed air vehicles: a drive cycle analysis of vehicle performance, environmental impacts, and economic costs, 2010 Annual meeting of the transportation research board and publication in the transportation research record.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)