

## Design and manufacturing of automatic gas pipe cutting machine

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### Abstract

To reduce human effort for repetitive work of cutter pieces of pipes as well as providing a convenient fixture to support and hold the pipes during cutting. Automatic gas pipe cutting machine is lightweight, portable chain type. Gas cutting machine is an automatically operated by cutting machine that uses chain drive which works on shaft rotated by DC motor. The shaft of DC motor rings the chain drive & whole assembly is circulated over the pipe in 360 degree; whereas lead screw with spring is attached to fix the base plate with 4 wheels & upper plate. The gas cutter or torch is fixed to base plate, which will be powered by oxy-fuel cylinder & the desired section is cut as per need. This project gives an idea about portable, easy to use gas pipe cutting machine which cuts the pipe from 380mm thickness to thickness having change in chain drive.

**Keywords:** Portable, Base plate, Torch, DC motor etc.

### 1. Introduction

It is essential, in the interest of strength and economy, to cut pipes cleanly and with a fair degree of accuracy. This has to be achieved, both in the workshop and on site, which means that a machine designed for such work requires to be light, portable and easy to maintain. The automatic portable gas pipe cutting machine has been designed to meet such requirements. It is simple mount, operate and maintain, and when operated at the correct cutting conditions, excellent finish is obtained on the cut face. It is for use when pipes require to be square cut and the edges given square preparation. The smallest diameter pipe that can be dealt with is 380mm (15 inch). The largest diameter depends upon the length of the drive chain. The cutter has the capacity to cut thickness depends upon the concentration of the gas flame adjusted. It is recommended that the standard type machine is used on pipe in the horizontal position. Pipe in other positions can be dealt with if some means of support is provided, against which the wheel can run. In this instance a track band, made from mild steel strip, has been strapped firmly around the pipe, for the lower wheels of the machine to run against. Track band type machine to run against. Track band type machines can be used on pipe in any position. The accuracy of the automatic portable pipe gas cutting machine depends upon the care exercised by the operator and keeping the machine in a clean condition. Machine tool standards should be maintained at all times. Maintenance of the machine has been reduced to a minimum and most components which in times may require attention can be replaced at a fixed cost.

Auto pipe cutting machine is a lightweight, portable chain type cutting machine. It can be used at large field jobs as well as in small workshop. The machine is designed with mild steel. The other parts of machine are of stainless steel making it rust free. Gas cutting machine is an automatically operated pipe cutting machine that uses a chain and gear drive system. The drive chain is comprised of durable, interlocking links

that can easily be added or removed for quick change of pipe diameters.

### 2. Literature Review

Oxy-fuel cutting and oxy-fuel welding are processes that use fuel gases and oxygen to weld and cut metals, respectively. French engineers Edmond Fouché and Charles Picard became the first to develop oxygen-acetylene cutting in 1903. Pure oxygen, instead of air is used to increase the flame temperature to allow localized melting of the work piece material (e.g. steel) in a room environment. A common propane/air flame burns at about 2,000 °C (3,630 °F), a propane/oxygen flame burns at about 2,500 °C (4,530 °F), and an acetylene/oxygen flame burns at about 3,500 °C (6,330 °F). Oxy-fuel is one of the oldest cutting processes, besides manual cutting. Still used in industry, in recent decades it has been less widely utilized in industrial applications as other specifically devised technologies have been adopted. It is still widely used for cutting pipes and tubes, as well as repair work. It is also frequently well-suited, and favored, for fabricating some types of metal-based artwork. As well, oxy-fuel has an advantage over manual cutting and welding processes in situations where accessing would present difficulties; it is more self-contained, in this sense — hence "more portable". In oxy-fuel cutting, a cutting torch is used to cut pipes. In oxy-fuel cutting. A torch is used to heat metal to its kindling temperature. A stream of oxygen is then trained on the metal, burning it into a metal oxide that flows out of the kerf as slag. Sometimes called a "Gas Axe". Torches that do not mix fuel with oxygen (combining, instead, atmospheric air) are not considered oxy-fuel torches and can typically be identified by a single tank (Oxy-fuel cutting requires two isolated supplies, fuel and oxygen). Most metals cannot be melted with a single-tank torch. As such, single-tank torches are typically used only for soldering and brazing. Rather than welding. Generally stated, the aim of the present invention is to provide a power driven machine which can be readily applied to a pipe in a

trench or a similar location, and operated with a minimum of clearance to sever the pipe circumferentially. A more specific object is to provide a machine for circumferentially severing a pipe in such a situation as that described, which will complete its severing operation without damaging or weakening the adjoining portion of the pipe. The invention also resides in a novel arrangement for preventing spiraling of the cut.

### 3. Construction



Fig 1

### 4. Design of Elements

#### 4.1 Selection Criterion for Design

In system design we mainly concentrated on the following parameters: -

- **System Selection Based On Physical Constraints**

While selecting any machine it must be checked whether it is going to be used in a large-scale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room.

The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that.

- **Arrangement of Various Components**

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

- **Components of System**

As already stated the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired.

- **Man Machine Interaction**

The friendliness of a machine with the operator that is operating is an important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship.

- **Chances of Failure**

The losses incurred by owner in case of any failure is an important criteria of design. Factor safety while doing mechanical design is kept high so that there are less chances of

failure. Moreover periodic maintenance is required to keep unit healthy.

- **Servicing Facility**

The layout of components should be such that easy servicing is possible. Especially those components which require frequents servicing can be easily disassembled.

- **Scope of Future Improvement**

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated; the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

- **Weight of Machine**

The total weight depends upon the selection of material components as well as the dimension of components. A higher weighted machine is difficult in transportation & in case of major breakdown; it is difficult to take it to workshop because of more weight.

- **Mechanical Design**

Mechanical design phase is very important from the view of designer.as whole success of the project depends on the correct deign analysis of the problem.

Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge above physical properties of material, loads stresses, deformation, and failure. Theories and wear analysis, He should identify the external and internal forces acting on the machine parts.

These forces may be classified as:

- 1) Dead weight forces
- 2) Friction forces
- 3) Inertia forces
- 4) Centrifugal forces
- 5) Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side.

Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements.

Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material. Provision should be made to minimize nearly adopting proper lubrications me.

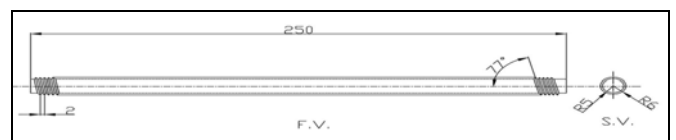


Fig 2: Lead Screw

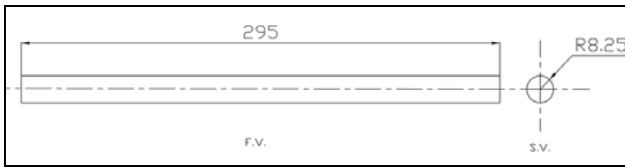


Fig 3: Pillar

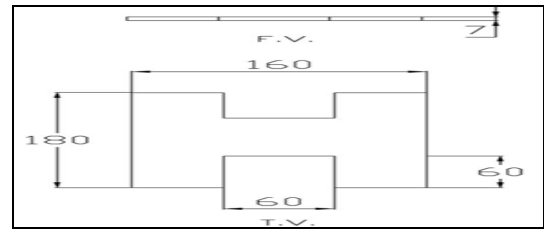


Fig 4: Base Plate

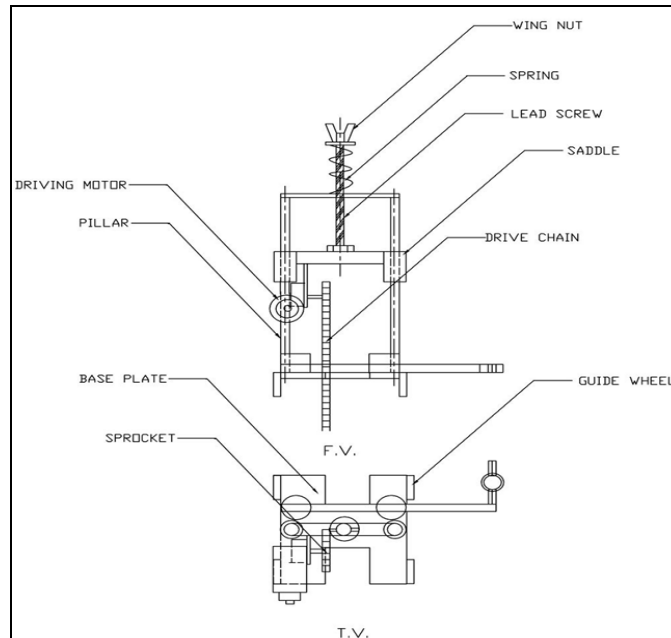


Fig 5: General Assembly

Process Sheets

Part Name : Lead Screw		Material : M.S.			
Sr. No	Description of Operation	Jigs & Fixture	M/c Tools	Cutting Tools	Measuring Instrument
1.	Facing (205mm length)	3 Jaw Chuck	Lathe Machine	R.H. Single Point Tip Tool	Vernier Calliper
2.	Turning (Ø12mm)	3 Jaw Chuck	Lathe Machine	R.H. Single Point Tip Tool	Vernier Calliper
3.	Threading (Ø12×M10)	3 Jaw Chuck	Lathe Machine	Thread Cutting Tool	Pitch Gauge

Part Name: LH Pillar		Material : M.S.			
Sr. No	Description of Operation	Jigs & Fixture	M/c Tools	Cutting Tools	Measuring Instrument
1.	Facing (295mm length)	3 Jaw Chuck	Lathe Machine	R.H. Single Point Tip Tool	Vernier Calliper
2.	Turning (Ø16.5mm)	3 Jaw Chuck	Lathe Machine	R.H. Single Point Tip Tool	Vernier Calliper

Part Name: Base Plate		Material : M.S.			
Sr. No	Description of Operation	Jigs & Fixture	M/c Tools	Cutting Tools	Measuring Instrument
1.	Cutting of Plate (180×160mm length)	M/C Table	Power Hacksaw	Saw	Vernier Calliper
2.	Slot Cutting	M/C Table	Power Hacksaw	Saw	Vernier Calliper

#### Cost sheet

SR. NO.	Part Name	Material	Quantity	Rate / Piece	Total Cost(Rs.)
1.	Wheel Shaft	M.S.	4	20	80
2.	Pillars	M.S.	2	300	600
3.	Guide Wheels	M.S.	4	60	240
4.	Butterfly Nut	Brass	1	100	100
5.	Spring	Carbon Steel	1	100	100
6.	Bushing	M.S.	2	200	400
7.	Base Plate	M.S.	1	400	400
8.	Gear/Sprocket	C.I.	1	150	150
9.	Chain	Steel	1	800	800
10.	Lead Screw	M.S.	1	100	100
11.	Washer	M.S.	1	10	10
12.	Hanger	Aluminium	1	300	300
13.	DC Gear Motor	Standard	1	3500	3500
14.	Battery	Standard	1	1200	1200
<b>Total Cost</b>					<b>7980</b>

#### 5. Conclusion

In this project a complete design of the gas pipe cutting machine is done and fabricated. The auto gas pipe cutting machine is designed taking in account of currently available components in the market. The designing and assembling of very large number of components was a tremendous task and was completed on time. However because of some parts couldn't be purchased the whole assembly was limited to welding operation.

The project can go beyond its current position and capabilities by employing automation into it. This can be done by using DC geared motor. The use of this machine increases production rate, workers safety in gas pipe cutting operation.

#### 6. Acknowledgement

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