

Abrasive Jet Gun

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Abstract: The AJM (Abrasive Jet Machining) Is A Non-Traditional Process, But Because Of The High Advantages Like, Machining Of Both Hard & Brittle Material, No Direct Contact Of Work Piece And Machine (Machining Obtained With Minimum Vibration), It Is Very Useful For Machining Operations . The Major Problem Of This Process Is The High Cost And The Bulky Size Of Machine. This Paper Is Presented For Reducing Machining Cost & Reducing The Size Of Machine.

Keywords : Compact Design, Elimination Of Some Parts, Glass Drilling, Deburring.

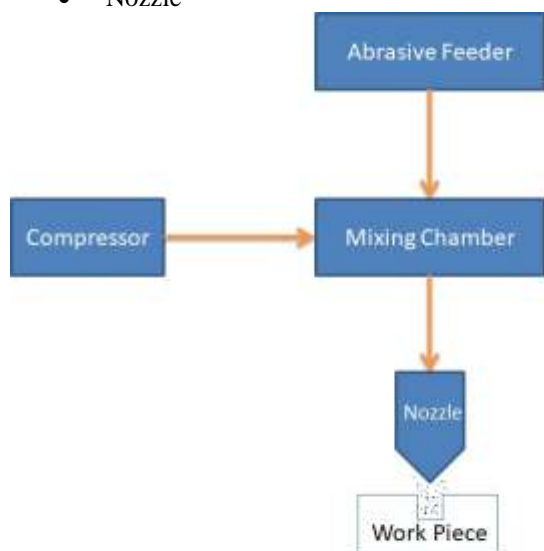
I. INTRODUCTION

This machine works on principle of Abrasive Jet Machining.

Abrasive Jet Machining is a process in which abrasive particles are bombard or fired on the work piece with the help of pressurized air or gas and because of this machining is achieved.

The main components of actual system are,

- Compressor
- Mixing Chamber
- Abrasive feeder
- Nozzle



Block Diagram of AJM

Working of abrasive machine

Working is simple, pressurized air from compressor, enters into the mixing chamber, and at the same time, abrasive material enter into mixing chamber from other side, A mixture of air and abrasive material is obtained here which is further supplied to nozzle with the help of hose or pipe. Nozzle fire the abrasive particles on work-piece from which material removal of work-piece is achieved, or in other words, machining operation is obtained. From reference [1]

II. Literature Review

The concept is to eliminate some component of old machine like mixing chamber and built it more compact in form of gun which can be used for drilling on glass and also deburring, cleaning process. Instead of separate mixing chamber, the mixing is control by an, opening of ports which are operated by trigger mechanism. Which will help us to build more compact machine and it will also reduce the machining cost. The flow rate of abrasive and air can be controlled by their area or diameter of ports in our case i.e(1). Some important thing to keep in mind while selecting the diameter of ports are, the mass flow rate of abrasive material should be less than mass flow rate of air .

III. Problem Defination

The traditional process, which is used for drilling glass is, use of drill bit today in practice, but this process is expensive, because of its tool (drill bit) and also a big machine is required for operation with addition to that an skillful worker is also needed. And mostly the work-piece is kept in horizontally under the drilling tool and then drilling is done but in our machine you can drill in both horizontally & vertically, you don't need to keep it down under the tool. You can place the drilling gun on glass and drill the hole directly. Some of the advantages of our machine compared to traditional machines are,

Advantages

- Small in size.
- No coolant is required.
- No need to clamp the work piece under it.
- Can drill in perpendicular direction also
- Minimize the Vibration effect, due to no direct contact of tool and work piece.
- Can machine both brittle as well as hard material.
- Multiple operation can be obtained.

TABLE 1 formula

1	FLOW RATE	$A \cdot V$
2	DISCHARGE OF NOZZLE	$28.9 \cdot D^2 \cdot \sqrt{P}$
3	VOLUME OF CYLINDER	$3.14 \cdot R^2 \cdot H$
4	VOLUME OF CONE	$1/3 \cdot 3.14 \cdot R^2 \cdot H$

IV. Description Of Abrasive Jet Machine (Gun)

Main components of glass AJM machine

- Compressor.
- Abrasive holder.
- Nozzle.
- Trigger mechanism.
- body

- **Compressor**

The main function of the compressor is to supply the pressurized air to the machine. Selection of compressor should be done, according to our requirement for operation. Our machine is operated between 1-7 bar pressure.

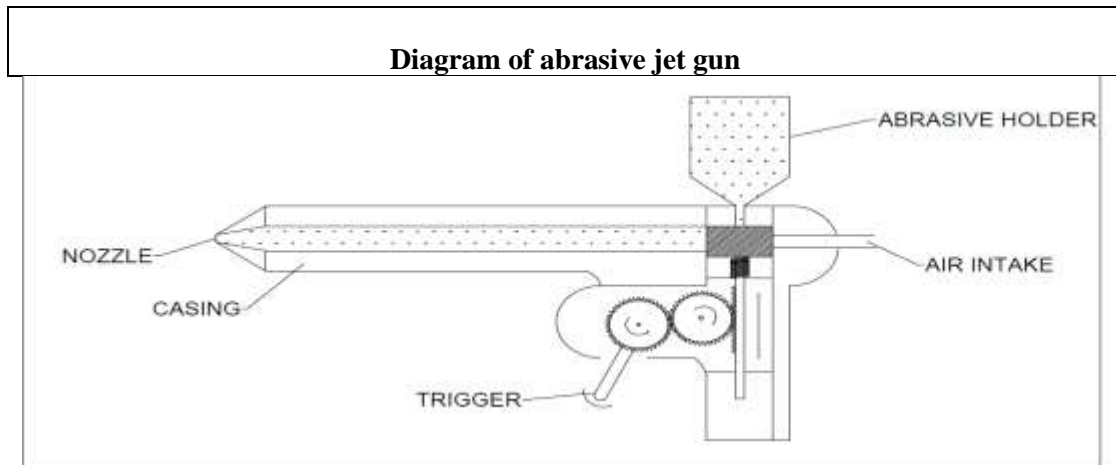
- **Abrasive holder**

The main function of the holder is to hold the abrasive material and supply when it is required for operation. During the design procedure the thickness of the holder should be considered in mind and also operating pressure (1-7). The capacity can decided as per the requirement of the user. Normally the volume is calculated.

- **Nozzle**

The main function of the nozzle is to control the direction of flow, of abrasive and air mixture. We can also use the standard selection procedure for selecting the nozzle according to our requirement such has operating pressure and abrasive material and diameter required. The nozzle discharge can be obtained from standard formula i.e(2) . The value is obtained in gpm in our case and other parameters like diameter and pressure are taken in inch and psi.

- Trigger mechanism**
 Trigger mechanism is use to open the ports, of abrasive holder and hose (pressurized air).so that we can control the output of the machine. In our design we had tried to kept the mechanism very simple to minimize the manufacturing cost of the machine. A small rectangular block is attached with an rod and arrangement of a spring to keep the ports normally in closed position. As soon as the trigger is pulled the rectangular block moves downward and open both the ports of abrasive holder and the air intake at the same time. Various other mechanisms can also be used as per requirement.
- Body**
 A body or casing is required to hold the parts of machine together. The design of the body is important in our case as the operating pressure should be kept in mind and also the weight of the body should minimum as much as possible.



Working of Abrasive jet gun.

When Trigger mechanism is pulled the ports are opened , of abrasive holder and hose (pressurized air). A mixture of air and abrasive material is obtained here which is further flow towards the nozzle . Nozzle fire the abrasive particles on work-piece from which material removal of work-piece is achieved or in other words machining operation is obtained. We can achieve drilling of brittle material and also deburring, cleaning of some metals.

By using convergent nozzle we can drill on glass and some metals also and by using divergent type nozzle we can do deburring and cleaning.

TABLE 2

Specification of Abrasive jet machine

1	Operating pressure up to-	3-5 bar.
2	Material can be machined	Glass and some metals
3	Abrasive material-	silicon carbide, sand
4	Machining process-	Drilling, deburring, cleaning etc,

5	Power source-	Pressurized air
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V. CONCLUSION

From the case study we can say that we can get an more compact abrasive jet machine by eliminating the mixing chamber of old conventional machine, which will definitely help us to obtain a low machining cost process. Which will have the ability to drill as well obtain deburring and cleaning etc . Thus a multiple machining processes can be obtained from single machine.

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