

# A Review on Hydraulic Shaper

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## Abstract

*This paper gives you knowledge about shaper machine. The shaper is a reciprocating type of machine tool intended primarily to produce flat surfaces. These surfaces may be horizontal vertical or inclined. In general, the shaper can produce any surface composed of straight line elements. Modern shapers can generate contoured surface.*

**Keywords:** Shaper Machine, Reciprocating, straight line elements, contoured surface.

## 1. Introduction

The shaping machine is used to machine flat metal surfaces especially where a large amount of metal has to be removed. Other machines such as milling machines are much more expensive and are more suited to removing smaller amounts of metal, very accurately.

There is reciprocating motion of the mechanism inside the shaping machine. As the disc rotates the top of the machine moves forwards and backwards, pushing a cutting tool. The cutting tool removes the metal from work which is carefully bolted down. The metal working shaper was developed in the year 1836 by James Nasmyth an, Englishman.

### Types of shapers

- ❖ Horizontal Shapers.
- ❖ Vertical Shapers.
- ❖ Crank Shapers.
- ❖ Gear shapers.
- ❖ Hydraulic Shapers.

### Introduction to Hydraulic System

A hydraulic drive system is a drive or transmission system that uses pressurized hydraulic fluid to power hydraulic machinery. The term hydrostatic refers to the transfer of energy from flow and pressure, not from the kinetic energy of the flow.

A hydraulic drive system consists of three parts: The generator (e.g. a hydraulic pump), driven by an electric motor, a combustion engine or a windmill; valves, filters, piping etc. (to guide and control the system); and the actuator (e.g. a hydraulic motor or hydraulic cylinder) to drive the machinery.

Pascal's law is the basis of hydraulic drive systems. As the pressure in the system is the same, the force that the fluid gives to the surroundings is therefore equal to pressure  $\times$  area. In such a way, a small piston feels a small force and a large piston feels a large force.

The same principle applies for a hydraulic pump with a small swept volume that asks for a small torque, combined with a hydraulic motor with a large swept

volume that gives a large torque. In such a way a transmission with a certain ratio can be built.

Most hydraulic drive systems make use of hydraulic cylinders. Here the same principle is used — a small torque can be transmitted into a large force.

By throttling the fluid between the generator part and the motor part, or by using hydraulic pumps and/or motors with adjustable swept volume, the ratio of the transmission can be changed easily. In case throttling is used, the efficiency of the transmission is limited. In case adjustable pumps and motors are used, the efficiency, however, is very large. In fact, up to around 1980, a hydraulic drive system had hardly any competition from other adjustable drive systems. Nowadays, electric drive systems using electric servomotors can be controlled in an excellent way and can easily compete with rotating hydraulic drive systems. Hydraulic cylinders are, in fact, without competition for linear forces. For these cylinders, hydraulic systems will remain of interest and if such a system is available, it is easy and logical to use this system for the rotating drives of the cooling systems, also.

An important advantage of a hydraulic drive is its high power density: the mass of a hydraulic drive is several times smaller than the mass of an electric drive of the same power.

## 2. Hydraulic shaper process

### Principal Parts of Shaper

- Base
- Column
- Table
- Cross Rail
- Ram
- Tool Head

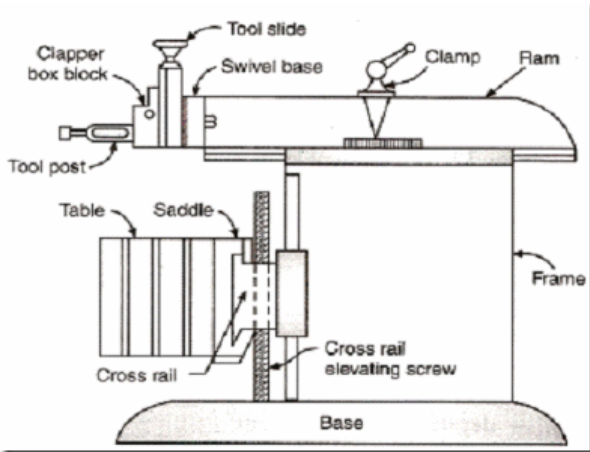


Fig.1 Shaper Machine

**Base-** The base is the necessary bed or support required for all machines tools. All other parts are mounted on and above the base. The bed takes up the total dead weight of the machine as well as the dynamic load during machining operations.

**Cross rail-** The cross rail is mounted on the front of the body frame and can be moved up and down. The vertical movement of the cross rail permits jobs of different heights to be accommodated below the tool. Sliding along the cross rail is a saddle which carries the work table.

**Column-** The column of the shaper is a hollow casting and is mounted on the base. It houses the drive mechanism for the ram and the table.

**Table-** The worktable of a shaper is fastened to the front of the column. The table moves across the column on crossrails to give the feed motion to the job.

**Ram-** The ram carries the tool head at its front end and travels in "guideways" to give straight line reciprocating motion to the tool. The ram is either mechanically driven or hydraulically operated. A single point tool is fastened in the tool post.

**Tool Head-** It holds the cutting tool and is fastened to the front of the ram. The tool is held in a tool holder/tool post similar to the lathe tool post. The tool post and the tool block fit snugly in the clapper box and is hinged at the upper edge.

These types of machine tool are of rectilinear cutting motion therefore, the rotary motion of the drive is converted into reciprocating motion.

The metal is removed in the forward cutting stroke, while the return stroke goes idle and no metal is removed during this period.

The cutting mechanism is so designed that it moves at a comparatively slower speed during forward cutting stroke, whereas during the return stroke it allow the ram to move at a faster speed to reduce the idle return time.

This mechanism is known as quick return mechanism.

### Hydraulic drive quick return mechanism

A constant speed motor drives a hydraulic pump which delivers oil at a constant pressure to the line. A regulating valve admits oil under pressure to each end on the piston

alternately, at the same time allowing oil from the opposite ends of the piston to return to the reservoir. The piston is pushed by the oil and, being connected to the ram by the piston rod, pushes the ram carrying the tool. The admission of oil to each end of the piston, alternately, is accomplished with the

help of trip dogs and pilot valve. As the ram moves and completes its stroke (forward or return) a trip dog will trip the pilot valve which operates the regulating valve. The regulating valve will admit the oil to the other side of the piston and the motion of the ram will get reversed. It is clear that the length of the ram stroke will depend upon the position of the trip dogs. The length of the ram stroke can be changed by unclamping and moving the trip dogs to the desired positions.

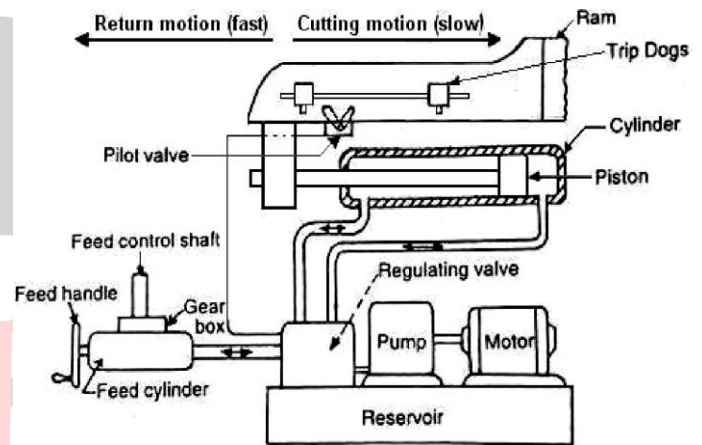


Fig.2 Hydraulic drive for horizontal shaper

The above system is a constant pressure system. The velocity of the ram travel will be directly proportional to the oil pressure and the piston area to which it is applied. The return stroke is quicker, since the piston area on which the oil pressure acts is greater as compared to the other end for which it gets reduced because of the piston rod. Another oil line is connected to a smaller feed cylinder to change the hydraulic power to mechanical power for feeding the work past the tool.

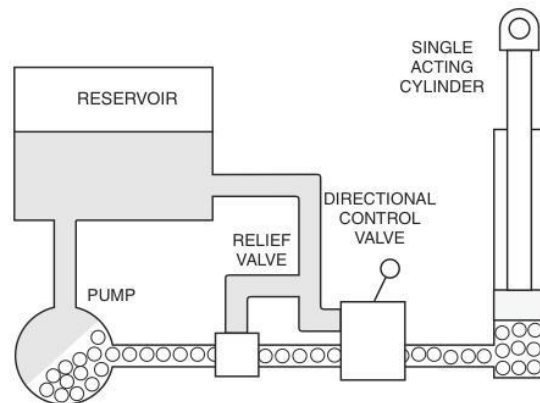


Fig.3 : General Layout of Hydraulic system

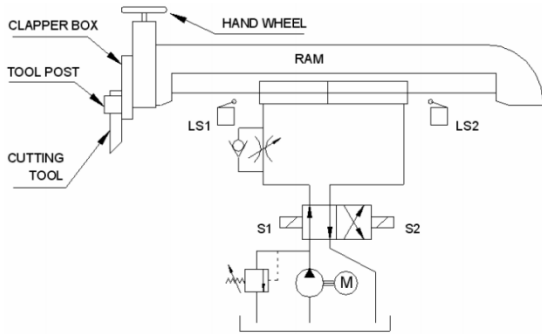


Fig 4 : Hydraulic Circuit for Shaper

**Advantages of Hydraulic drive**

- \_ Lower first cost
- \_ Simpler in operation
- \_ Does not make any noise and operates very quietly.
- \_ Ability to stall against an obstruction without damage to the tool.
- \_ Ability to change length and position of stroke or speed while the machine is running.
- \_ The cutting and return speeds are practically constant throughout the stroke. This permits the cutting tool to work uniformly during cutting stroke.
- \_ The reversal of the ram is obtained quickly without any shock as the oil on the other end of the cylinder provides cushioning effect.
- \_ Offers great flexibility of speed and feed
- \_ The hydraulic drive shows a very nearly constant velocity as compared to a crank mechanism which has a constantly changing velocity because the horizontal component of the crankpin moving about its circle is constantly changing.

**3. Placing the tables**

**Table 1** Experimental procedure parameters

- Raw Material: 1. 1" x 1" x 20 Feet L Chanel  
 2. 18 Gauge CRC Sheet 2.5 x 6 ft.  
 3. 16 Gauge CRC Sheet 8" x 2ft  
 4. MS Flat 50mm x 5mm, 200 mm long

Sr. No	Operation	Machine Required	Time (min)	Remark
1.	Cutting of the L angle in desired Length 1"x1"x2.5 Feet = 4No 1"x1"x2 Feet = 4No 1" x 1"x 6" = 4No	Hack Saw	120	Cut the MS Chanel in the desired length . Power Saw or Hand Cutter can be used for the cutting
2.	Cutting MS Flat in desired Length 50mm x 50 mm =4 No	Hack Saw	40	Cut the MS Chanel in the desired length. Power Saw or Hand Cutter can be used for the cutting

3.	Drilling Holes in MS Flat Φ8 mm drill x 4 Nos	Drilling Machine	20	Foundation Bolts are mounted in These MS Flat Pieces
4.	Bending of CRC Sheet	Bending Machine	25	The sheet is bended at 8",32",40"& 64" From One end
5	Welding of Frame	Arc Welding Machine	45	First All L channels are welded to form box of size 2ft x 8" x 2.5 ft. Then The CRC sheet is welded on the frame then the Top sheet is welded &finally MS Flats are welded

**Conclusions**

This shaping machine can be used to machine flat metal surfaces especially where a large amount of metal has to be removed. On the basis of Pascal Law hydraulic system works, where a small torque can be transmitted to large force. Nowadays hydraulic system is controlled by electric servo motors. High power density property of machine makes it more suitable for use.

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