

Istituto d'istruzione Superiore "G. Vallauri" - Fossano

# **Tool machines: The bending machine**

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## Introduction

The bending machine is a tool machine used in many sectors: from paper sector to metallurgic sector. In this relation I want to describe the bending machine used in the metallurgic sector.

This machine in general is composed by two or more rotating rollers, where the operator puts the metal sheet that will be worked. This is a cold working process that transforms a plate sheet into a circular or conical section, using four compressor rollers that change their distance making all types of curve.

The applications of this tool machine are various:

- wind turbines
- naval industry
- aeronautics industry
- automotive industry



The wind turbines cones, hulls, columns of ships, aircraft structure are only some products that came from this tool machine. Bending the metal is a real craft, very different from using a press, this because the bending machine deforms metals but does not press them. In this process the operator experience is very important.

## Mechanical

The bending machine structure is very hard to resist to the strong vibrations.

The structure is composed by a basement where the machine will be assemble. Above the basement two side walls will be fixed and they will support the rollers. The basement and the side wall will be worked by a milling machine that levels the two sides that will be fixed together. In this way it is possible to reduce the mechanic mistakes. (pic. 1, point 6). After that the bearing location will be created on both sides, where the rollers will be put and the pistons will be fixed. When the side wall will be fixed to the basement, the two side walls will be fixed together by two bars called "connecting bar".

The rollers are composed by a particular allow called C45.

The skins of this allow are a good compromise between hardness and elasticity. The rollers are not perfectly circular but there is a conical area in the central sector.

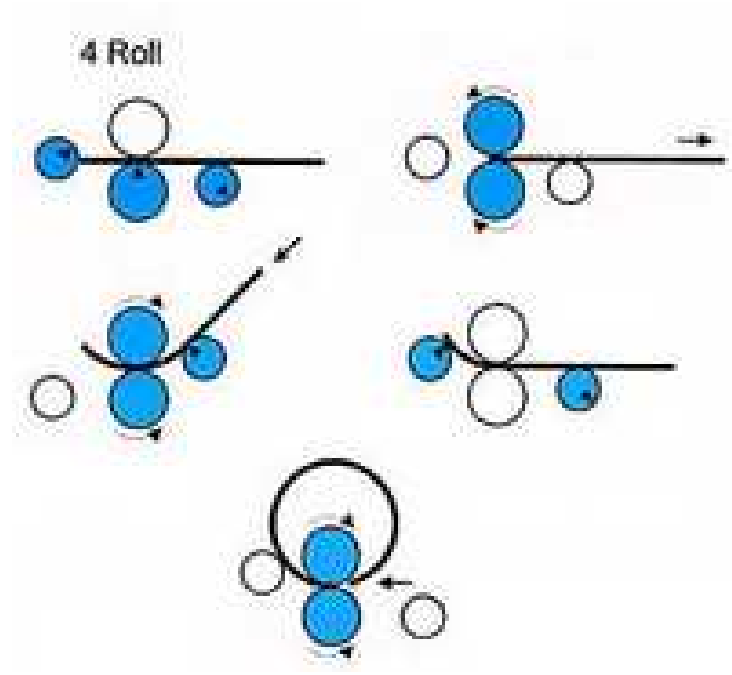
In this way, when the operators press the metal sheet, it has a better support surface.

The lateral rollers are fixed to the side wall by four rods to the edge. The rods allow all movements. (pic.1, point 4)

To the inferior roller edge will be assembled two sliding supports. The inferior roller will be put in two slits previously made in the sides wall. The superior roller is fixed only on one side. Opposite edge a yoke with a hydraulic piston is locked. When the machine works the yoke is closed but when the operator finishes, he can open it and remove the tube. (pic.1, point 3).



Pic. 1 bending machines components.

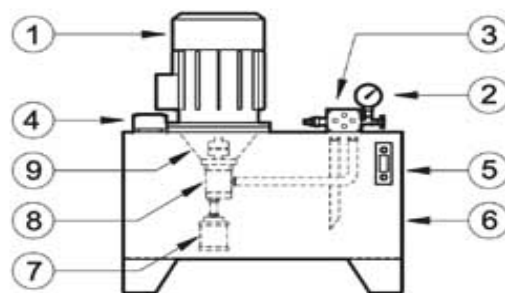


**Pic. 2 functioning of the machine.**

In the bending machine that works with four rollers we can see that the central rollers transmit the rotation and the lateral rollers deform the metal sheet, changing their angle.

## Oleo-dynamic

This machine has an oleo-dynamic plant that allows all movements. Even the rotation is actioned by two hydraulic motors which are on the edge of two rollers. These motors transmit the movement by two reducers that have to lower the speed and increase the torque. The maximum pressure rotate setting is 160 bar, in this way the machine will not be damaged. The lateral and pinching rollers are set in a different pressure:220bar. This because the rotation force is lower then the deformation force. Every pistons is protect by an over-center that discharges the oil if the mechanic force overcomes its setting:160 bar. The heart of this plant is on the extreme side of the machine. According to the machine model it is possible to find different types of hydraulic control unites that have different capacity and dimension. Inside them two mechanic pumps work like the rial heart of the machine.



**Pic. 3 hydraulic control unites.**

- 1) Motore elettrico
- 2) Manometro con esclusore
- 3) Valvola di massima pressione
- 4) Tappo di carico
- 5) Indicatore di livello
- 6) Serbatoio
- 7) Filtro in aspirazione
- 8) Pompa ad ingranaggi
- 9) Gruppo di collegamento motore - pompa

In this picture there is a hydraulic control unit with all components. The pumps works with an electric motor (pic.3, point 1). Near the motor there is a cap where we can put the oil inside the control unit (pic.3, point 4). On the side of the tank there is a controller for the oil level. (pic.3, point 5). Inside the control unit, under the connected group, there are the volumetric pumps: used to make a push on a fluid (pic.3, point 8). There is also an oil filter used to avoid plant damages of the plant (pic.3, point 7). Above the hydraulic control unite there are two valves where we can set the maximum pressure (pic.3, point 2-3).