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Press Brake: Types and Operating Principles

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Bending is a manufacturing process that produces a V-shape, U-shape, or channel shape along a straight axis in ductile materials, most commonly sheet metal. A press brake or a bending press is a device designed for metal bending and metal strips and sheets forming. It allows producing metal sections of given sizes and there is no need to carry out preliminary thermal treatment of the material. The production of details of the required parameters is performed by the method of cold deformation [1].

The operating principle of the bending press is to provide the necessary force and the working stroke of a traverse – a steel rigid beam that the necessary tooling is installed on, depending on the intended manufactured product and the bending mode. The beam stroke is controlled by linear motion sensors, usually two of them, controlling the left and right sides of the traverse to ensure uniform motion and synchronization. The back stop is used as an additional piece of equipment installed on the bending presses. Its position can be programmed based on the required size of the bent edge [2].

The most important part of the brake press is its safety system which serves primarily to protect a human operative from injury. Its auxiliary function is to limit the working stroke in case of certain technological operation perturbations. The safety system is a combination of hardware and software that processes signals from various devices controlling a particular technological process, a laser control device determining a

foreign object presence (for example, an operator's hand) being the most important one. Laser beams form a plane under the upper tool at a distance of about 3-5 mm below it. If during the transverse movement the operator's hands get into the working area, the laser beams will cross and thus the control system will direct a command to stop the movement immediately.

The press brake has got two main hydraulic cylinders providing a fast approach and power stroke of the traverse. Each cylinder is equipped with a position sensor that reports the position of each cylinder piston to the electronic control system. Besides these two main hydraulic cylinders, the press brake can also be provided with extra hydraulic cylinders: matrix moving cylinders, cylinders for adjusting the position of the back stops for the workpiece, cylinders for hydraulic support and compensation of the deflection of the matrix (crowning), cylinders for upper and lower tool clamps. All these cylinders have a feedback position system or end position switches (sensors) [3].

The sequence of actions, the operation speeds, the developed force and the component under pressure holding time in the bending press are monitored by the electronic press control system. It is connected by control wires to the solenoid coils of proportional valves. Depending on the value of the electrical signal, these valves provide pressure adjustment (hydraulic cylinder force) or the value of the oil flow (cylinders speed). Each proportional valve is equipped with an electronic position sensor of the valve main spool – electrical position feedback. This sensor continuously informs the control system about the position of valve main spool at the right moment. Besides these valves hydraulic system of the brake press is equipped with pressure sensors and pressure switches of the working liquid of the hydraulic system [2].

According to the applied force press brakes are described as mechanical, pneumatic, hydraulic, and servo-electric. In a

mechanical press, energy is added to a flywheel with an electric motor. A clutch engages the flywheel to power a crank mechanism that moves the ram vertically. Accuracy and speed are two advantages of the mechanical press. Hydraulic presses operate by means of two synchronized hydraulic cylinders on the C-frames moving the upper beam. Servo-electric brakes use a servo-motor to drive a ballscrew or belt drive to exert tonnage on the ram. Pneumatic presses utilize air pressure to develop tonnage on the ram. Hydraulic brakes produce accurate high quality products, are reliable, use little energy and are safer because the motion of the ram can be easily stopped at any time in response to a safety device [1].

Modern press brakes often include a multi-axis computer-controlled back gauge, a device that can be used to accurately position a piece of metal so that the brake puts the bend in the correct place. Optical sensors allow operators to make adjustments during the bending process. These sensors send real-time data about the bending angle in the bend cycle to machine controls that adjust process parameters [1].

The press brakes find wide application in the mechanical engineering, instrument making, construction, metal production for bending metal products of different assignment according to the prescribed form and specified dimensions.

References:

1. Mode of access: https://en.wikipedia.org/wiki/Press_brake. – Date of access: 10.03.2019.
2. Mode of access: <https://www.abamet.ru/press/article/listogibochnyepressy/>. – Date of access: 12.03.2019.
3. Mode of access: <http://kuzlitmash.by/projects-archive/pressy-listogibochnye-gidravlicheskie-c-chpu/>. – Date of access: 05.03.2019.