PROJECT ABSTRACT

Pneumatic Sheet Bending Machine

A working pneumatic press brake — a vertical double-acting cylinder drives a punch into a V-die under 5/2 hand-lever valve control with FRL air conditioning — bending sheet strips to repeatable angles. Delivered built-to-order with the fabricated machine, pneumatic components and complete viva kit.

01. Title

Pneumatic Sheet Bending Machine

02. Introduction / Background

Small workshops and college fabrication labs bend sheet metal with hammers, bench vices or hand brakes — slow, inconsistent, and hard on the operator for anything beyond a one-off bracket. This project builds a compact pneumatic press brake: a double-acting pneumatic cylinder mounted on a welded C-frame drives a punch into a V-die, folding sheet strips (aluminium or mild steel) to a repeatable angle. A 5/2 hand-lever valve gives the operator direct push–pull control, an FRL unit (filter–regulator–lubricator) keeps the air clean and the pressure set, and adjustable stops and a back gauge position each bend. The student fabricates the frame, sizes the cylinder from the required bending force, plumbs the pneumatic circuit, and demonstrates repeat bends on real sheet.

03. Problem Statement

Manual sheet bending is inconsistent and unscalable: every part depends on the operator's hand, and there is no clean way to teach bending-force sizing or pneumatic circuit design on a hammer-and-vice setup. The project addresses this with a complete, demonstrable manufacturing machine built from standard industrial components — giving the student a real fabrication, a real pneumatic circuit, a first-principles force calculation, and a demonstrated production run of bent parts.

04. Objectives

- Build a cylinder-driven V-die press brake that produces clean air-bends in sheet strips.
- Control extend and retract with a 5/2 hand-lever directional valve — simple, transparent, standard industrial practice.
- Condition shop air and set working pressure with an FRL unit and pressure gauge.
- Repeat bend angles across parts with adjustable mechanical angle stops.
- Position each bend consistently with an adjustable back gauge.
- Size the cylinder bore from the required bending force (pressure × piston area) as a design-target calculation shown step-by-step in the report.
- Fabricate a rigid welded MS C-frame with the working area open at the front for easy loading.
- Provide an operating procedure and safety notes keeping hands clear of the die during the stroke.

- Deliver the complete student kit: machine, pneumatics, circuit diagram, report, PPT and viva Q&A.;

05. Proposed Methodology

The build follows three stages. (1) Design: the required bending force is estimated from standard sheet-bending data, the cylinder bore is selected from force = pressure × piston area (design target approx. 1.2–1.9 kN at 6 bar, bore-dependent), and the C-frame is fabricated. (2) Circuit: the cylinder, 5/2 valve and FRL unit are plumbed with PU tubing and push-in fittings per the circuit diagram, with silencers on the exhausts. (3) Commissioning: working pressure is set at the FRL regulator, bend trials are run on sample strips, angles are measured with a protractor, stops are adjusted, and a batch of identical strips is bent to demonstrate repeatability — the spread across the batch is reported honestly, including springback characterization on the student's own samples.

06. System Architecture / Working

Shop air enters the FRL unit, where it is filtered, pressure-regulated and lubricated; the gauge shows the set working pressure. The 5/2 hand-lever valve routes air to either side of the double-acting cylinder: one lever position extends the piston, driving the punch down into the V-die and folding the sheet; the other retracts it. Adjustable mechanical stops limit punch travel to set the bend angle, the back gauge sets flange length, and exhaust air vents through silencers. The sheet is placed on the V-die against the back gauge, the lever is shifted to bend, held briefly, and shifted back to retract — a complete press cycle.

07. Hardware / Software Requirements

- Double-acting pneumatic cylinder (approx. 50–63 mm bore, design target)
- 5/2 hand-lever directional control valve
- FRL unit with pressure gauge
- Hardened punch and V-die set
- Welded MS C-frame (approx. 500 × 400 × 900 mm)
- Adjustable back gauge and angle stops
- PU tubing, push-in fittings and silencers
- External shop-air compressor, 6–8 bar (buyer-arranged — not included)
- Protractor for angle measurement; no software required.

08. Expected Outcomes

- A working pneumatic press brake bending sheet strips to set, repeatable angles.
- A demonstrated batch run with measured bend angles showing the repeatability spread.
- A documented cylinder-sizing calculation (design target) and pneumatic circuit diagram.
- A complete report, PPT and viva Q&A; on pneumatics theory, machine design and procedure.

09. Applications

- Manufacturing and pneumatics teaching laboratories.
- Demonstrating press-brake operation, air-bending and springback on real sheet.
- Teaching pneumatic circuit design, FRL function and force sizing from first principles.

10. Future Scope

- Solenoid 5/2 valve with foot-pedal or pushbutton electric control.
- Stroke counter for batch counting.
- Interchangeable die sets (U-die, hemming) as an optional study.
- Two-hand pushbutton safety control as an added safety module.