Duplomatic Oleodinamica in the Metal Forming sector



Tube Bending Machines





Decoilers



CAN-BUS



Hot shears



Punching machines



Vertical presses



Deep drawing presses

Rapidity, precision and safety for the tube bending machines

Duplomatic has been supplying hydraulic systems for tube bending machines for several years.

Since the '70s when the machine bending cycles were realized with hydraulic sequence valves, the system has been undergoing a constant evolution with the introduction of the first open loop proportional valves (mainly used to control the bending speed) up to the current circuits assembled using servovalves equipped with integrated electronics and operated by numerical control systems with an interactive three-dimensional graphics programming. Every need for a technical development aimed at improving the machine performances has been met by Duplomatic with a series of top ranking components suitable to satisfy the requirements of the tube processing market.

The tube deforming machines equipped with hydraulic circuits are mainly used to bend and end form big diameter thick tubes.

Thanks to their advanced performances the bending machines of the "8" series can bend tubes with diameters from 4 up to 80 mm.; the bending speed can reach 220°/sec with a bending tolerance of \pm 0.1 °.

Particular attention is paid to the bending function which, as

shown by the above stated values, requires precision and speed combined with high acceleration. The natural consequence is the need for modern proportional valves operated by custom-made electronic controls.

The hydraulic movements, which are common to all kinds of tube bending machines, are tube traction, bending with speed and position control, core extraction, blocking, lifting, die change and pliers. Each function has a dedicated circuit developed directly through the cooperation with the technicians of the customer company after a series of lab tests performed on prototypes.

As far as the circuit is concerned, the tube end forming machines are less demanding because they are exclusively equipped with open loop proportional valves and on-off components. Anyway, they must be fast and precise in order to increase the per hour production (the main factor in the choice of the machine type).

A basic element common to all kinds of machines is the search for the operator highest safety. For this reason the circuits have been recently equipped with monitored electrovalves performing a "cut-off" function during the most dangerous sequences carried out by the operator, i.e. machine manual adjustment or maintenance.



Precision during parallelism and positioning sequences



Bending rolls machine

Bending rolls are machines used for the metal deformation; they usually turn a plane sheet into a more complex tubular shape, mainly round or elliptical.

At first sight they appear extremely easy to be designed and managed; in the reality these machines require accuracy and precision to obtain a quality product. They stand out for the dimension (length of the product) and for the thicknesses that can be processed.

Duplomatic is a leader in supplying systems for small (metal thickness up to 10 mm.), medium and medium-large benders (thicknesses higher than 50 mm.).

The hydraulic circuit for simple benders usually requires series cylinders with the possibility to change the inclination angle. The cylinder positioning speed is constant and the need to use the circuit with slowing down feature for precise positioning procedures is rare. Such a circuit is normally applied to low-power benders, as the strength of a series circuit is calculated only on the section of the main cylinder rod. Higher powers would require very big cylinders. More powerful benders need a parallel circuit with mechanical (by now rarely used) or electronic devices aimed at controlling parallelism and final positioning.

A special application worth to be mentioned is the handling with interpolated axes for the roller leveling of the big truck tanks containing diesel fuel. The elliptical shape of these tanks requires extreme precision during the roller welding process so that the edges can properly fit together for the welding.

Furthermore, considering that series production is involved, the time required by the roller welding procedure must be as short as possible.

The bender is equipped with a 12-axis control and the position parallelism of each roller is strictly controlled. Each roller is also interpolated with the hydraulic motor which controls the rotation of the 4 rollers (lateral + pliers + higher roller) connected to each other through a mechanical device.

This system is provided with servo proportional valves type DXJ3-DOL* with a ± 10 Vdc signal in order to ensure a degree of parallelism and positioning precision lower than the tenth of a millimeter.

A co-operation to develop the control of several hydraulic axes

Proportional valve with integrated electronics

 $"\!D$ esigning a modern machine for the metal deformation using the best features of the modern hydraulic technology"

Such words brought Duplomatic Oleodinamica to the technical co-operation with an important leading company in the sector of the metal deformation, in order to develop a new bidirectional folding press. Managing the decoiling speed control

he metal forming process involves the so-called decoilers. Such machines are used to feed transversal or longitudinal cutting plants.

The material to be decoiled can be: cold or hot rolled steel, coated steel, silicon steel, stainless steel or aluminium.

The hydraulic driving system is dimensioned in order to handle coils weighing up to 20 tons with a metal thickness from 0.3 to 4 mm. The system can also manage the decoiling speed control of the strip up to 200 meters per minute with an average width of 1000 mm.

The hydraulic system supplied by Duplomatic Oleodinamica consists of two power units: the former is used for the line which enables the spindle expansion and the decoiler transversal alignment, the latter is dedicated to the circuit for the decoiler breaking.

The aim of the application is to ensure the "pull back" with a

constant opposite strength through the breaking of the hydraulic motor via two pilot operated pressure



The breaking regulation occurs through a potentiometer which gives the reference signal to a proportional pressure reducing valve.

The involved flow rates reach 200 l/min and are generated by the rotation of the hydraulic motor with a breaking pressure up to 200 bars



Sheet metal processing line



Decoiler with Duplomatic power pack

The bidirectional folders with double oscillating valve can process metals with thicknesses ranging from 8 to 20 mm and a width from 2 to 8 meters.

The hydraulic system has been developed to control several hydraulic axes by means of the new DSE5G and DSPE*G proportional valves equipped with the CAN-BUS communication system.

Such proportional valves allow to control and synchronize all the hydraulic axes with a single PLC for the management of the position and parallelism closed loop to which the digital position sensors are connected.

The repeatability and linearity of these new proportional valves with digital integrated electronics allow

to obtain decimal precision values (+/- 0.1mm) and a very high level of valve interchangeability, thus reducing the machine start-up times.

The control of the hydraulic pressure is obtained through a PRE*G valve with integrated electronics; such valve is equipped with the CAN-BUS communication system for the parameterization of the product.

Bidirectional folding press

High cutting power

he hydraulic shears for hot cutting plants are designed to be used with integrated systems for the whole automation of the bar cutting cycle.

The typical cutting plant consists of:

- Automatic loading bench receiving the bar bundles; it loads one bar at the time on the roller table.
- Roller table leading the bars to the induction furnace with an adjustable speed according to the heating needs.
- Induction furnace for the progressive heating of the bars up to the molding temperature.
- Hydraulic shears

The shears are power supplied by a power unit with a tank whose capacity reaches 1200 liters.

The hydraulic driving system has been dimensioned to achieve high cutting powers with a maximum pressure of 350 bars.

The flow rate is delivered by variable flow rate pumps with a constant power, flow rates up to 250 l/min and a maximum of three motor-pump groups.

In addition to the control of the main cutting cylinder and of the pressing cylinder, the hydraulic system, through the gauge cylinder, controls also the length of the piece to be cut.

The measurement precision is ensured by the use of

a servo-valve which allows at maximum a decimal error.

In order to avoid interferences due to pressure drops, the servo-valve driving is operated by an auxiliary pump. Furthermore an accumulator is required for the flow rate storage in order to avoid possible tracking errors while the bar is pushed into the furnace.



Hot shears

Control of the hydraulic axis

he punching operation is the impression of a sign or a shape on a metal surface by pressing an instrument called "punch".

Nowadays such a technique is frequently used by mechanics for the metal forming. The use of automatic machines to cut and bore metal plates through very complex cutting and shaping processes, whose cycles are getting faster and faster, gave rise to the need of specific cards for the control of the punching axis.

For this specific application Duplomatic developed the EWM-S-B*/10 digital card for the control of the hydraulic axis; the accuracy of the feedback signal is equal to 0.01% while the sampling time of the control loop corresponds to 1 ms.

three Via selectable inputs (programmable binary code) it is possible to combine the card through the PLC with 8 positions and with the punching speed.

The same card can control directly

the valves with integrated electronics with a voltage reference of +/- 10V or a current reference of 4-20mA.

It is furthermore possible to use an on-board drive for the direct control of the solenoids of the proportional valve.

The position loop with feedback can manage 0-10V or 4-20mA analog signals.



Punching machine

High flexibility with the hydraulic circuit press

n this article we take into consideration the realization of a vertical press with hydraulic control for hot deformation or deep drawing.

In this specific case the press with a four-column frame applies a "classic" hydraulic circuit which is commonly used in the heavy deformation sector.

The power section consists of two piston pumps with constant power and proportional variable displacement; each pump is driven by a 110 kW motor.

Such a control allows a high programming flexibility combined with a rational exploitation of the available power. Several speeds and powers can be programmed during the different cycle phases.

The moving table is driven by two double acting cylinders allowing a fast approach and return together with an increase of the pushing phase during the pressing procedure supported by the main plunging cylinder.

The main block uses both monitored control valves and logic elements for the control of the different cycle phases: from the fast adjustable down movement to the selection of the pressing procedure at different speeds, from the controlled pressure decrease to the return.

The pressing force is detected by a pressure transducer and is displayed on the machine control panel.

The safety blocks with monitored logic elements are installed on the lower chambers of the approaching cylinders (they are directly flanged on the ports).



Vertical press

The technical features of this circuit are:

approaching speed:	300 mm/sec
adjustable pressing	frame 0 to 40 mm/sec
speed:	from 9 to 40 mm/sec
return speed:	350 mm/sec
pressing force:	20000 kN



Blm Bariola Bema Boldrini Camu Colgar Ficep Fili Vimercati Gasparini I.Ma.L. Group Iron Italmacchine Lime Mecolpress Miramondi O.C.S. Sacma Sala Schiavi Somo S.T.A.M. Rainer Valdarno



Controlling the pad of a deep drawing press

The deep drawing presses are very complex machines used for the cold production of a finished product starting from plane metal: pans, sinks, vehicle bonnets and doors are the typical products obtained through the deep drawing process.

The press consists of a vertical structure allowing the movement of the two main axes: the moving table on the machine lower section, called ram, and the pad in the lower section, called pressure bar. The mold housing the metal to be deep drawn is positioned between the two axes.

The metal is pressed by the ram towards the mold and it is simultaneously supported by the pad: being trapped between the two axes, it is gently moved to the mold inner section in order not to be broken or deformed.

The pad is moved by the hydraulic cylinders which, during the first processing phase, accelerate its down movement till reaching the ram speed and afterwards they slow down and lead the pad descent.

At the end of the deep drawing process the pad goes back to its starting position where it is sometimes used to extract the finished piece.

DuplomaticOleodinamicahas been supplying hydraulic blocks for the safety and the handling of the moving table for years and has developed a position and

pressure control system for the pad management. The supply consists of proportional valves and digital multi-axis cards and can be interfaced with the most widely used industrial and PC-based controllers, thus ensuring the axis synchronization and an effective control of the pad reaction power.



Deep drawing press





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