

The Choice of the Coil Punching Machine

News and applications of the coil punching machines

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DALCOS
COIL PUNCHING MACHINES

Author:

Andrea Dallan

THE CHOICHE of the coil punching machine

News and applications of the coil punching machines

More and more companies are choosing to punch directly from coil. In order to approach this technology it is necessary to know the line from a technical and operational point of view. This article evaluates the coil punching line from the user's point of view.

The first section will be dedicated to the selection of products to transfer to the machine.

A second section will analyse the coil punching line and will consider how to choose each component (decoiler, straightener, coil punching machine); the latest technologies in coil punching machines will be described as well (picture 1).

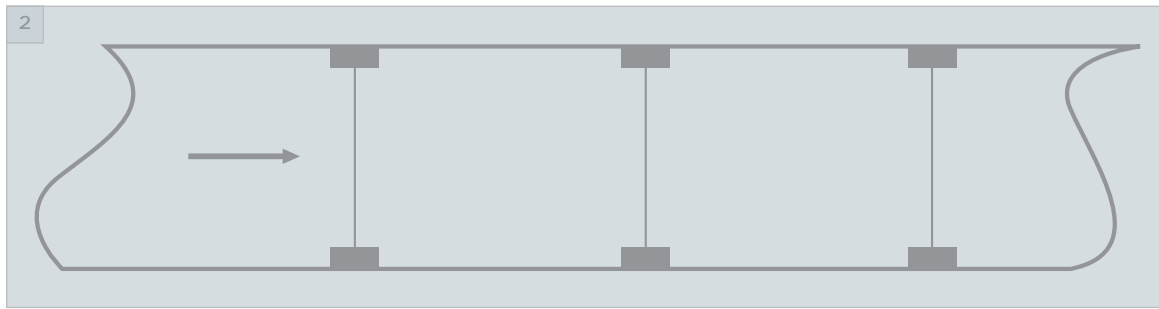
The final part will present the advantages of working from the coil and the industrial sectors that mostly benefit from it; a section will be particularly dedicated to the raw materials and to the line management.

Picture 1

Coil punching machine



SELECTION OF PRODUCTS



Picture 2
Positioning of notched panels on the strip

First of all, the products to be processed with the coil punching machine have to be examined. Pieces that have two sides equal to the width of the strip maximise the advantages than on conventional sheets.

Picture 2 shows a panel with four notching. As we will examine in the section dedicated to applications, for more complex products can be processed (picture 3).

The maximum and minimum width of the coil is determined by the shape of the pieces; coil punching machines work both very narrow strips, from 20 mm width and wide strips up to 1500 mm width (picture 4).

The working program decides the length of the piece: coil punching machines can process very long products or rewind punched strips.

The strip can be cut longitudinally by means of a

longitudinal trimming tool: the cutting shear detaches then several products with one operation (picture 5).

The thickness of the strip and type of raw material is defined by the choice of products: mirror – polished aluminium, galvanised steel, pre-painted steel, pre-painted aluminium, copper, stainless steel with special surfaces and mirror-polished aluminium, with or without protective film.

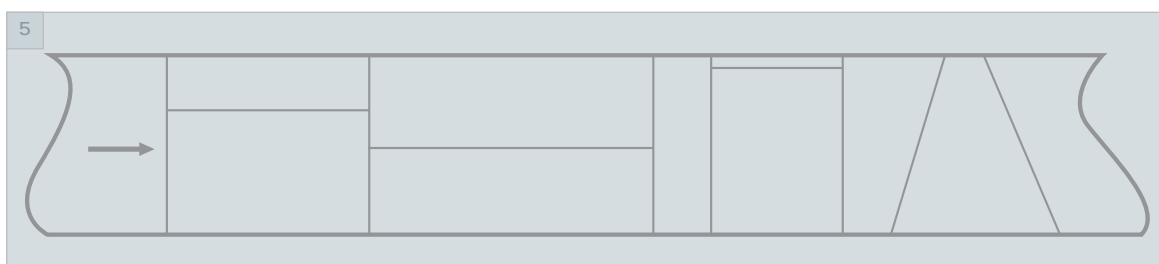
The product drawings define the number coil punching tools as well.

With simple tools (E.G. round, squares), the shapes can be combined in nibbling operations, thus taking advantage from the flexibility of the line and reducing the tooling investment.

The use of combined tools (multiple holes and special shapes) reduces the number of operations and guarantees high productivity.

Picture 3
Panels for lighting fittings and tool boxes

Picture 4
Coil punching machine 1500 mm width, 20 mobile tools with bi-alternating grip feeder



Picture 5
use of the surface on a strip

The Pareto law (80/20) in the production systems

The Pareto law establishes that, in an economical environment, 20% of the actions determines 80% of the results, thus its definition 80/20. In 1897 Vilfredo Pareto demonstrated that most of the richness in a geographic area belonged to very few people.

The same can be observed in a political and social environment: the elements that are relevant to the outcome of the system are few, while the others make little difference, even though they are the majority. The law was given the name 80/20 in 1950 by J. Juran.

An example of the Pareto graphic can be seen in picture 6.

When analysing a phenomenon in economical system, the graphic helps identifying the relevant elements. Many examples are possible in a company:

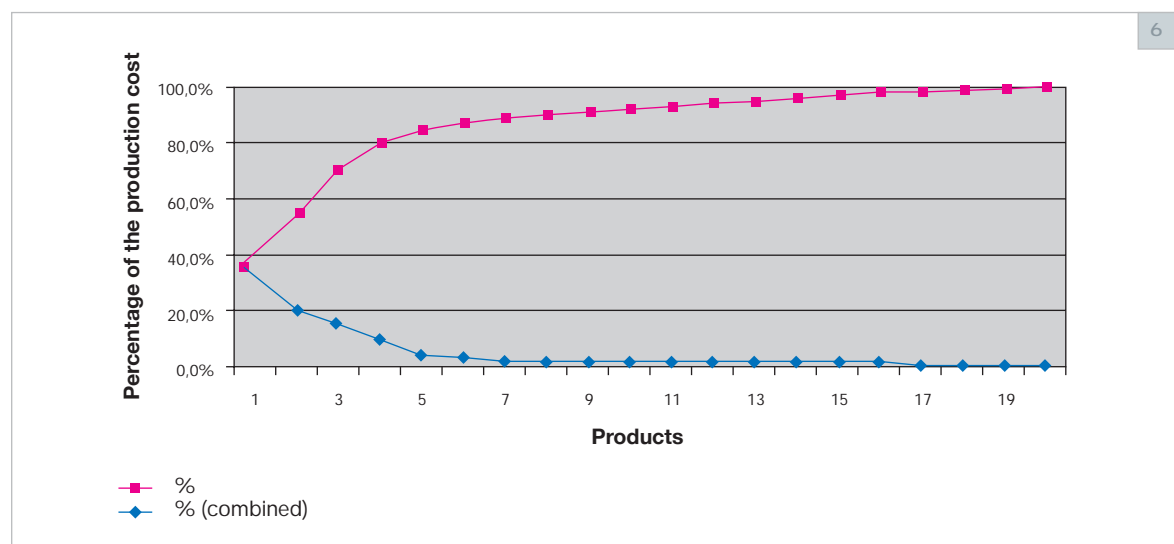
- The 80% of the company turnover derives from 20% of its products;
- The 80 % of the company turnover comes from the 20% of the customers.
- The 20% of the parts of a product make up 80% of its cost.

The cost of the system can be significantly reduced and the economical outcome maximised through a careful engineering of products and processes.

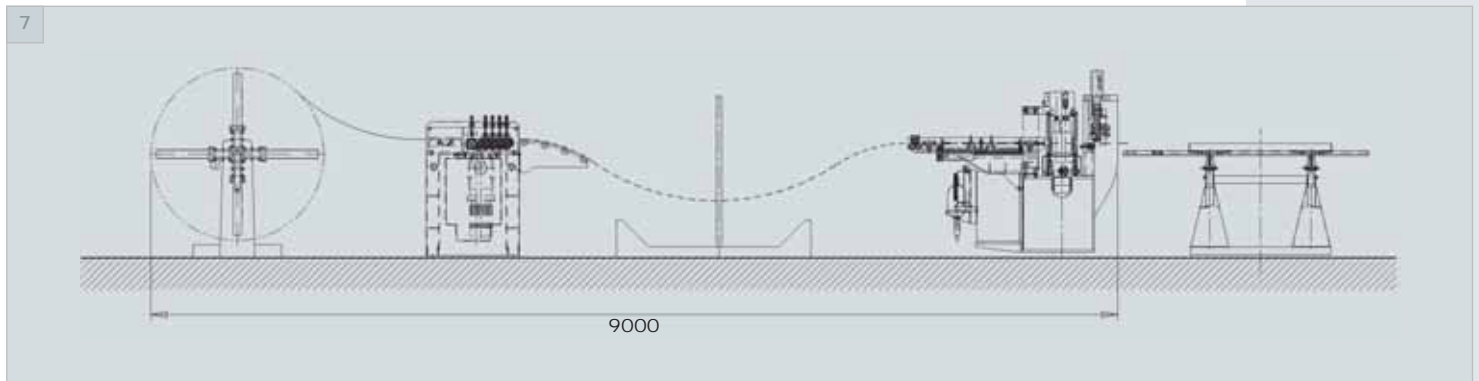
To order a machine that produces 100% of the products, means that the producer has to customize the system. Nowadays there are coil punching machines that are very cost - effective, even though they work thin strips and have a reduced number of tools. This type of machines is even more interesting when it allows the production of the said 20% of the items that, according to the Pareto law, represent 80% of the production cost.

Picture 6

Example of the Pareto diagram



THE CHOICE OF THE COIL PUNCHING MACHINE



A coil punching line includes the decoiler, straightener, coil punching machine and unloading system (picture 7). In the following paragraphs practical indications are given to select each one of these machines.

Choosing the decoiler

The decoiler is the automatic loading system of the coil punching machine.

The first thing to consider when choosing a decoiler is the capacity, then the rotation (that may or not be motorised) and the expansion (manual or hydraulic).

As far as the capacity is concerned, it has to be considered that transport of the coils from the store will be done with forklifts or bridge cranes. It is a good thing to limit the capacity of the decoiler to the maximum load of the available transportation means. The table in picture 8 can be used; it indicates the weight per millimetre in width of the roll based on the material type and external diameter of the coil. The internal diameter is considered equal to 500 mm.

The rotation of thinner and more delicate strips up to 1.5 mm thickness has to be motorised, while thicknesses from 1.5 to 2.5 mm can be motorised or idle. An idle decoiler is normally used for thicker strips. The expansion of the decoiler can be manual or hydraulic up to 2000 Kg weight, while hydraulic expansion is advised for over 2000 Kg weight.

The snubber roll is a necessary option to process thick strips (over 2mm). It can be pneumatically or hydraulically activated (picture 9) and it makes the opening of the coil a safer operation.

Another useful equipment in addition to the decoiler is the loading chair which is advisable for coils over 4-6 tons.

Choosing the straightener

On a straightener machine it is important to know the number of straightening rollers, their diameter, if they are counter-rolled and if there are introduction and feeding rollers.

It is also necessary to evaluate the type and number of adjustments allowed. Very different straightening machines can be implemented depending on the result that has to be obtained. They start from simple machines with 2 introduction rollers and 3+2 straightening rollers up to straighteners with 2 introduction rollers and 9+8 straightening rollers. Stretching and flattening machines can be used in addition to these types of machine.

Coil external Ø mm		800	1000	1200	1400	1600	1800
Steel	Kg/mm	2,4	4,6	7,3	10,5	14,1	18,3
Aluminium	Kg/mm	0,8	1,6	2,5	3,6	4,9	6,2



Picture 7

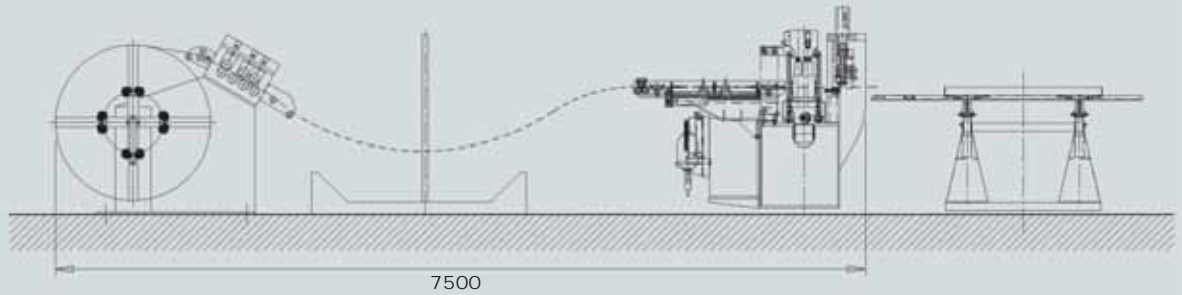
Side view of a coil punching line with decoiler, straightener, punching unit and discharging bench

Picture 8

Decoiler capacity calculation table

Picture 9

Coil punching line complete with sound-proofing cabin, straightener and double decoiler with snubber roll



Picture 10

Side view of the Coil punching line with straightener applied to the decoiler

Picture 11

Photo of the gripper movement on a bi-alternating gripper feeder

Picture 12

1250 mm wide Coil punching machine viewed from the cutting shear. Production in stainless steel

Combined decoiler -straightener system

It being understood the evaluation made for the decoiler and straightener, there are also combined machines that can give the line an even more compact layout, positioning the straightener in an inclined position and very close to the decoiler (picture 10).



Choosing the Coil punching machine

The coil punching machine is a system made up of defined sections: feeder, moving presses, fixed presses, cutting shear. Each section will be examined in detail.

Feeder

The feeder, which is always electronic, can have

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either simple or bi-alternating grippers, with rollers with or without integrated straightener.

The feeder with simple grippers has one fixed and a mobile gripper. The fixed gripper holds the material while the moving one recovers.

The feeder with bi-alternating grippers (pictures 11 and 15) uses two moving grippers in opposite directions and therefore time for recovering the mobile gripper is saved (which is necessary for feeders with simple grippers).

The feeders with bi-alternating grippers are used for raw and prefinished materials because they guarantee the same precision with different materials, even with protective film. This type of feeder can move the sheet metal backwards and forwards thereby optimising the processing and guaranteeing higher speed.

Their versatility and high precision make this feeder ideal for all materials (even pre-painted metal strip, stainless steel, mirrored aluminium) from 0.2 mm up to 2 mm thickness (picture 12).

The roller feeder is used for materials with thicknesses starting from 0.5 mm.

It is suitable for long products (with few operations) and raw materials: black or pickled metal strip, hot galvanised and electro-galvanised. The roller acts by applying pressure on the material along a line. Therefore this type of roller feeder is not so suitable for thin and delicate materials, especially when there is protective film.

Finally, feeders with integrated straighteners are more suitable for medium and large thickness

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materials and where space saving is necessary for the installation of the system (picture 13).

Moving presses

The number of moving presses indicates how many tools can be installed in the moving axis, longitudinally to the sheet feeding direction.

The tools are thick turret type (standard punching tools) and the size varies from A (maximum punch diameter 12.7 mm) up to F (maximum diameter equal to 153.5 mm) as can be seen in picture 14).

The number of moving tools is variable from 5 to over 40, depending on the type of machine.

Punches and matrixes can be installed on one or more tool bearing arches; each tool has its own activation hydraulic cylinder.

Moreover, they can be installed on one or more blocks which are independent one from the other.

When producing symmetrical pieces, it is useful that the blocks are positioned opposite one to another; in this way the two sides of the product can be worked at the same time, increasing production (production 15).

The cylinders in the hydraulic head can be equipped with special solenoid valves which allow to exceed 600 strikes per minute; on the other hand, these speeds are only used for nibbling operations with movements of just a few millimetres. The use of these more costly distributors is planned in nibbling presses.

Rotating tools

The Coil punching machines can manage one or more rotating tools. This function is mainly used in companies that work for third parties, because the rotation of the tools increases the machine's flexibility. The dimension of the rotating tools normally goes up to size D.

Multiple rotating tools

There is even more flexibility through the use of multiple rotating tools.

Many smaller sized punches are housed inside a single rotating tool holder (normally B and A or



Picture 14
Hydraulic moving presses with tool dimension B on the left and F on the right.

Picture 15
Coil punching machine with two end-on blocks and bi-alternating gripper feeder

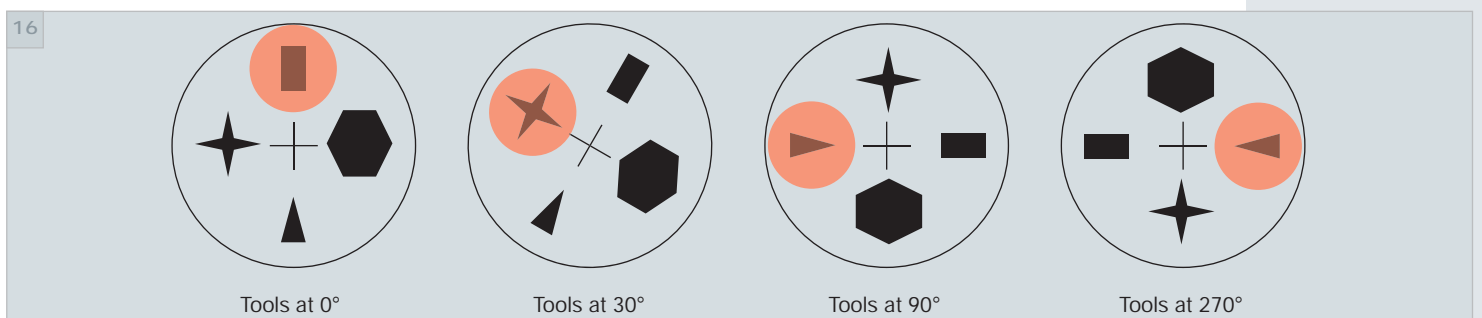
special and much smaller tools).

When the tool holder rotates, the punches, which are now incorporated, rotate at its centre.

Picture 16 illustrates the tool holder with 4 punch shapes, at 0° and rotated by 30°, 90° and 270°. A second rotating selector is placed at the base of the hydraulic activation cylinder rod. During the punching operations, the tool holder rotates until the tool arrives at the desired angle.

The rotating selector is positioned over the chosen tool and the cylinder descends to punch (the selector is highlighted in red in picture 16). As for the simple tools, the multiple rotating tools are on greater demand by companies working for third parties, giving wide choice in the shape of the pieces.

Picture 16
Functioning of the multiple rotating tools



Picture 17

Completely punched and folded accessories

Fixed presses

The fixed presses increase machine productivity. In fact they can be equipped with multiple perforation tools or dedicated to head-tail operations. With these tools the piece can be produced with few strikes; the cost must obviously be amortized on the quantity of pieces to produce (picture 18).

Fixed presses can also be equipped with folding dies to produce small formed accessories (picture 17).



Picture 18

Coil punching machine with 32 moving tools, 3 moving blocks and 3 fixed hydraulic presses



Picture 19

Compact coil punching machine viewed from the cutting shear.



Cutting shear

The cutting shear, which is a very important part of the punching machine, is positioned at the end of the machine (picture 19).

This in fact rapidly cuts the product leaving a continuous and high quality surface which is suitable for the production of panels.

The cutting shear also allows the machine to be used as a blanking machine, to produce panels and sheet metal cut to measure in width and length.

In-depth analysis: Standard, Custom-made Coil punching machine and Compact Coil punching machine

The Coil punching machine can be either custom-made or chosen from a range of standard machines.

The custom-made machines are produced by the manufacturer based on the specific requirements of the user. Whereas Standard type coil punching machines are available for widths, thicknesses and number of tools that the manufacturer has decided upon.

The following technical specifications have to be known when choosing a standard coil punching machine:

- Maximum and minimum thickness of the material
- Maximum and minimum width
- Types of materials
- Number, type and dimension of moving tools
- If there is a transversal cutting shear integrated.

Once this information is known, the percentage of product that can be made by the selected machine is verified (also using the Pareto law in the analysis).

Compact coil punching machines have been recently introduced (picture 20). These machines have a monoblock structure which includes punching unit, electrical cabinet and hydraulic unit and they have very compact dimensions. They can be installed along a wall and are adaptable even to small workshops.

The compact coil punching machines can work with just one moving tool block, therefore they only have two controlled axes (the first is the feeder, the second is the cross moving block); the number of tools is minimised on this machine and it is suitable for thin strips.

By working thicknesses up to 2 mm, investment on the machine, straightener and decoiler is very much reduced.

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Picture 20

Compact coil punching machine in relation to the dimensions of the operator

Programming

Picture 21

PC connection to the Coil punching machine

The simplest machine programming is performed directly on the machine, filling a table which contains the punch coordinates and the name of the heads to activate. The Coil punching machine can be connected to a PC in order to use CAD CAM programming systems (picture 21).

There are punching softwares that automatically fill the table with the coordinates and the name of the working head, taken from the CAD drawing.

This software contains both the tools library fitted on the machine and functions that make the programming of very different pieces simple.

This is extremely useful for companies with a continuous products changing, working for third parties.

Companies with their own product notice that programming the machine with parametric software is very useful because programming time is substantially reduced.

Let's take the two products in picture 22 as an example, which are notched panels.

The four notched edges are identical but measurements A and B change in width and length.



The central working position is obtained mathematically from these two dimensions.

Once the basic program has been created, it is simply necessary to fill the production table shown in picture 23 with the parametric programming.

A single piece can contain many variable parameters.

These data can be sent to the machine's computer by means of a network or taken from other management programs for production programming.

Furthermore, additional data (to be printed with an ink-jet printer, dot marker or labelling machine) can also be introduced.

Different pieces can be mass produced by means of parametric programming.

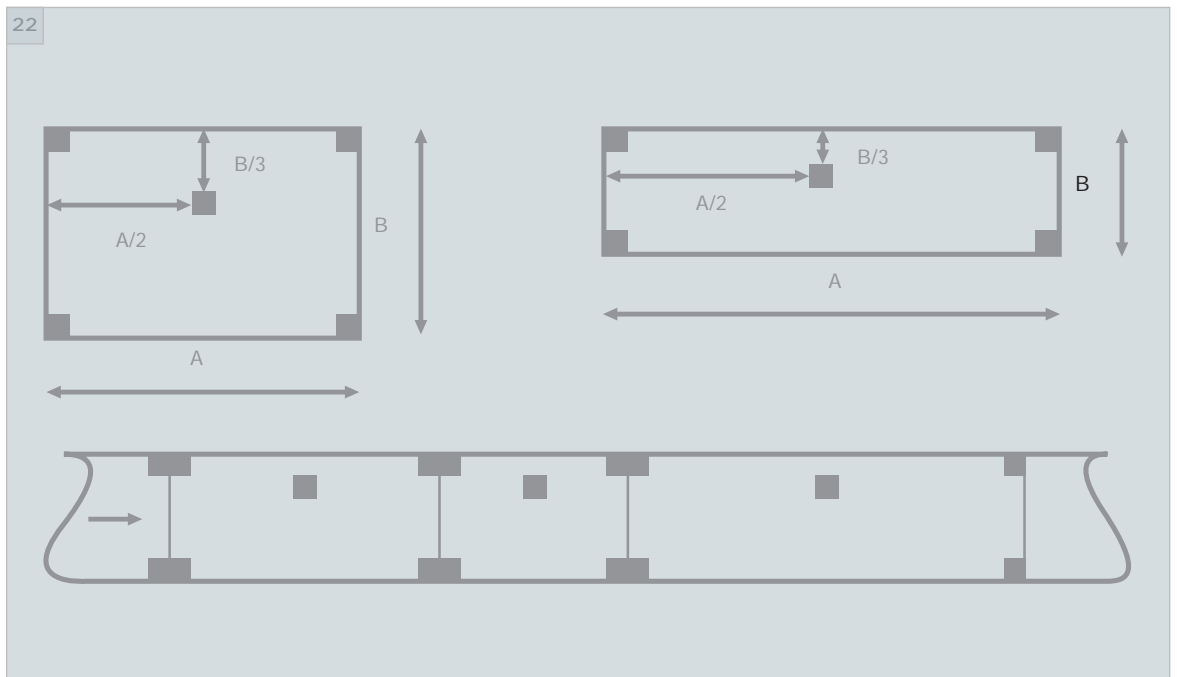
Picture 23

Machine work introduction table with parametric programming

Line	Product	Quantity	Meas. A	Meas. B
1	"notched panel"	10	2000	1000
2	"notched panel"	5	2500	700

Picture 22

Use of the parametric programming



Unloading system

Many companies use the punching machine placing a platform at the end of the line below the material output level.

The pieces exit sliding one on top of the other. This system works with non delicate pieces. An efficient and convenient alternative is the use of a stacking bench; this system is as fast as the punching machine and has a very good stacking precision (picture 24).

Robotised stacking systems are also available in addition to this system, with vacuum suction and aspiration. Cycle - time for handling and stacking each piece must be carefully taken into consideration for this system. It has to be shorter than the time of the coil punching machine cycle – time.



Picture 24
Stacking bench system

Next in part (2)

“The Advantages of the Coil punching machine”.

Dalcos® produces machines for metal strip processing.

Our core focus is in the design and manufacture of coil punching machines, perforation lines and CNC strip feeders using our own developed and proven patented technologies. Our technical and commercial service offers you the best solution to your production requirement.

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The author is the technical and commercial manager of Dalcos Spa.



DALCOS S.p.A.
Via Fusina, 8
31033 CASTELFRANCO VENETO TV - Italy
Tel. +39 0423 734311
Fax +39 0423 734343
info@dalcoss.com - www.dalcoss.com

www.pxneasy.com