ROPE-MAKING MACHINERY
STRANDING, BUNCHING AND CABLING MACHINES FOR PRODUCTION OF CORDS, CABLES AND WIRE ROPE
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DTU Bunching Machines

The DTU produces 5 or 2 lay strand or rope constructions on the basis of the double-twist principle, so that at every revolution of the flywheels the cord or cable is twisted two times. Some models are specifically destined for the production of strands that are then used for complex cord or rope constructions.

DTU bunching machines are composed of separate modular units, including a filament pay-off unit, an external, performing twisting unit (when necessary) and a take-up unit. The external twist and the take-up are enclosed in soundproof covers, to reduce noise to a minimum.

The take-up unit consists of a cradle mounted between two flywheels that create the double twist. A haul-off capstan group, overtwister, wire straightener, traverse mechanism and take-up spool support are mounted on the cradle.

The double-deck haul-off capstan consists of two coaxial rings, one idle and the other motorized. The idle capstan includes a wirestraightener, traverse mechanism and take-up spool support are mounted on the cradle.

The design of the flywheel also varies, depending on the size of the cord and the working material. The flywheels can be bell-shaped without transmission pulleys (DTUF version), or with specially designed guide pulleys that facilitate passage of the torsions, suitable for zinc-plated or stainless steel wire (DTUR version). Both types foresee a free catenary curve. For particular uses, such as machines for production of cord with high flexibility or with flexible shaft or low resistance wires, the flywheels can be equipped with bows designed to contain the catenary curve (DTUF version).

The layplate consists of a metal ring with as many equidistant holes and, if necessary, wireguide pulleys as there are filaments. The core passes through the middle of the layplate (when foreseen).

From the layplate the filaments converge on a closing die where formation of the cord takes place. The distance between the closing die and the layplate is adjustable to obtain the best cord formation.

The external twist serves to perform the cord before it enters the double-twist take-up. This twist is optional. However, it is important in case of complex cord constructions and/or Unilay cords with many wires in order to recall the exact length necessary to place a particular wire in the finished product.

Moreover, because the external twist speed can be varied in relation to the take-up speed, constructions with many different characteristics can be produced, to meet all manufacturing requirements.

The traverse consists of a rotor with guide pulleys splined inside so that the cord is wound around them in its path from the closing die to the take-up unit.

The unit is driven by an independent motor, which is electronically synchronized with the main motor of the take-up unit. Upstream of the layplate and closing die is the pay-off stand, on which are mounted a certain number of spool supports and corresponding wireguide rollers depending on production requirements.

The pay-off braking system provides even braking of the spools, thus ensuring smooth winding off which helps to avoid breakage of the wires or strands caused by variations in tension. In the construction of cords using the double-twist cabling principle, this is of fundamental importance.

In particular, tension on the pay-off wires must be uniform, constant and controlled. We have dedicated a great deal of attention to this problem and have designed a series of pay-offs for a wide variety of spools. These assure constant tension that is controlled from full to empty spool and it is adjustable depending on the diameter and type of spool to be used and can be summarized as follows:

Horizontal Axis with Mechanical Dancer Arm and Band Brake

The spool is mounted on a horizontal axis shaft with a spool locking system. The shaft rotates on bearings and it is integral to a drum with a band brake. The torque generated by the brake is controlled by a mechanical dancer arm loaded by an adjustable spring.

Vertical Axis with Mechanical Dancer Arm and Band Brake

The spool is mounted on a vertical axis shaft that rotates on bearings and it is integral to a drum with a band brake. Here too, the torque generated by the brake is controlled by a mechanical dancer arm loaded by an adjustable spring. In both cases, each pay-off is equipped with hardened steel guide rolls to direct the wire to the layplate.

The electrical cabinet is positioned behind the external twist. The main operator control station is mounted on the cabinet, facing the operator. The electrical equipment in the cabinet is easily accessible by opening a door located on the back. The control station includes a liquid crystal keypad display connected to a microprocessor, with which all the machine settings are made (motor speed, metercounter length, direction of bunching lay, etc.). The electrical equipment is constructed in accordance with IEC Standards.

All rotating parts are dynamically balanced and the structures are destined to eliminate vibrations and attenuate noise. With the soundproof covers, this makes machine operation smooth and silent, even at the highest rotating speeds.

Machine foundations are not necessary.
The DTSM produces SS or SZ lay constructions on the basis of the double-twist principle, so that at every revolution of the flywheels the cord or cable is twisted two times. The machine is composed of modular units that are separate from one another, more precisely: a core pay-off unit, a filament pay-off unit, an external twisting unit and a take-up unit. The core pay-off, external twister and take-up units are enclosed in soundproof covers, to reduce noise to a minimum.

Among special features of the DTSM machine is the design of the take-up that permits that at every revolution of the flywheels the cord or cable is twisted two times. The first pay-off is a rotating unit, for construction of the core strand, or as back twister for a pre-stranded core. The vertical spool supports are mounted on a rotating cradle between the flywheels, which twist the wires or strand. Following the core pay-off unit is the “static” filament pay-off stand on which are mounted a certain number of vertical spool supports and corresponding wireguide rollers depending on production requirements.

On both the rotating core pay-off and the static filament pay-off, constant pay-off tension is maintained by a braking system that requires no further regulation once it has been defined for each working cycle. This braking system provides even braking of the spools, thus assuring smooth winding off which helps to avoid breakage of the wires or strand caused by variations in tension. In the construction of cords using the double-twist cabling principle, this is of fundamental importance. In particular, tension on the pay-off wires must be uniform, constant and controlled.

We have dedicated a great deal of attention to this problem and have designed a series of pay-offs for a wide variety of spools. Besides satisfying the most advanced technological requirements, these pay-offs need practically no maintenance whatsoever. Furthermore, our pay-off tensioning system differs totally from that of other manufacturers, who use mechanical friction brakes controlled with a dancer arm.

The pay-off spools are braked using a special gravity system which is based on the simple principle that the braking torque depends on the total weight of the spool, the spool support and the wire: less weight means less torque, which is equivalent to lower pay-off diameter. To simplify loading and unloading with a hoist or other similar handling systems, it should be noted that the spools are normally mounted on their vertical axis. This also means that ballstofks, shafts and spool locking systems are not necessary.

The number and type of pay-offs is up to the customer, depending on the cord to be manufactured and the spools to be used for the filament wires. It is also possible to combine different-sized pay-offs, in particular for the production of Seale or Filler type ropes. To assure precise equilibrium of the core and filament pay-off pull, a specially designed “equalizer group” is used, with wireguide rolls and clutch-operated castings around which the wires and core strand are wound.

From the pay-offs and pull equalizer group, the wires and core strand pass through a lapplate and closing die, which are mounted on the external twisting unit. The external twister performs the cord or rope construction with a lay close to the final preset lay.

The partially formed cord, consisting of the core strand and the filaments, passes into the take-up unit, which consists of a cradle mounted between the cabling flywheels, on a working structure that is completely enclosed in a sound-absorbing cabinet.

The partially formed cord is pulled into the take-up unit by AC motors, with belt and pulley transmissions. The pay-off and twisting group motors are electronically controlled to operate in synchronization with the take-up motor. To vary the length of the bunching lay, it is sufficient to substitute two toothed pulleys (extra parts are optional). The direction of the lay (S or Z) is changed by adjusting the gear wheel and reversing the motor phases. To vary the revolutions of the overtwister inside the take-up unit, it is necessary to substitute the overtwister transmission pulleys.

The electrical cabinet is positioned behind the external twister. The main operator control station is mounted on the cabinet, facing the operator. The electrical equipment in the cabinet is easily accessible by opening a door located on the back. The control station includes a liquid crystal keypad display connected to a microprocessor, with which all the machine settings are made (motor speed, metercounter length, direction of bunching lay, etc.).

Machine foundations are not necessary.
The DTAR cabling machine has been designed for the production of multi-strand high tensile strength ropes using the indirect cabling method. With indirect cabling the wires or simple strands are twisted around their own axes (twisting of the wires and double-twisting of the strands), and these twists become double-twists around the axis of the cord. The unique feature of this machine is thus the application of double-twisting in the concept of indirect cabling (back twisting).

The latest versions of the DTAR cabling machine incorporate certain technological innovations, which makes it simpler and more flexible than ever. Accurately assembled, high quality components help to reduce maintenance. Carefully balanced rotating groups make it possible to operate the machine at high speeds; and the noise level has been further reduced by the use of anti-vibration supports and specially designed noise-insulating machine structures and covers.

The machine is modular, with separate rotating pay-off and take-up units, as well as a stand for the layplate and closing die and an external twister.

The rotating strand pay-off consists of a number of vertical spool supports, each one mounted on an oscillating cradle between two flywheels, which twist the strands as they are paid off. These spool groups are arranged in groups of four and, depending on the type of cord to be manufactured, the machine is supplied with two or more groups.

The core pay-off is located on a separate stand upstream of the filament strand pay-offs. The speeds of the core pay-off and the strand pay-offs can be regulated independently. Each pay-off spool is braked separately and each strand also passes through a strand tension detection device.

This assures smooth winding off and helps to avoid wire breakage or defects in the formation of the cord or rope. From the pay-offs, the core and filament strands pass through a layplate and closing die, which are located on an intermediate stand that also houses the external double-twisting groups to form and stabilize the cord construction. The first twisting group performs the construction with a lay close to the final preset lay. The second group stabilizes the construction.

The partially formed cord then passes into the take-up unit, which consists of a cradle mounted between the cabling flywheels, on a working structure that is also completely enclosed in a sound-absorbing cabinet.

On the take-up cradle are mounted the haul-off capstan, traverse mechanism, take-up spool support, etc. The rope advances by means of a double-deck capstan through the overtwister and straightening group, and is wound on the spool.

The rotating pay-offs, external twisting groups and take-up unit are driven by AC motors, with belt and pulley transmissions. The pay-off and twisting group motors are electronically controlled to operate in synchronization with the take-up motor. Once the speed ratio has been set among the various units, it remains constant.

Each unit automatically adjusts to eventual speed changes of the main, take-up motor. To vary the length of the cabling lay, it is sufficient to substitute two toothed pinions. The direction of the lay (S or Z) is changed by adjusting the gear wheel and reversing the motor phases.

The electrical cabinet is positioned behind the external twister. The main operator control station is mounted on the cabinet, facing the operator. The electrical equipment in the cabinet is easily accessible by opening a door located on the back.

The control station includes a liquid crystal keypad display connected to a microprocessor, with which all the machine settings are made (motor speed, metercounter length, direction of bunching lay, etc.). The control station also includes all the buttons and signal lights to operate the machine. The preset metercounters control the length of cord wound on the take-up spool, as well as the wires and strand unwound from the pay-off spools. When the preset cord length is reached, or the pay-off metercounters register zero meters, the machine stops automatically.

Wire break contacts signal eventual wire or strand breaks both before and after formation of the cord, and automatically cause the machine to stop.

Machine foundations are not necessary.
The QT3 stranding machine is designed to take a number of steel filaments from spools and form them into a cable by using the double twist principle twice with the in-out-in system, to produce a final product or a semi-finished product for subsequent operations.

The machine produces high tensile strength strands composed of two to four filaments with diameters ranging from 0.15 to 0.40 mm, in constructions with S or Z lay direction. The machine is simple and functional and noise and maintenance problems are reduced to a minimum by, among other things: the use of high quality components accurately assembled; the equilibrium of the rotating groups which are dynamically balanced at high speeds; and insulation of the machine structure itself with soundproofing material.

The machine is composed of two units and, as a matter of fact, each of them is a complete stranding unit. They are assembled on the same structure.

The external pay-off can accommodate one vertical axis spool holder mounted on a block attached to the machine frame. Finger rolls and pulleys guide the external filament to the center of the inlet bushing of the rotating shaft. Inside the cradle, rolls and pulleys are mounted to guide the external filaments according to the out-in-out system.

Correct wire unwinding tension is maintained by a gravity braking system, which assures even winding off and smooth braking. The system is based on the ratio between the weight of the spool and the spool holder, the filament unwinding diameter and the diameter of the friction ring. Once regulated, this system requires no further adjustments and no maintenance and, moreover, it has a very long working life.

The partially formed strand (first double-twist) passes into the rotating take-up unit (second double-twist). This consists of a cradle which is mounted between the stranding flywheels and holds the double-grooved haul-off capstan, overtwister, wire straightener, traverse mechanism and take-up spool support. The cord advances by means of the capstan through the overtwister and wire straightener and is wound on the spool.

The traverse mechanism runs on a double-cross-threaded screw and is designed to assure perfect winding of the strand. The traverse is driven by the take-up spool shaft, so the traverse lay is also constant as the spool fills up. When changing from one spool type to another, it is sufficient to substitute the traverse screw with a very simple operator intervention.

The rotating pay-off unit and the take-up unit are driven by AC motors and they are electronically controlled to operate in synchronization. The take-up motor is the master.

The direction of lay of each unit can be chosen, right or left, depending on needs, simply by adjusting switches located on the operator control station.

The housing is closed with doors that have thick glass viewing windows. When the doors are open, the operator has easy access to the inside. The doors are electrically interlocked to prevent running of the machine when they are open or opening when the machine is running.

The operator control station is located above the take-up unit. It includes keyboard with a liquid crystal display to visualize the working parameters, such as rotating speed, lay length, spool length, etc. The control station also includes a series of pushbuttons for execution of the normal commands and signal lights.

Air is circulated inside the sound-absorbing cabinet by a fan which draws air in from outside.

The electrical equipment is contained in a cabinet mounted on one side of the take-up unit and is easily accessible.

The electrical equipment is constructed in accordance with IEC standards.

Machine foundations are not necessary.
**TC TUBULAR STRANDERS**

The tubular strander is designed for the production of wire ropes with different diameters and is composed of: an external spool pay-off, a rotor with the spool cradles, a closing die, a double haul-off capstan and a take-up.

The external pay-off spool is mounted on tailstocks connected to a mechanical brake controlled by a dancer arm to maintain correct tension on the wire.

The tubular elements of the rotor are made of high-quality, stress-relieved carbon steel. Each tube is balanced statically and dynamically before assembly. A micrometric device allows easy alignment of the rotor during installation and after maintenance operations.

The rotor rotates on a series of large-sized, heavy duty bearings that are mounted on normalized, welded steel stands. The rigid construction of the stands assures efficient dampening of any vibrations. The bearings are lubricated through a centralized system, with a positive displacement pump that delivers the exact required volume of lubricant to each bearing.

The bearings are housed in very thick, high precision rings that are bolted to the corresponding rotor flange. This design makes it easy to disassemble them for repair or substitution.

The rotor houses all the spool cradles. The number of cradles depends on the construction of the rope and can range from 3 to 48 units.

The spools rotate on tailstocks that are also mounted on ball bearings. One is stationary and the other is moveable to load and unload the spool. The moveable tailstock is pneumatically operated with manual controls. A safety device prevents accidental opening of the tailstocks during machine operation.

The rotor is driven by a speed-controlled AC motor. Power is transmitted with pulleys and belts. The rotor is braked with pneumatically controlled disk brakes.

Wire tension is adjusted for each spool with shore brakes. The adjustment is manual and the tension is kept constant with a sensor. The wire path is designed to avoid scratching or other damage to the filaments. They pass through polished hard metal bushings. The rotor is enclosed in a soundproof cabinet that is separate from the machine structure itself. It is accessible through doors that can be opened only when the machine is stopped. Thick safety glass inspection windows and internal lights allow inspection when the machine is running. Internal ventilation is also foreseen.

Care has been taken to prevent accidents to the machine and/or operator. Besides the other protection and safety devices, in particular the rotor includes: a pressure switch to control bearing lubricant pressure; a thermostat to control bearing temperature; wire break detectors in the path of the filaments, soundproof cabinet door interlocks.

The closing die is located after the rotor and consists of a welded steel stand on which is mounted the die itself. The position of the die on the horizontal axis can be adjusted longitudinally with a handwheel.

For production of closed cords, a preformer can be installed upstream of the closing die and a wire straightener can be installed downstream (optional).

The strandings lays are continuously adjustable and different strandings lays are obtained by setting the two motor speed ratios with the keypad display located on the main operator control station.

The take-up consists of a heavy steel structure on which are mounted the drive components, traverse group and spool tailstocks.

The tailstocks are mounted on shoulders with displacement devices that permit a wide tailstock stroke, with a torque-limiting device to adjust locking pressure on the spool flanges.

The traverse excursion and speed are adjustable depending on the different production requirements.

The take-up is driven by a separate AC motor synchronized with the haul-off capstan drive.

Safety features: Whenever an alarm is activated, the machine either does not start up, or stops with the emergency brake.

This can occur if the rotor doors or other safety guards are open or opened during operation, if bearing lubrication is faulty, if any of the bearings overheat or in case of wire breakage.
The CLR bow or “skip” type strander is suitable for the production of 3 to 7 wire strands. The size and characteristics of the machine model depends on the individual requirements of the customer. The CLR is also the strander that is coupled with GCR’s PC stranding line for production of concrete reinforcement strands.

Basically, the machine is composed of the following elements: the skip type strander structure with cradles suitable for spools according to customer specifications, a separate postformer, the machine drives, transmission, electrical and electronic equipment and various accessories.

The bow strander is the equivalent of a tubular strander in all of its applications. The heavy steel tube rotating on rollers or large bearings is replaced by a pair of bows or flyers, one pair for each cradle which, due to the low mass and high rigidity of the bows, rotates at speeds higher than an equivalent tubular machine.

Inside the structure there are a number of cradles, one for each spool. The cradles are welded, stress-relieved steel structures that oscillate on bearings in cradle supports mounted at the ends of the hollow rotor shafts. Photocells monitor the movement of the cradles and signal any anomalies.

On each cradle, the spool is suspended between pneumatically operated tailstocks that hold it in place. A band brake is mounted on each tailstock.

The brakes are designed to maintain constant tension on the wire as it is being paid off. This is done by means of a sensor arm that detects the diameter of the spool as the wire is unwinding and the torque varies accordingly.

The bows are attached to the rotor shafts, by means of clamps mounted at the ends. The bows are equipped with bushings to guide the wires. This system assures smooth running of the wire along the bows without unwanted friction, and preserves the quality of the wire surface.

The wires, guided by the bushings along the path formed by the bows, pass through the center of each rotor so that tension on the wires is greatly reduced by the balanced centrifugal force.

All the bearings have grease nipples, for easy lubrication. The rotor bearings are automatically grease lubricated with one or more centralized pumps. The temperature of the bearings is measured with thermostats. If the temperature exceeds the preset level, the stranding machine stops.

The shafts are driven by belts and pulleys connected to a transmission shaft. The transmission shaft is divided into sections connected by universal joints, to simplify dismantling for maintenance or for substitution of the drive belts.

The transmission shaft is braked with disk brakes that are activated electro-pneumatically and a dual braking system is provided, for normal and emergency braking.

The internal working structure is completely enclosed in a sound absorbing cover, to reduce noise to a minimum. The cover is equipped with a ventilation system to maintain the temperature inside the machine within acceptable limits.

The postformer is made of normalized welded steel and consists of a closing die mounted on a moveable housing that can be adjusted longitudinally with a handwheel.

The machine is driven by an AC. motor controlled by a frequency inverter. The electrical and electronic controls are contained in a sturdy metal cabinet.

The main machine functions are electronically controlled and evidenced by LEDs located on an operator control station at the front of the cabinet.

The controls include machine start, stop, jogging pushbuttons, signal and alarm lights etc. for the electrical and pneumatic systems, a preset metercounter, and a wire break detector system, with identification of the cradle section where the wire has broken.
CONTROL CABLE WRAPPING LINES

The line is specifically designed for the production of control cables for automotive applications. It includes elements both of a PC strand and a PC wire production line and is composed of a rotating spool pay-off for the wrapping wire, a rotating spool pay-off for the control cable, a haul-off capstan, a pinch wheel pulling unit and a basket coiler.

The wrapping wire coming from the wrap wire pay-off is passed through the rotating bow pay-off that houses the control cable. The cable is paid off though the shaft of the cradle. The bows rotate around the cable spool and a special device winds the wrapping wire on the center cable at the desired pitch.

This makes it possible to use large spools for the wrapping wire and for the cable to be wrapped, so that downtime can be considerably reduced. In addition, the cable can be double-wrapped with textile at the same time, by adding a second wrapping unit in-line with the first one.

A special device controls the pitch of the wrapped wire so that it is always within the desired specification.

The haul-off capstan pulls the wrapped cable out of the bow pay-off.

The pinch wheel puts the cable under tension and at the same time directs it to the basket coiler.

The final product is generally used as a control cable/screw for operating automotive components such as electrical roofs or power windows, but also in other applications where it is necessary to use special flexible shafts cables.

With this line, control cables can be manufactured in a one-step high-speed operation with substantially lower manufacturing costs compared to traditional methods. In the past, the same product was made in three steps and at much lower speeds.
KNOW HOW, AFTER SALES SERVICE AND SPARE PARTS

GCR Eurodraw began over 35 years ago to design and build double-twist machines for tire steel cord production. From this experience the product range expanded to machines for fine strands for other automotive applications and then further to machines for the production of ropes for elevators, cranes and for the mining industry, and others.

The stranders manufactured by GCR have been designed taking into consideration the feedback received from our customers during the past 35 years. This invaluable experience allows GCR to develop new machines for specific rope constructions such as flexible shaft, wrapped ropes, high flexibility ropes.

GCR Eurodraw’s broad experience in setting up wire production plants allows us to offer complete turnkey wire rope production plants, from wire rod to finished rope, including intermediate patenting, electro- or hot dip galvanizing and wet or dry drawing. Our technology department can provide all the necessary know-how for production of all the most popular types of ropes and can assist in the development of special ropes.

Our after sales service staff is fully prepared to assist our customers not only to solve any type of problem pertaining to the equipment, but also to help in the development of new products. GCR Eurodraw always has a double-twist machine in-house that is used for test and development purposes. This machine is used by to help customers test new products, make trial runs and test new developments that can later be implemented on the production equipment.

The after sales service staff works closely with our spare parts department. This means that in case of urgent spare parts requirements everyone works as a team to solve the emergency as quickly as possible.

GCR Eurodraw’s sophisticated software systems are capable of tracing the availability of a spare part in a matter of minutes. If the part is not available, the production order is immediately released to our production department or to our external sourcing department.

GCR Eurodraw can supply spares from the first to the latest machines ever built. If the spares are commercial components not available any longer GCR Eurodraw will solve the problem by selecting alternative components that are compatible with the original function.

KEY FACTS ABOUT THE GCR GROUP

In 1974 established as GCR Engineering SPA with the scope of designing and building equipment for the production of steel cord.

In 1982 acquired the company MILL, specialized in the production of wire drawing machines.

In 1988 established the company Eurodraw Srl for the production of straight through wire drawing machines.

In 1990 acquired the company OZ Cams and merged MILL and OZ Cams into Eurodraw.

GCR Engineering and Eurodraw work as a team for the supply of several turnkey steel cord plants in Europe, Asia, USA and South Africa, as well as supplying a wide range of equipment for different applications throughout the world.

In 1999 GCR Engineering is awarded ISO 9001 quality certification, further requalified in 2002 to VISION 2000 certification and now valid until 2011.

In 2002 GCR Engineering and Eurodraw Srl move to new premises.

In 2002 GCR Engineering and Eurodraw Srl merge into GCR Eurodraw to become one of the largest wire machinery manufacturers and with the widest production program.

In 2005 GCR Eurodraw opens a branch operation in China to consolidate its market position in the People’s Republic of China.

In 2006 GCR Eurodraw is awarded construction of the largest PC strand operation in the Middle East, with a capacity of 100,000 tons/year.

In 2007 GCR Eurodraw, in cooperation with EVG of Austria, purchases the company OEM located in Udine; with this acquisition the production program of the group also covers rolling cassettes and wire profile machinery.

In 2007 GCR Eurodraw purchases Comapac Wire Machinery Srl located near Lecco, a company specialized in the production of pay-offs and take-ups, competitive rolling machines and custom-designed wire drawing equipment for special applications.