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Successful Winding of Coated Papers

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Many new technologies and developments designed to increase paper machine speeds and improve paper printability have emerged in recent years. These improvements have changed the structure of paper and given winder manufacturers new challenges, especially as the requirements of printing presses have also changed. Ever-increasing roll widths and diameters are needed. Along with faster press speeds and shorter acceleration times, the unwinding of rolls in the press room has become a true test of paper strength and roll structure.

In the following we will review the special winding features of coated papers and discuss a selection of the winder type to meet a mill's specific needs.

Winders for Coated Grades

Coated papers include a wide variety of paper grades and end users thus creating varying demands for winding.

Traditionally, two-drum winders were also used to wind coated grades, but factors such as increasing sizes of rotogravure rolls and evolving paper grades challenged winders and lead to the development of multistation winders.

When unwinding, especially large roto rolls on a printing press unwind, a machine direction burst near the core (commonly referred to as core burst) is a common phenomena causing web breaks at or just before the flying splice. This is caused by core and roll deflection on the printing press unwind.

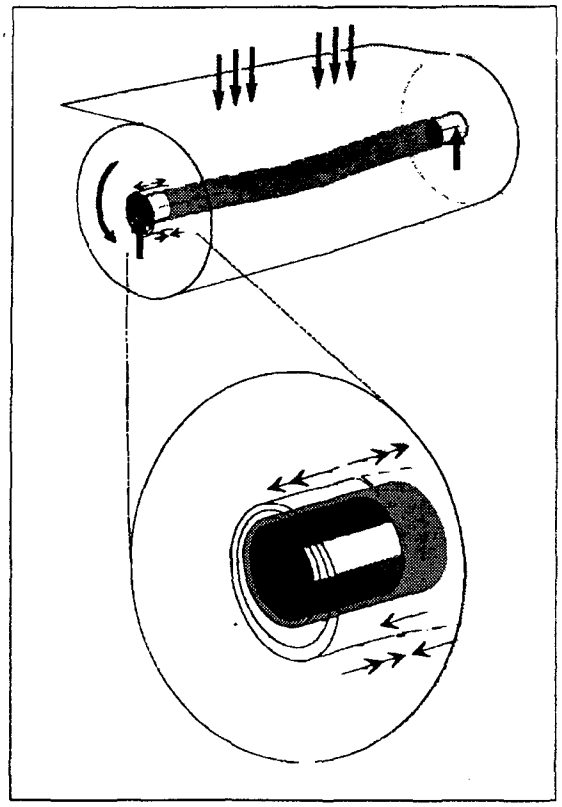

Fig. 1. Paper roll loads at printing press unwind

The deflection generates an alternating cross machine web force at the bottom of the roll. This force, if greater than the web's cross machine direction elastic limit, tears the web in the machine direction. This problem is more likely to occur if the web's fiber orientation ratio is high and the machine direction tear resistance is low.

The problem can be avoided by uniformly winding the roll bottom hard enough so that the roll can better support itself during unwinding.

On the contemporary multistation winders, roll bottom hardness can be increased by using large center drives and belted rider rolls. However, this method reaches physical limits caused by excessive loads to the core and the chucks and there is risk of roll bottom wrinkles and sheet tear offs.

The solution for the problems described above is in **Winding Force**. Winding force principle is used in both WinBelt and WinRoll winders.

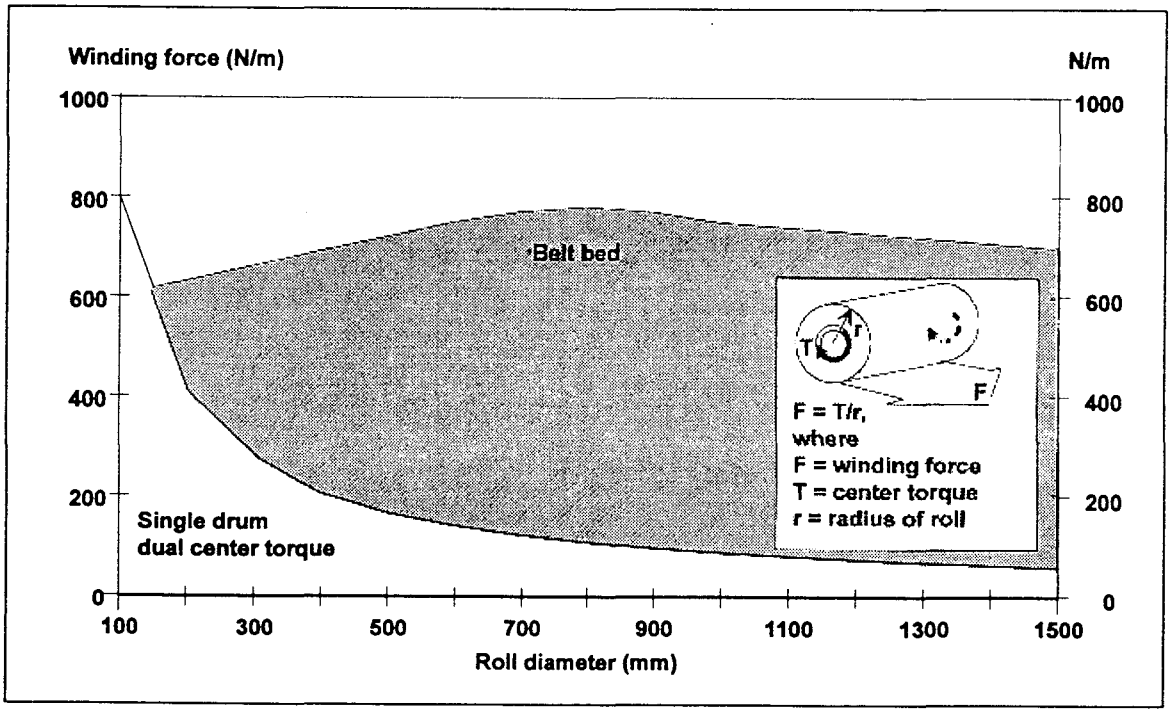

Fig. 2. Winding force from belt bed or single drum winder center torque drive

WinBelt - Winding by Winding Force

The WinBelt winder, where rolls are wound on drum and belt-bed system has been on the market since late 80' and it is today used in winding of all kinds of paper.

WinBelt winding does not regulate roll hardness by varying the nip load. A suitable nip load has been set to prevent air entrapment in the first and most important nip. This base nip load, combined with web tension, gives rolls their basic hardness.

However, the most important tool in WinBelt winding is the Winding Force, which is the force difference between the belt bed and the rear drum.

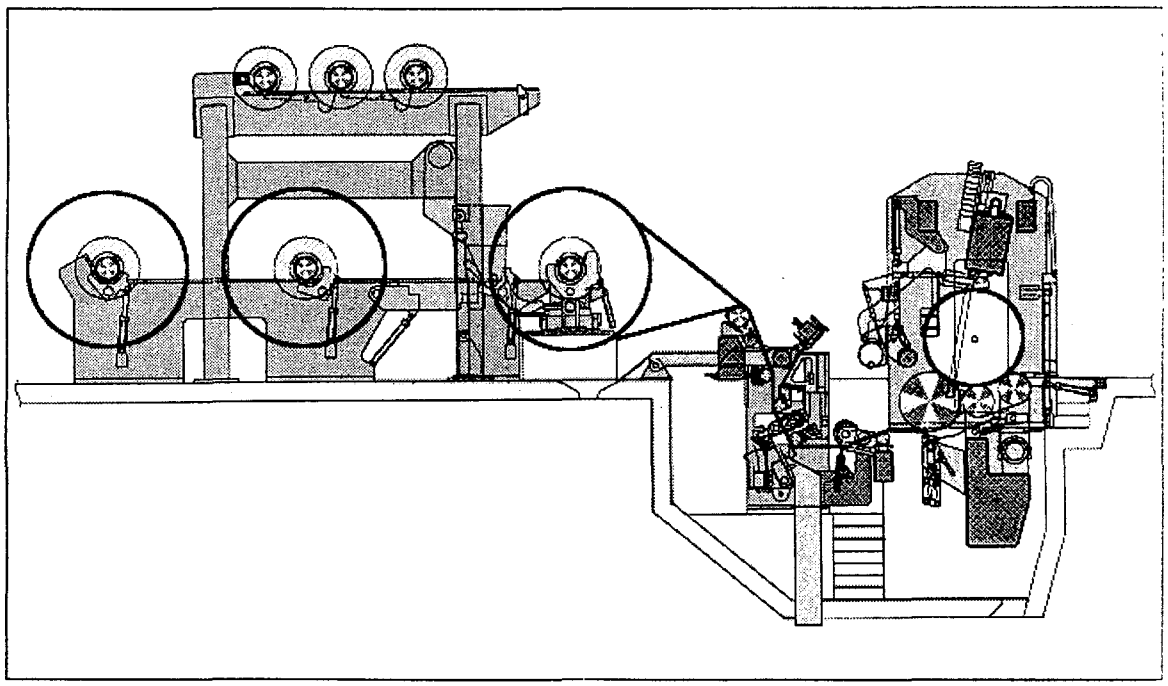

Fig. 3. WinBelt winder

This force difference is applied to the surface layer of the roll. Winding force is a very versatile tool. It tightens the roll's surface layers and thus ensures the desired roll hardness. It stretches the web in the correct manner and thus lowers the diameter differences and nip load variations caused by paper caliber variations. It makes it easier to tighten the web on the roll surface after a splice. In addition, it works in the same way as a web tension separation nip and gives the rolls even tightness set by set, even in the cross-machine direction.

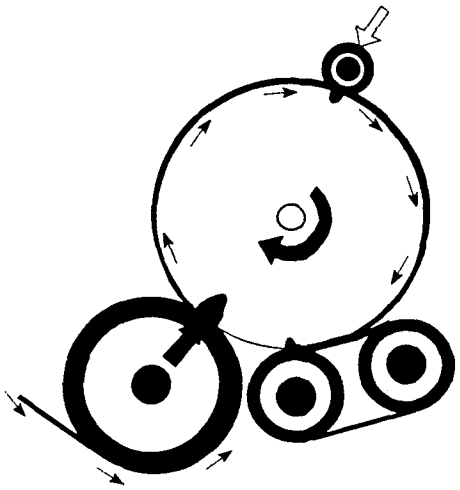

Fig. 4. Winding principle of WinBelt winder

Flexifility and high capacity are other advantages of the WinBelt winder. There are no limits to the trim settings. Winding process control is easy and there is no need for different recipes for each roll. Besides, the winding is so flexible that the normal internal variations in the sheet will not affect the winding process. The winding force is programmed only according to the density and stretch properties of the paper.

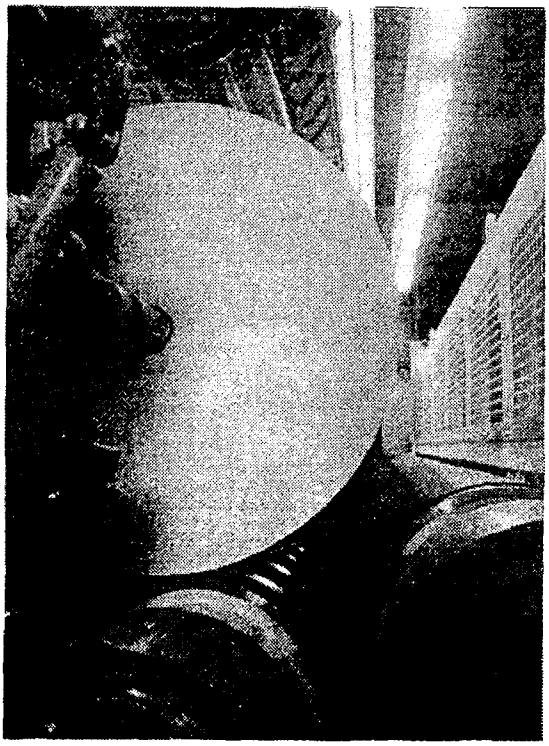

Fig. 5. Belt bed of WinBelt winder

WinRoll - Latest Innovation in Multistation Winding

When the project to develop a new multi-station winder was started four years ago the following targets were set based on both discussions and reviews with customers and our own experience:

- improved winding method to make first class roll structure also for jumbo rolls
- maximum capacity with fully automated functions
- one-man operation.

After the extensive development work and test programs we have met these targets with the new WinRoll winder. The pilot machine has started successfully at UPM-Kymmene Voikkaa mill in May to wind MFC paper grade, Fig. 6. Let us look the structure of WinRoll section by section:

Automatic Parent Reel Handling with Butt-joint Splicing

In addition to proven system for automatic parent reel change we have now a new butt-join splicer which provides a commercial splice automatically. This, together with full width web threading, makes one-man operation possible.

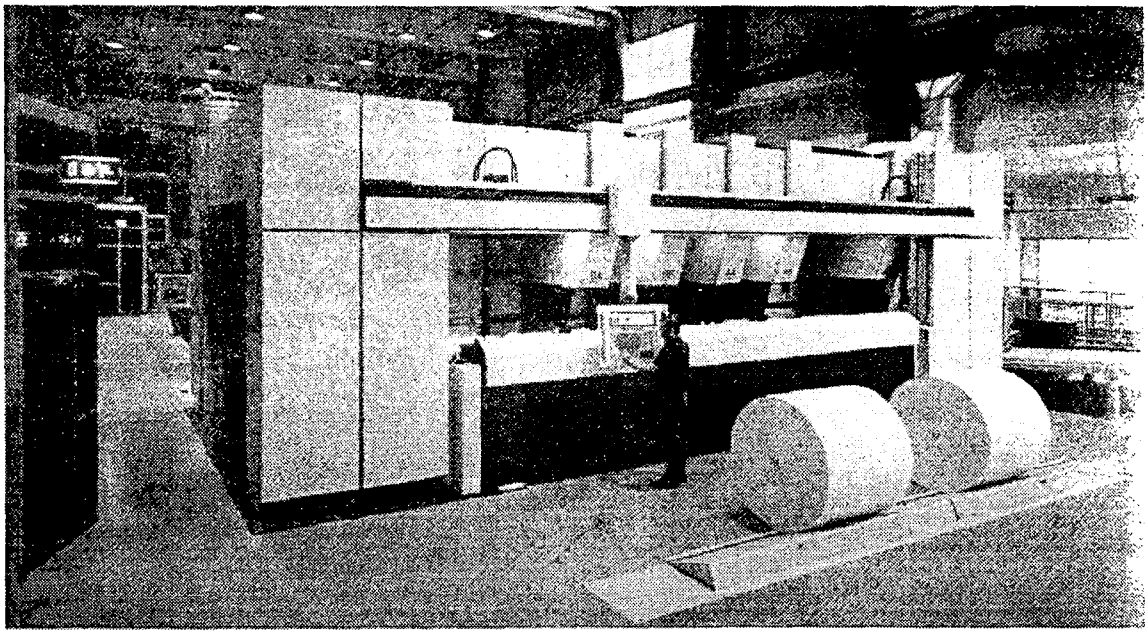

Fig. 6. The pilot WinRoll winder at UPM Kymmene, Voikkaa mill

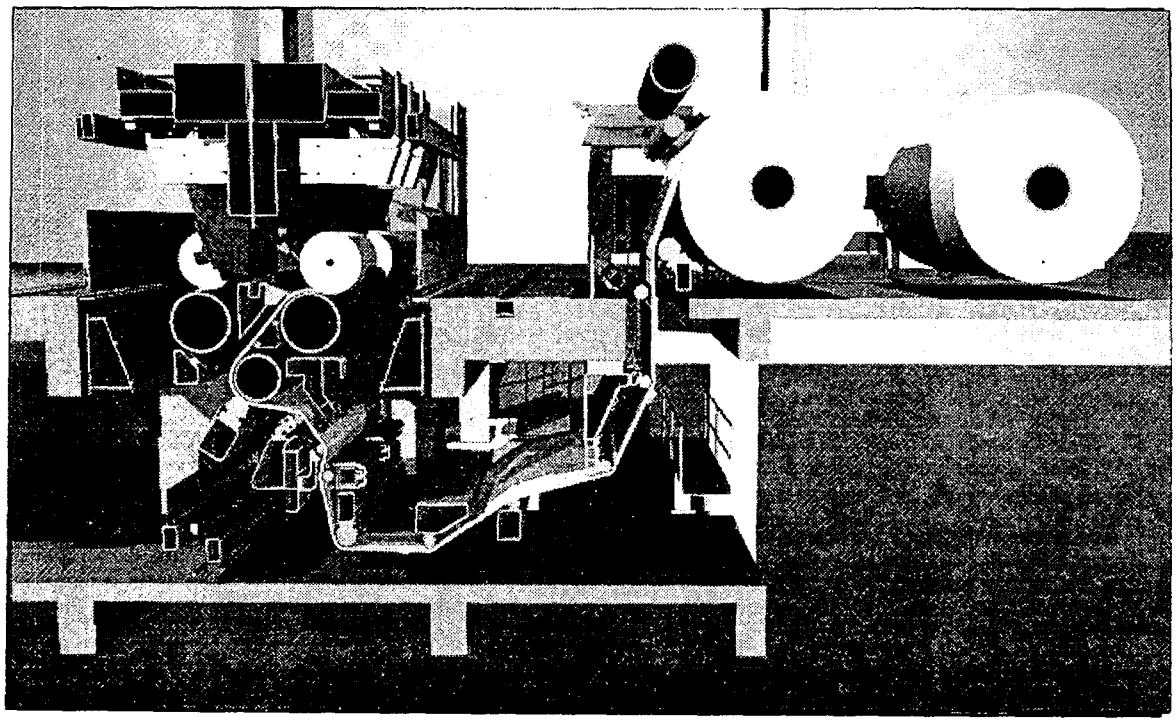

Fig. 7. WinRoll winder

Web Run

The stream line web run is realised below the floor level. This enables the control of the paper web moisture so that web skrinkage during splices and set change can be solved.

Windup

In WinRoll winders, winding force is applied to the roll through driven belted rider rolls.

At the beginning of winding the rider rolls prevent the core from bending and produce the desired nip load by linearly moving up to the diameter of max. 600 mm.

When the desired nip load level is reached by the roll weight alone, a totally new sequence begins.

The rider rolls move down around the roll perimeter initially to give side support and eventually, as the roll diameter increases, they begin the relief function. The relief provided to the rolls by the rider rolls can be 1000 kg/m in the longitudinal direction.

This means an extra 3 tons of relief to a 3 m roll, which essentially reduces the mechanical stress of the core and minimizes bending, the main reason for core bursts in heavy rolls.

There is one significant feature added to the rider rolls. The centre drives are replaced by surface traction integrated in the belt rider rolls. This provides a strong tightening effect, winding force, all the way to the maximum roll diameter.

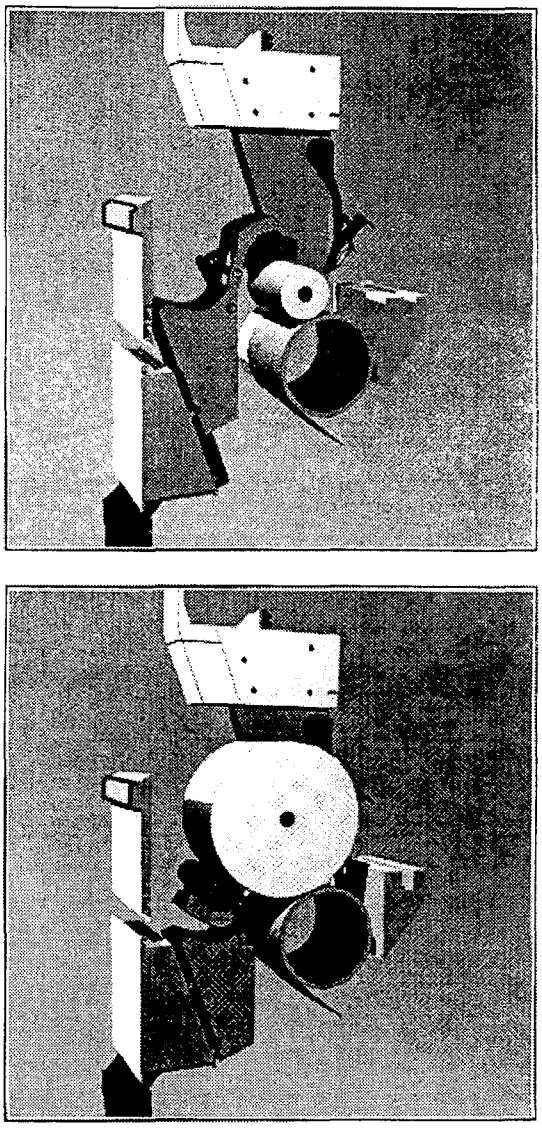

Fig. 8 and 9. The function of rider roll during winding

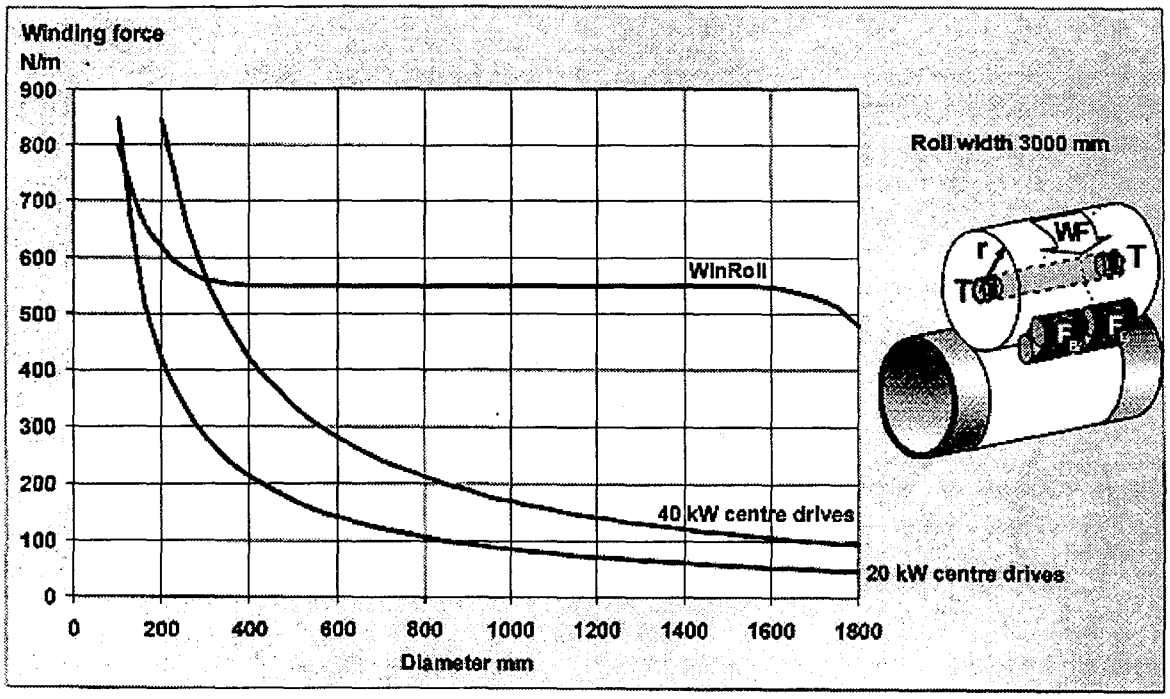

Fig. 10. Winding force created to centre or surface drive

Because of this remarkable rider roll innovation, the WinRoll winder is able to produce 10 ton rolls, using today's fiber cores.

In addition, the rider roll load can be profiled in wide rolls, when several rider rolls are in use and if there is a need, to utilize this advanced possibility.

Capacity Increase by Continuous Winding Method

With both WinBelt and WinRoll winders, the capacity can be increased by the new way of operation called Continuous Winding. Winder control system WindControl can be completed by a software package to enable the winder to perform fully automatically until there is a web brake or no new parent reels are available, Fig. 11. This function gives significant improvement in the capacity since small delays caused by manual operations are eliminated.

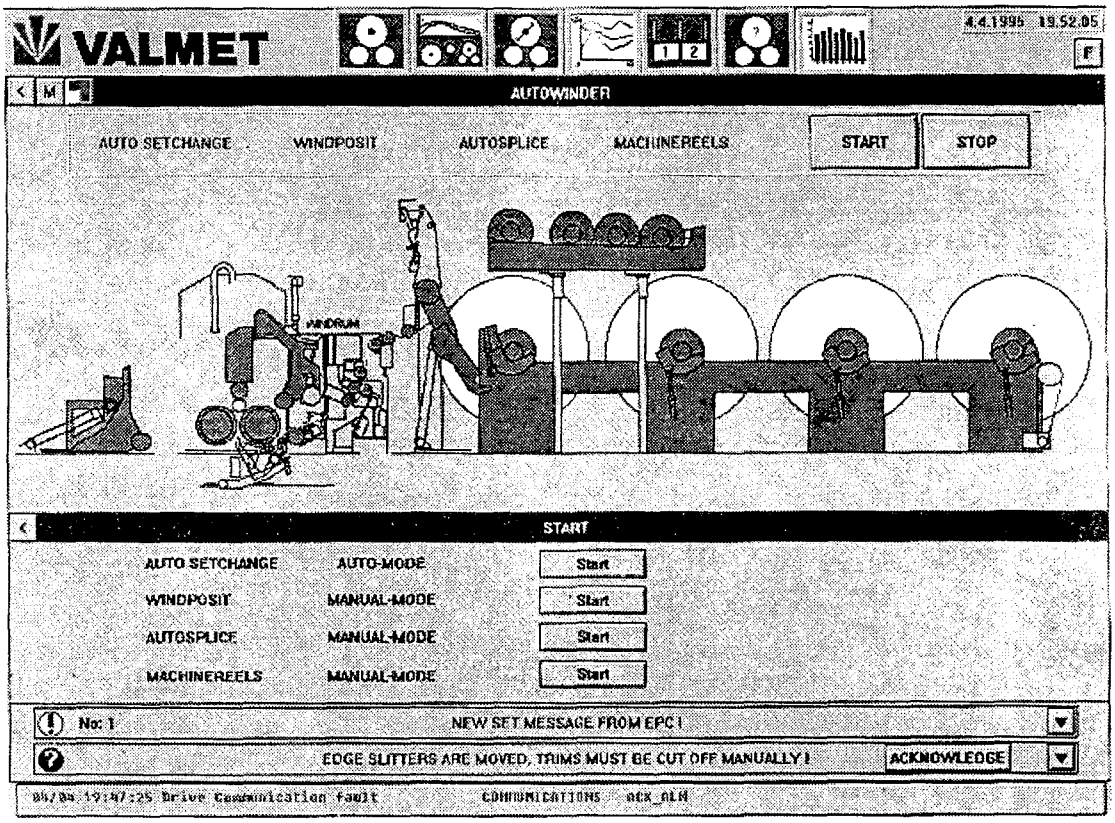

Fig. 11. The user interface of Continuous Winding

Summary

Recent development work has produced two new winder types, WinBelt and WinRoll, using winding force to meet the demands of winding coated papers.

The following features can be listed:

WinBelt

- Suitable for wide variety of coated grades
- Soft winding possibility for coated wood free grades
- High capacity
- Enables one core size / set
- Minimum roll widths possible
- Flexible lay-out / easy roll transport
- Excellent rewinder for all grades
- One-man operation

WinRoll

- Suitable for all paper grades
- New winding method by using surface traction
- High capacity
- Enables different core sizes / set
- Narrow rolls possible
- One-man operation

Solutions are available to reach one-man operation in winding and also different lay out possibilities to fit a mill's specific investment and process needs.