CUT-SIZE SHEETING TECHNOLOGY TODAY AND IN THE FUTURE

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RECENT ADVANCES, INCLUDING IMPROVED REEL HANDLING AND BRAKING, KNIFING, AND MEASUREMENT SYSTEMS, ENABLE CUT-SIZE SHEETING TO REMAIN ON THE CUTTING EDGE OF TECHNOLOGY.

THE FINISHING ROOM OF TODAY AND IN THE FUTURE IS required to be a low-cost producer of cut-size paper with high-quality standards; this demands outstanding performance. The applied technology in today's sheeters enables the operator to maintain this performance level. In this article, we show the features in today's cut-size sheeter for enhanced production and operation as well as offer services to investigate how to improve cross-cut quality with special respect to future paper material changes.

DISCUSSION

The world production record for cut-size sheeters with packaging lines for sizes DIN A 4 or 8-1/2 x 11–in. size is about 480 short tons in 24 hours. This production record is achieved on 12-pocket-wide machines, but cut-size sheeters with a working width of 13 pockets have already been produced and installed and a further increase to 15-pocket sheeters will soon be a reality.

As a result of close cooperation between vendors and the paper industry and of continuous product-line development, the highest level of productivity and flexibility of cut-size sheeters is achieved through high levels of automation and the use of the latest developments in control and drive technology. The incorporation of modern materials such as carbon fiber has also boosted productivity.

The paper composition of the past has changed in two areas—higher filler content and recycled fibers. This trend will continue for the foreseeable future, increasing the demands on cutting technology. The objective is to work toward low-dust cutting edges. Low-dust copy paper is the most important requisite today to reduce maintenance in high-performance copiers, which can work in the range of 100 copies/min.

Modern measuring methods, high-speed video recording, and computer simulation on longitudinal and cross-direction cutters (Fig. 1) are major contributors in working toward the objective of low-dust cut edges.

Even the smallest amount of dust on the paper reduces the time interval between servicing the copy machines. Accessory devices, such as web and ream cleaners, can mechanically brush and draw off the dust from the surface of the paper and the cut edges. The cut-size sheeting technology is applied for a variety of products and overhead material as well as film and foil. The various properties of these products require adequate processing devices, which are discussed in this article.

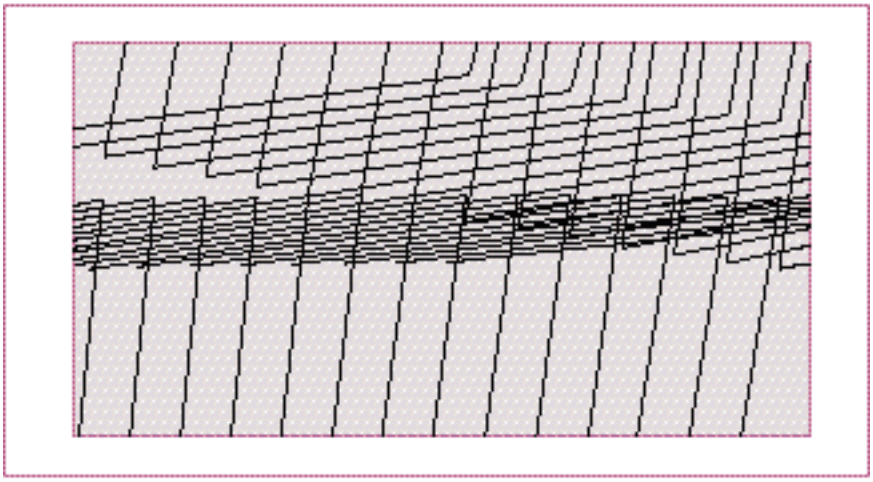
Material handling and logistics

Material handling and logistics in paper processing are the most important parameters in raising productivity. This requires the optimum use of space during the cut-size sheeter system's planning stage.

Fully automatic unwind stands reduce the space requirements and improve the work environment of the operators. Here we present the newest development in unwind stations. The essential feature of this new unwind system is its modular structure. The automation of the roll stands can be increased per customer requirements. Some of the automation features can also be retrofitted.

In today's finishing room, space is at a premium. The Pick-up 2000 is the answer to reducing space requirements. The automatic version (C) (Fig. 2) can replace the popular zero-speed unwind system.

Several of these unwind systems have been supplied and the feedback on the automatic roll-changing system and butt roll removal system has been positive. The average roll change time for a complete machine with five unwind stands is approximately 5 min for two operators.



1. Computer simulation of cut geometry

Braking systems

Constant web tension is critical in high-speed converting operations to maintain sheet length accuracy. Environmental, maintenance, and operating concerns are additional points to consider in selecting the appropriate tensioning system. The newly developed braking system, an oil-cooled multiple disc brake, meets the several requirements of today's converting facilities. This new brake system is virtually maintenance and noise free. Furthermore, it is the answer for high-speed converting operations with increased roll width and increased demands on brake torque capabilities. This brake system has been successfully introduced as a digressive system without the requirements of a dancer-tensioning system (Fig. 3).

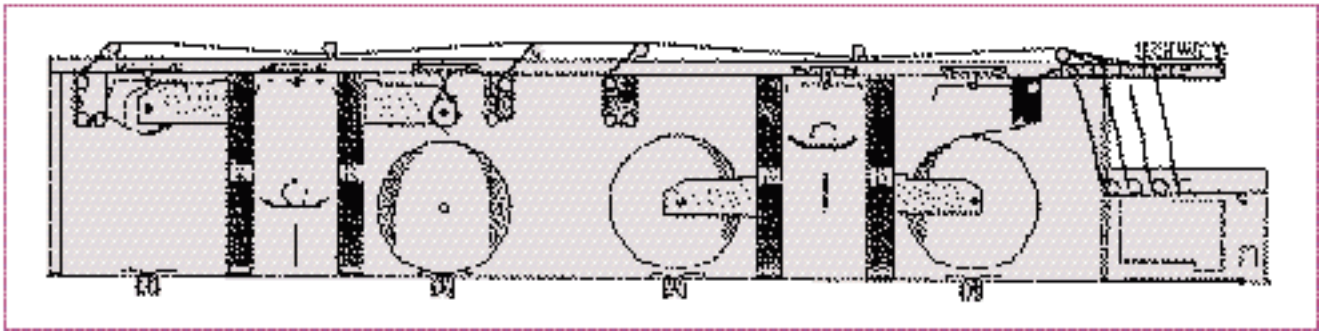
Market demands on converting facilities have changed over the past few years, especially for cut-size paper. The flexibility of cut-size sheeters is becoming a more important deciding factor. In the past, cut-size sheeters were generally purchased for one to three sizes only. Size changes on cut-size sheeters were less frequent. Today, the market demands more sizes. A variety of products exist with many different counts and, in particular, frequently changing packaging. Internal demands for reduced work in process supports the demand for flexible cut-size sheeters. This requirement is a challenge for high-performance cut-size sheeters.

The machine manufacturer has studied all sections of the cut-size sheeter to minimize size change time. The short paper draw of the Pick-up 2000 allows quick adaptation to changing roll width. Quick-change features for the slitter and cross-cutter sections allow a fast changeover between sizes. Throughout the tape and delivery section, quick-change features minimize the size change time. An entire cut-size line can change sizes in less than 2 h.

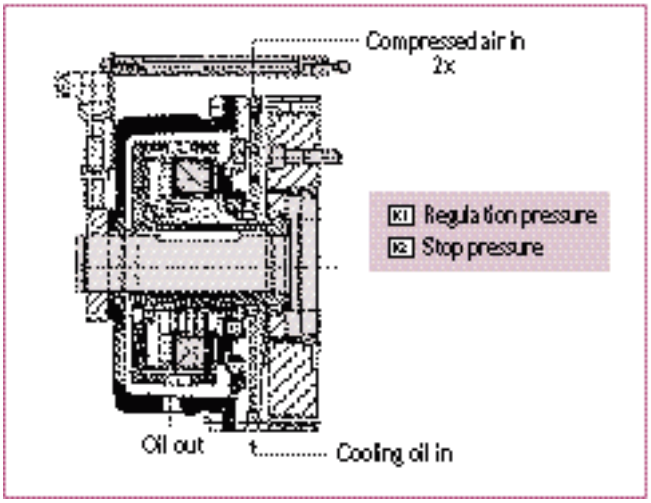
Knife systems

To accommodate various sheet lengths, it was common in the past to have exchangeable size-bound double rotary cross cutters or conventional cross cutters (fixed bed knife systems). Each system has its shortcomings. The conventional cross cutter requires additional change time between sizes. It also has limits within the knife load and the production speed. Furthermore, the requirement for low dust on the cut edges reduces the applications for conventional cross cutters. An alternative is a direct-driven double rotary synchro cross cutter. This cutting principle is well known in the industry from the folio sheeters. The high cutting frequencies common to cut-size sheeters increase the demand on the design of the cross cutter and the drive system. A prototype of this uniform driven synchro cross cutter with ac drive for quick size change is currently being tested (Fig. 4).

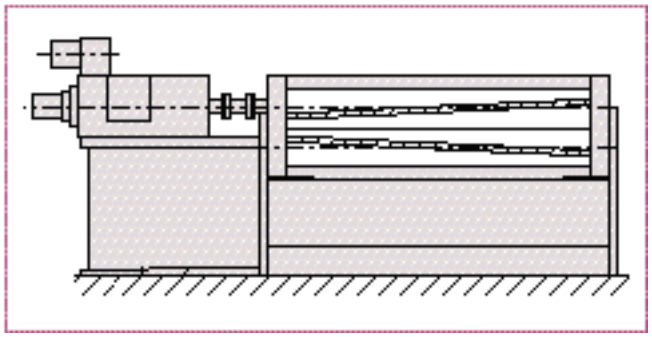
The use of carbon fiber materials for the cross-cutter knife cylinder reduces the inertia while maintaining the necessary high rigidity. A newly developed, extremely high-dynamic ac servo motor guarantees the precision required for cut-size paper. The motor drives the two knife cylinders, which are connected via reversing gears. No additional drive components are used. This improves the precision and reduces the inertia of the overall system. Because of the physical limitation of the motor-knife drive system, all sizes cannot be produced at maximum machine speed. A speed curve similar to that known for the folio sheeters specifies the maximum speed as a function of the sheet length. This speed curve documents the performance capability of the direct-drive synchro cross cutter (Fig. 5).



2. Pick-up 2000 unwind stand with automatic reel-handling system



3. Multiple disc brake



4. Individual driven knife block

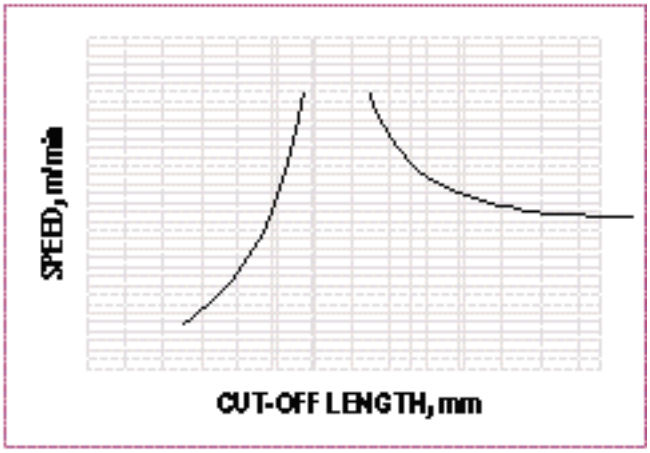
Test machine

The ongoing changes of the previously mentioned product properties require the slitter-cut geometry and the cross-cutter cut geometry to be adapted. Because of the relatively large working width of the installed machines, tests with mechanical changes are proportionally costly and some are lengthy and difficult. For further developments and adaptation of the cutting technology to customer's materials, a newly developed factory testing cut-size machine is available for investigating customer's products (Fig. 6).

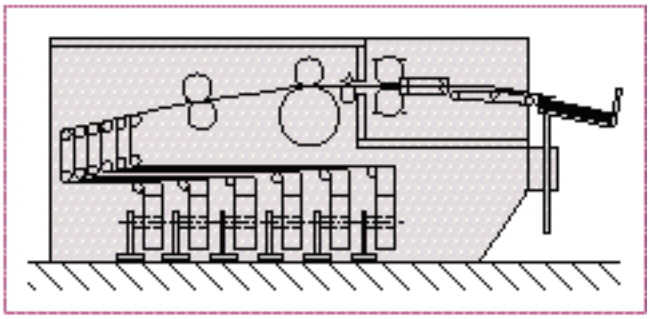
This new cut-size machine is one pocket wide with up to six paper unwind stands and contains all processing stations such as product feeding, slitting, cross cutting, tape section, and delivery section. All rollers, tapes, and cutting devices are supported on one side only to permit unobstructed video taping with high-speed cameras or stroboscope video during test runs. Test runs can be made at speeds up to 600 m/min. This 1-pocket testing cut-size sheeter is of modular construction, and all subassemblies can be exchanged and reset easily. Changing the cutting geometry can be arranged without economic and time constraints due to the narrow working width. The individual shafts and rollers that are important for the converting process can be provided with sensors that enable us to record forces in the dynamic processes.

The objectives of the planned test run are as follows:

- Further improvement of the cutting quality by determining the cutting forces acting on the slitter and cross cutter in relation to the number of paper webs, the paper weight, and the paper speed for the different knife shapes and improvement of the current cutting quality
- Increasing the knife load and life by examining the speed components during the cutting process. Different knife geometries and materials will be tested.
- Increasing the production speed by examining the paper flow throughout the cut-size sheeter, including the cross cutter and the overlapper, and observing all motions via high-speed tape recordings.



5. Speed curve for variable sheet length



6. Test machine

This is not a complete list of all in-house test programs that will be undertaken in the near future. This machine will also be made available to our customers, the papermakers, as a test rig, so they can examine existing and new products for properties such as cutting possibilities and dust generation, with a focus on increased productivity.

The increasingly complicated mechanical and electronic structure of modern office technology places ever higher demands on cut-size paper. Adherence to geometric dimensions and the quality of the cut are of particular importance in this context.

Measurement system

Until now, these factors have been determined by a special metering panel (for sheet length) or optical comparison with standardized sample cuts (for cut quality). Both were restricted in the past to very small random samples due to the time involved. To meet increased demands on quality, a new measurement device has been developed. This device makes it possible to check these quality factors automatically and objectively and to evaluate the results statistically (Fig. 7). TJ

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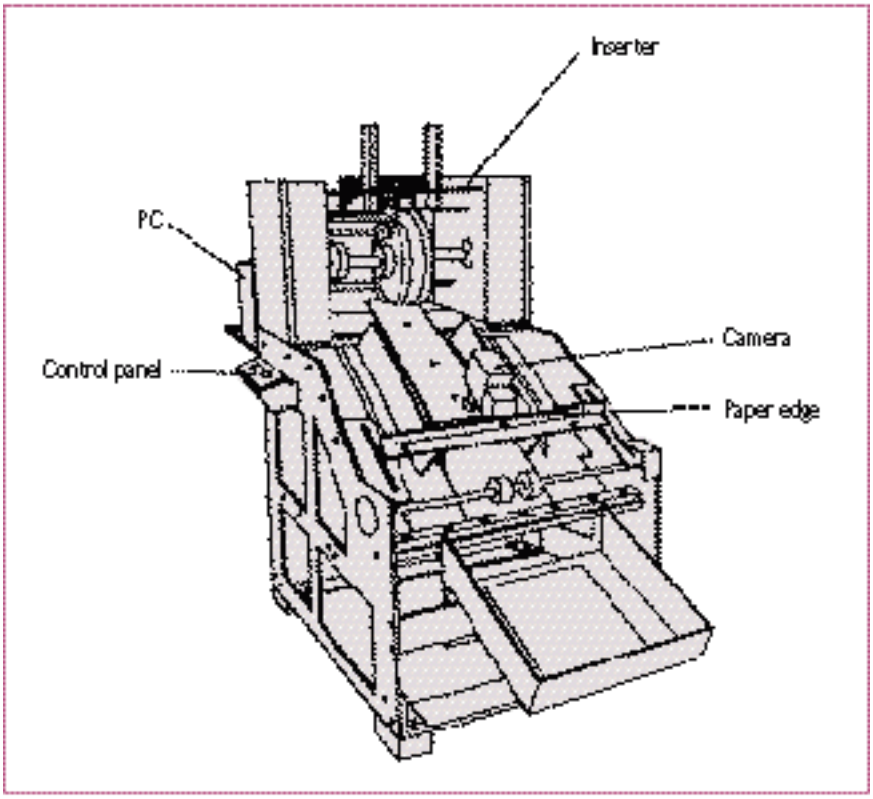

7. Measurement system