New Box Making Machine "Mitsubishi EVOL"

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1. Introduction

Mitsubishi Heavy Industries, Ltd. (MHI) has produced corrugated fiberboard box making machines since 1960, and has a good reputation from customers both inside and outside Japan.

In particular, the SUMMIT series of box making machines first marketed in 1982 have since come to be highly regarded in the industry. The series introduced the first computer-controlled system for these types of machines in the world, and some 400 machines have been delivered to customers both in Japan and around the world.

To meet ever greater demands for increased quality and productivity in recent years, MHI has newly developed and started to market the "Mitsubishi EVOL". The features of the EVOL are introduced below.

2. Features

The development of the EVOL was advanced by introducing exclusive Mitsubishi technologies based on the results of prior thorough investigation of customer needs under the theme "a machine capable of providing added merit to customers." This concept and related features consist of the following four items.

Fig. 1 View of single-stage type counter ejector

2.1 Pursuit of productivity

(1) Reduction in set-up time

Corrugated fiberboard box making machine generally changes production set ups for about 100 orders per day. Hence, there is a strong need for the time taken to switch to a new set up to be as short as possible.

A change time of two minutes by two operators (a 60% reduction from previous times) could be achieved with the EVOL through the adoption of a fixed frame type structure, (in which the frame must not be opened while changing a set up), the automation of units, and the mounting of auto test printing control.

(2) Increase in speed

A speed of 350 sheets/minute, which is the fastest speed in the world for a machine of this size with a maximum sheet length of 870 mm, could be realized by carefully examining and adjusting the strength and rigidity of the sections of the machine.

2.2 Coping with diversified productivity

(1) Production of small-sized boxes

Demand for small-sized boxes is increasing due to changes in distribution patterns such as growing distribution to convenience stores. To cope with these trends, the arrangement of the machine rolls was reviewed, and the minimum sheet length was reduced to 220 mm, which is the shortest in the world for this class of machine.

(2) Production of special shaped boxes

The bottom of a corrugated fiberboard box has been fixed with a stitcher (metal fixture). However, recently, Bottom Lock System (special shaped die cut box) is adopted for facilitating the recycling of corrugated fiberboard boxes.

In this system, corrugated fiberboards are combined with each other and fixed. To facilitate the high-speed production of boxes, an exclusive Mitsubishi single-stage type counter ejector is mounted on the counter ejector section.

Figure 1 shows a view of the single-stage type counter ejector.

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(3) Use of printing dies with different thicknesses

In the Japanese market, the leading printing dies have been 7.2 mm in thickness. However, the number of customers using 3.2 mm printing dies have been increasing as they seek to increase printing quality by reducing the thickness of dies, reduce the work load on operators by reducing the weight of dies, reduce costs, and save resources. In conventional box making machines, a 3.2 mm die is installed on a wound 4 mm thick backing material when the 3.2 mm die is used. This is done in order to eliminate variations in the outer peripheral speed of the printing dies due to changes in the thickness of the printing dies. In the EVOL, automatic peripheral speed change can be performed with the adoption of an all-unit independent drive system. This has made it possible to realize the common use of printing dies with different thicknesses without backing material.

2.3 Increased box quality and reduced losses

(1) Increase in sheet feed accuracy

A staggered-layout lead edge feeder capable of stably feeding low grade sheets and warped sheets has been mounted on the paper feed section used as the basis for box accuracy.

(2) Increase in printing quality

A proprietary Mitsubishi chamber doctor blade device has been installed in the printing section, as a standard to realize not only an increase in printing quality but also a reduction in ink changing time (50% reduction from before) and a reduction in the amount of loss of ink during color changes (70% reduction from before). In addition, a newly developed one piece belt type suction carrying mechanism has been mounted on the carrying conveyor to achieve an extremely high level of printing register accuracy.

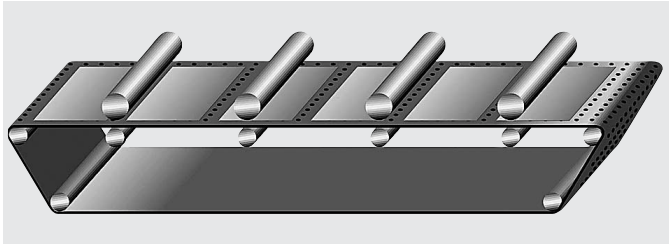

Fig. 2 Conceptual drawing of one piece belt type carrying conveyor

Figure 2 shows a conceptual drawing of the one piece belt type carrying conveyor.

(3) Increase in folding accuracy

An extremely high box accuracy (folding accuracy) is requested for automatic casing machines used in the subsequent process. On the EVOL, a special creasing device capable of coping with boxes made of different types of paper, a multi-stage gauge roller and a folding guide fine adjusting mechanism that effectively correct the formation of the boxes from both the inside and outside of the boxes are mounted to increase folding accuracy to a high level that cannot be achieved in conventional models.

2.4 Increase in workability and maintainability

(1) Adoption of integrated operation panel

A 10-inch large color liquid crystal touch panel is installed at the counter eject section of the machine where an operator is stationed at all times so that the operator can collectively operate the machine from the panel while sheet is threading through the machine.

Figure 3 shows a display of the integrated operation panel.

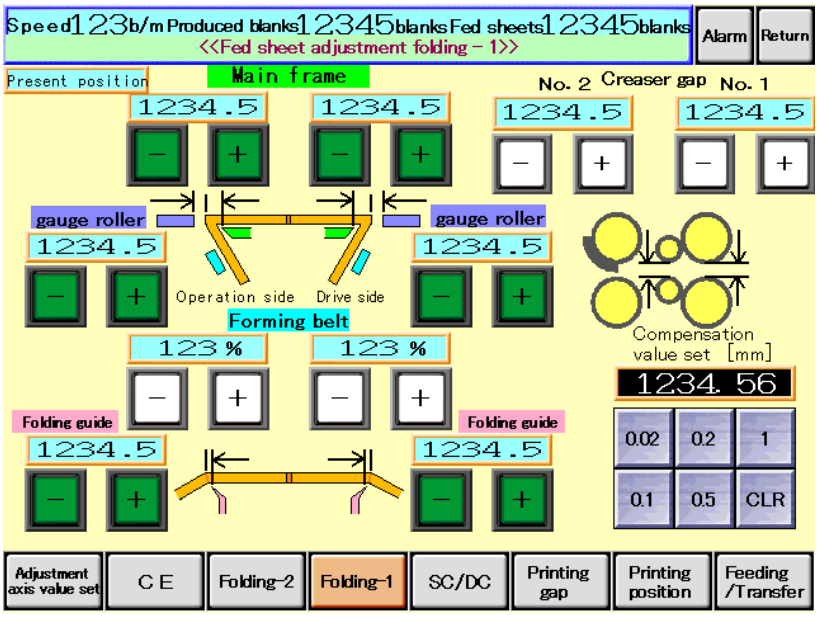

Fig. 3 Display of integrated operation panel

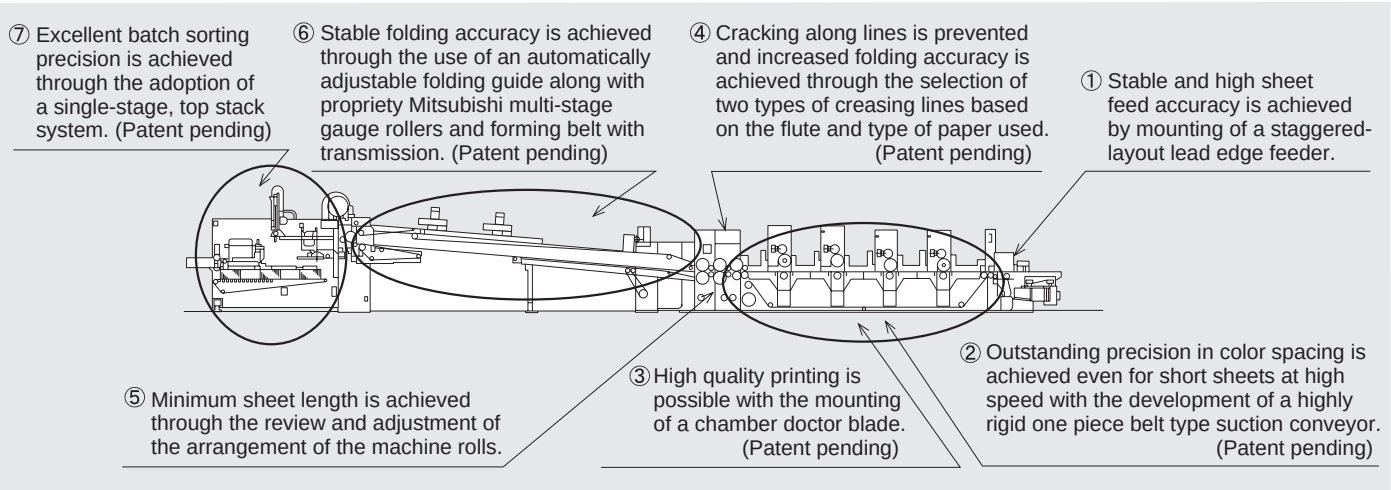

Fig. 4 Main features of the EVOL

(2) Fault diagnostic function

A fault diagnostic function capable of monitoring defective portions of the machine, then displays the results on a CRT screen, suggests measures that can be taken when a problem occurs, and outlines inspection methods, has been mounted to minimize machine down time.

In addition, a history display function capable of retrieving the history of the operations of the machine has also been installed to help significantly increase maintainability and serviceability.

(3) Preventive maintenance function

A preventive maintenance function that automatically notifies the operator of maintenance periods based on the actual operating condition of the machine has been installed so that appropriate maintenance control can be performed.

Figure 4 shows the main features of the EVOL.

3. Conclusion

With its functions and high standards of performance that meet the demanding requirements of customers, the Mitsubishi EVOL has developed a very high reputation after delivery of the first manufactured machine in September 2003. Thus far, orders have been received for twenty-two machines, of which eight are currently operating satisfactorily in Japan.

It is anticipated that serialization of the EVOL system will result in expanded sales of the machine in the future. Marketing efforts have already been undertaken to expand sales of the box making machines overseas, which have fallen off the during past few years. It is expected that positioning the EVOL as a global strategic model fully capable meeting a broad range of market needs will lead to a greater expansion of sales overseas.


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