

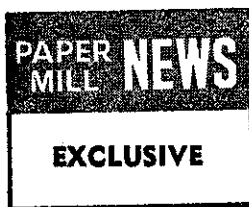
# Basis weight control

How the addition of basis weight measurement enables the user to become a lower cost producer of a higher quality product.



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On-machine scanning basis weight measurement and automatic stock valve control systems are fast becoming almost a standard item on new construction paper machines, rebuilds, and coaters. In addition, of course, a very large number of old existing machines are being modernized through the addition of these systems.

Strangely enough, it is not because of basis weight problems per se that the basis weight systems are being added to the machines. Very few paper machines, today, have basis weight problems even without these beta ray gauge systems. A good conscientious machine crew can produce acceptable paper within commercial tolerances without the use of these systems. Why, then, are progressive managements adding the cost and complexity of automatic basis weight control to their machines? The reason is straightforward if we examine the economics of their usage and ability to permit cost cutting by aggressive mill managements. Essentially, the addition of basis weight measurement and automatic control enables the user to become a lower cost producer of a higher quality product. These economics arise primarily through the ability of the scanning beta

ray gauge system to produce a narrow process spread of basis weight compared to the manual sampling methods. Typical spread reduction are illustrated in the distribution curves in Fig. 1. Narrowing the process spread, as illustrated in Fig. 1, and producing the basis weight within closer tolerance permits a number of direct economies in paper machine operation. The more important of these are enumerated below:

1. Higher Good Production — Improved Throughput—On machines that are dryer limited in capacity, the production of a "flat sheet" across the width of the machine as well as in the machine direction permits a more uniform loading on the dryers through elimination of the excessively heavy areas. Machine speed increases in the range of 1% to 3% are typical.
2. Stock Savings—A good deal of production is sold on an area or ream basis or utilized by the manufacturer on this basis as in bag plants or box production. Users of basis weight control systems in these fields find prime savings in the reduction of stock usage through the elimination of overweight production and running as close to the lower acceptable limit as possible.
3. Better Machine Utilization—The ability to track basis weight continuously and instantaneously permits the crew to reduce weight change and start-up time by factors of 50% to 60%. This area of economics becomes quite significant on machines with frequent weight and grade changes.
4. Some fine paper mills have produced tangible savings simply in the elimination of tear-outs.
5. While difficult to assign direct dollar savings, one of the larger areas of economics frequently found in the usage of basis weight control systems lies in their ability to immediately detect machine failures and to assist in pinpointing their cause and elimination.

Examples of this type of economics are in detection of such phenomena as head box surges, cycling stock pumps, and pressure variation in pressure head boxes, etcetera. Many of these machine failures are cyclical and of such magnitude that they are almost impossible to detect through turn-up sampling. The on-machine basis weight system makes it feasible to catch the horse thief while he's still in the barn rather than locking the door after the horse is long gone.

The addition of these economics on machines results in quite significant dollar totals. Recent studies on a number of relatively small fine writing paper machines from mill records indicated consistent savings of \$30,000 to \$40,000 per year that were directly attributable to on-machine basis weight control systems. A number of large high speed Kraft machines have provided savings of well over \$100,000 per year. Another area of economics not covered

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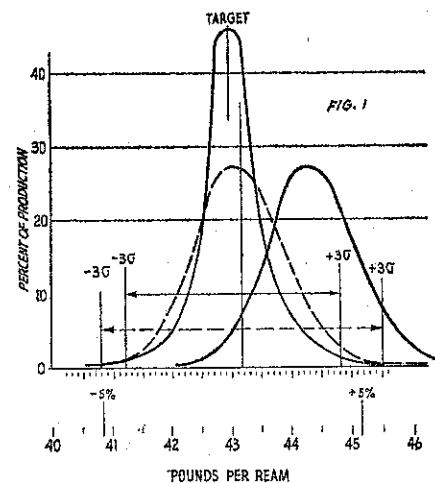


Figure 1

## Basis weight

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above lies in the ability of the basis weight system to make subsequent coating operations easier. This is particularly true with trailing blade coaters where the use of beta ray gauges both on the producing machine and the coater itself has become practically standard.

Including converting operations, approximately 550 beta ray gauge units have been purchased by the paper industry since they first became available in 1949. Successful control of average basis weight, of course, requires the ability to scan the entire width, average this, and feed the signal through an automatic controller to the stock valve. Systems of this type were first installed in late 1953 or early 1954. The modern system, as we know it today, which incorporates XY readout of cross-machine weight was introduced in 1958. Throughout this period, a large number of single point instruments were installed. These systems, of course, while simple in nature, present information only about the strip of paper that runs through their measuring area about three to four inches wide. Their great limitation lies in their inability to distinguish between machine direction changes and cross-machine profile variation.

Automatic control systems linked to these units can trigger a stock valve correction when it may be set properly and a slice correction is indicated to correct profile. Consequently, these systems have been fading from use in favor of the more complete scanning units. Of the total of 550 units purchased by the industry, approximately 320 of them are on-machine as opposed to converting operations, and of this 320, approximately 150 are scanning units. The largest concentration of these systems is located on fine paper, book paper and Kraft machines.

In view of the large economics noted above which produce payouts in short periods, it is interesting to speculate why more of the 1700 machines are not equipped with these systems. I believe it is due in large part to disappointments caused by performance failures of basis weight systems and secondarily, to the failures of some managements to take advantage of the potential economics produced by these systems.

The cure of the first of these reasons has been instituted—the production of high reliability equipment and proper training of mill personnel in maintenance of the systems. Detailed maintenance logs of a number of complex scanning basis weight control systems reveal that up-times of 99% are obtained with good preventive maintenance.

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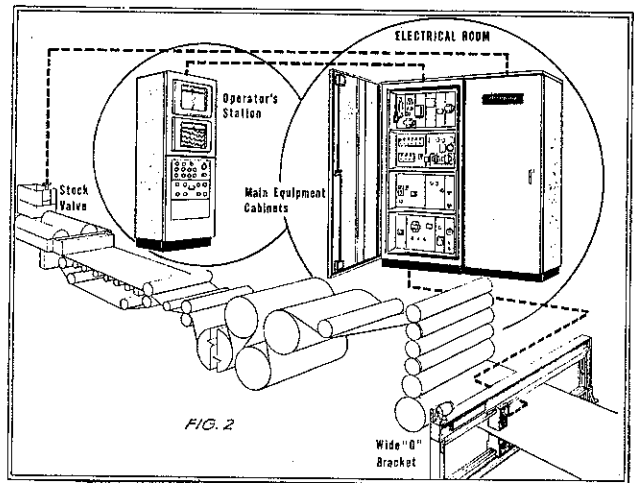
nance. Other installations which do not receive routine preventive maintenance average approximately 97% up-time.

Management's failure to take advantage of the potential economics produced by these systems can be corrected by a better understanding of how the information produced by these systems can be best utilized. A quality control program that integrates data from these systems into a periodic management report will constantly bring to the attention of management personnel those dollar and quality advantages that these systems can provide. It is incumbent upon the supplier to work with management personnel to provide them with a better understanding of the system and work out integrated programs that utilize the important data that such systems make available to the management team. Management must make the important decisions as to new weight targets and machine speeds and follow up their implementation.

A better understanding of the potentialities of such a system can best be started well in advance of the installation. As an example, consideration must be given to the location of the recorders and controls to insure maximum utilization by the machine operators. This is a factor that should be discussed and decisions made by operating as well as management personnel. During these discussions, the importance of the data that will be made available by the system can be brought to light and plans made for its integration into a management report system.

Any single basis weight measurement and control system must be engineered to fulfill the requirements of each particular application or machine. There is no such thing as an "off the shelf" beta gauge. A typical installation will usually consist of a source detector unit, a remote operator's control sta-

FIGURE 2



tion and basic electronic equipment housings.

While these elements do provide for a basis weight measurement, there are other considerations to be examined. As an example, because of the "formation" variations that might occur in the cross sheet as well as in the machine direction, it is important that a scanning system be utilized to show up those profile variations from one side of the machine to the other in order that proper slice screw adjustments can be made to produce a "flat" sheet. This information in itself is not useful for the automatic control of a stock valve or stuff gate, but does provide information necessary for getting a more uniform distribution of stock across the wire. The amount of stuff provided to the wire is dependent upon the average basis weight across the sheet. This dictates the need for a profile average computer to provide an average basis weight across sheet in order to initiate the proper automatic control action. A combination of scanning and average computation provides the machine tender and/or the back tender with the information necessary to give a "flat" sheet with the average basis weight of that sheet being on target.

Another important consideration is the elimination of check samples or other adjustments by the operator. In

a production system, it is necessary that the system incorporate controls that will make it accurate and reliable at all times. This dictates the need for automatic standardization to compensate for accumulation of the foreign material in the air gap which might cause a change in basis weight readings and also to insure that the electronics of the system have not varied due to tube aging, etc. A two point automatic standardization cycle will insure that the system is measuring accurately.

Each installation provides problems of unique mounting that dictates that the supplier have available a number of different types of source detector units to scan narrow to wide sheets and will not crowd existing machine facilities. Another factor that must also be incorporated in the design of the source detector unit is "Free-throw" space to allow the operators room enough to thread the paper at high speeds.

**Chain Belt Company** has consolidated its 10 High Street, Boston, Mass., and 32 Park Street, Springfield, Mass. offices in a new building at 10 Kearney Road Needham Heights 94, Mass., P.O. Box 205. The Chain Belt Co.'s stock carrying warehouse serving New England will now be located in Worcester, Mass.

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