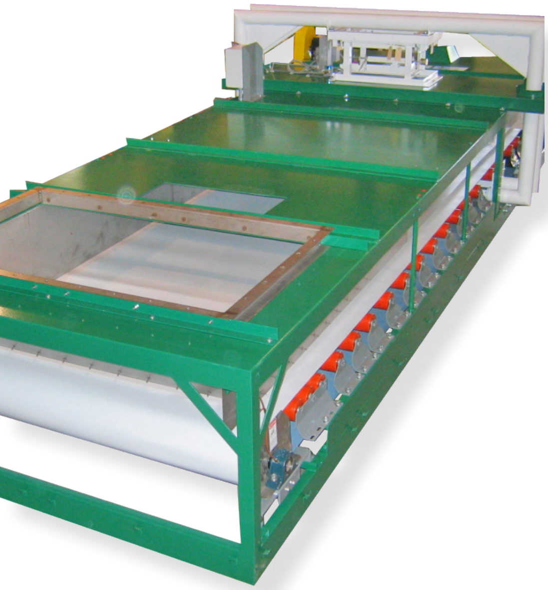
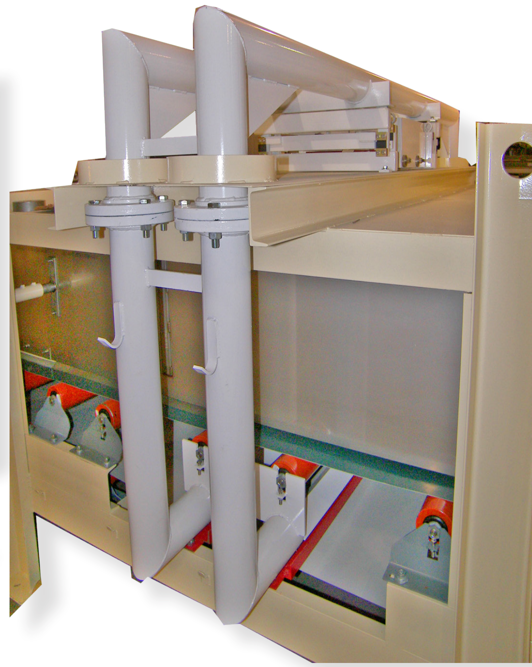
THAYER SCALE

CONTINUOUS WEIGHING & FEEDING OF BULK MATERIALS

FORCE MEASUREMENT FMSS SUSPENSION SYSTEM

THAYER MODEL M-LD LIGHT LOADING/LIGHT DENSITY WEIGH BELT





MODEL M-LD

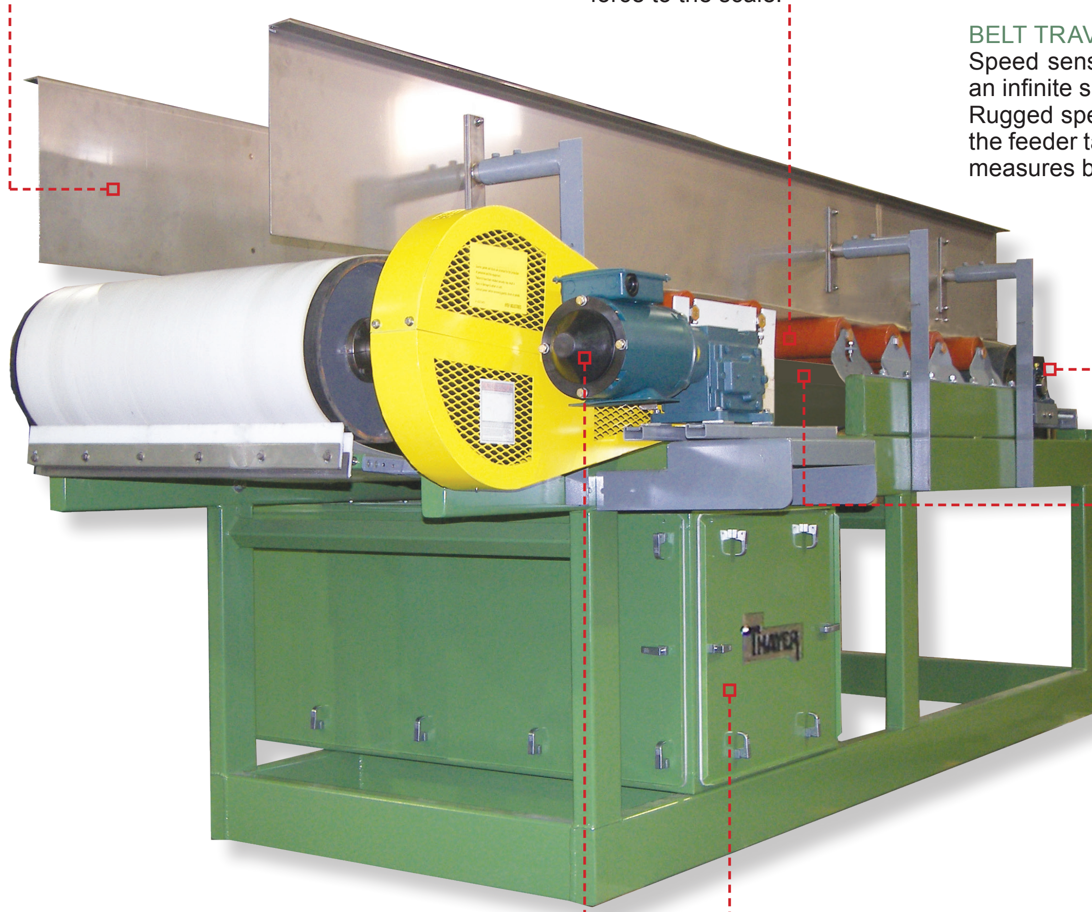
The Worlds Most Accurate Light Loading/Low Density Weigh Belts

Thayer Scale's Heavy Industry Model "M-LD" Low Density Feeder line has been specifically designed for weighing bulk materials having densities under 10 lb/ft^3. Without question, Thayer Scale has more experience than any other manufacturer in weighing low density materials. With an outstanding performance record in over 1,000 installations, the THAYER Model "M-LD" Low Density Weigh Belt Feeder represents the standard to which all others are compared. Many of these feeders have been in operation for more than 35 years with the only modifications being instrumentation upgrades to better suit the interconnection needs of modern-day automation schemes, or re-rating of either the load or speed sensing range to accommodate line capacity changes.

FULL LENGTH ADJUSTABLE SKIRT BOARDS:
Installation of skirt boards along the entire length of the conveyor totally confines the material flow channel which helps control dust. Skirt boards are tapered and flared from the inlet to the discharge to prevent pinching of material between the skirt and the belt.

PRECISION HEAVY-DUTY IDLERS:
Precision scale idlers are mounted on individual CEMA brackets, permitting removal to either side without major framework disassembly or belt removal. Idler alignment is critical to minimize transmission of any belt tension force to the scale.

BELT TRAVEL PULSER:
Speed sensing is digital and accurate over an infinite speed range.
Rugged speed sensor is coupled directly to the feeder tail pulley not the drive pulley and measures belt speed and belt travel.

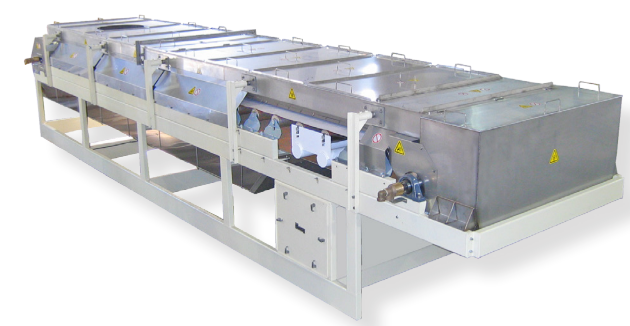


SLACK BELT DESIGN:
Low belt tension increases belt life, produces more stable measurement and eliminates the need for belt tracking devices.

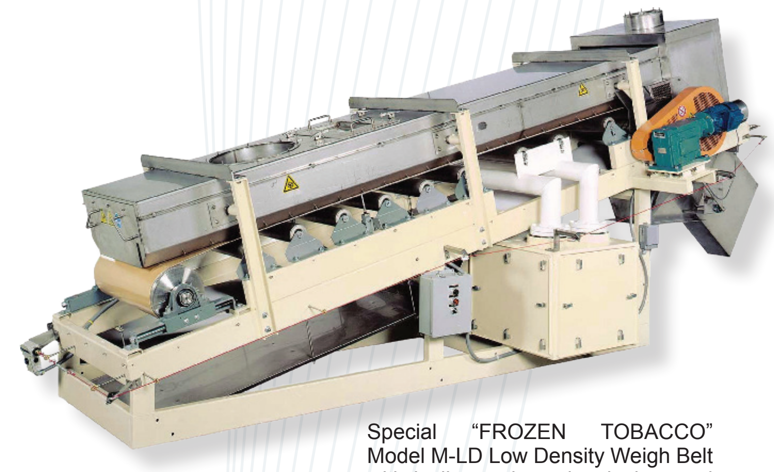
DRIVE SYSTEM:
Horse power requirement calculations are performed by computer. Also computerized is the selection of shafts, drive chain, gear box and motor. Head and tail pulley are selected in accordance with CEMA standards, with lagging as required.

SCALE LOCATED OUTSIDE THE MATERIAL HANDLING AREA:
Thayer's scale is not mounted between the strands of the belt, but in a location outside of the material handling area such that an idler supporting the belt (the weigh idler) transmits the load to the scale. This design has several benefits. The scale is not prone to damage, is out of the way for cleaning, and is not subject to tare build-up that would change the weight, causing incorrect calibration. Thayer's scales can take high load direct overloads that are caused by operating personnel or by the occasional particle pinching that can occur between the conveyor and the side skirt.

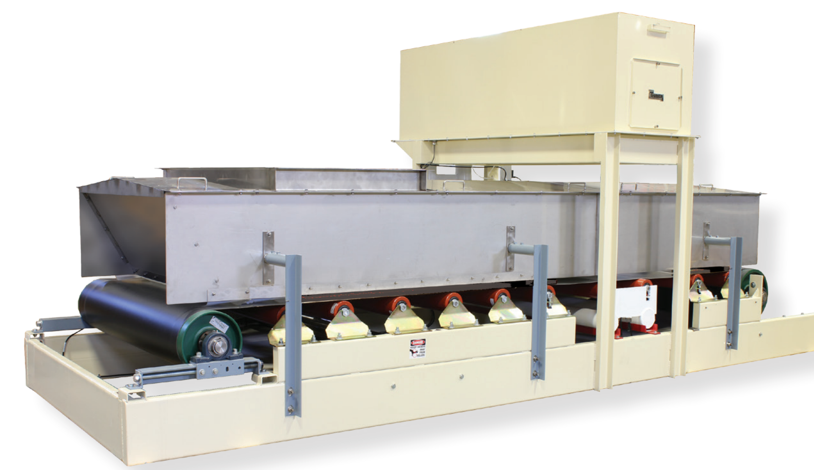
THAYER Model M-LD Low Density Weigh Belts



Model M Low Density, enclosed material flow channel, scale under.



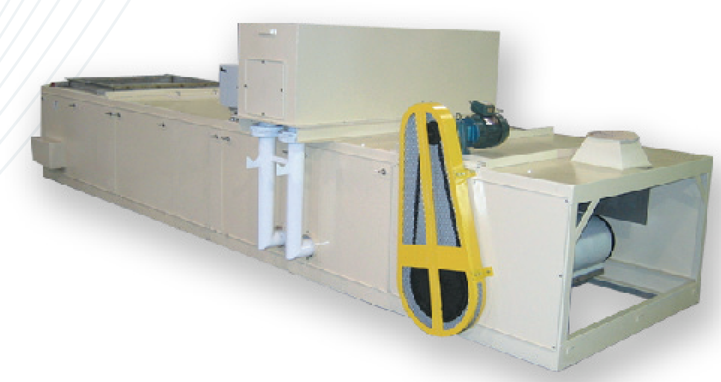
Special "FROZEN TOBACCO" Model M-LD Low Density Weigh Belt with incline, cale under design, and enclosed and insulated material flow channel.



Model M Low Density, enclosed material flow channel, scale over design.

Model M Low Density, open material flow channel, scale under design, sanitary all stainless steel construction

Model M Low Density, enclosed material flow channel, scale under design.

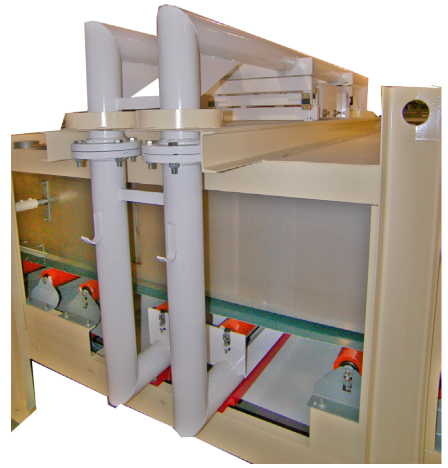


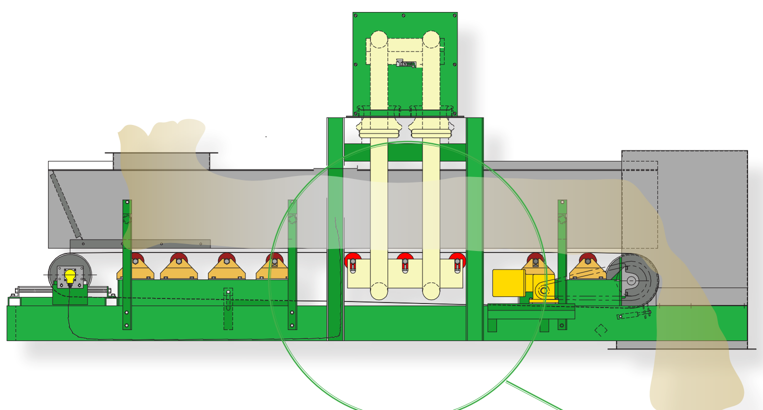
Model M Low Density, fully enclosed with removable access panels, scale over design.

Low-density weighing requires considerable attention to design details that influence the accuracy and stability of the specific belt-loading measurement ("pounds per linear foot"), which is dependent on the interaction of various conveyor operating factors and alignments throughout the weighing region of the conveyor. Also, many low-density materials contain elements (strands, irregular chips, and lumps) that cause the material stream to develop significant "beam" strength on its own. The higher the bed depth, the larger this effect. To minimize the adverse effects of material beam strength, idlers should be mounted closer together and consideration should be given to increasing both the settling span and the weigh span.

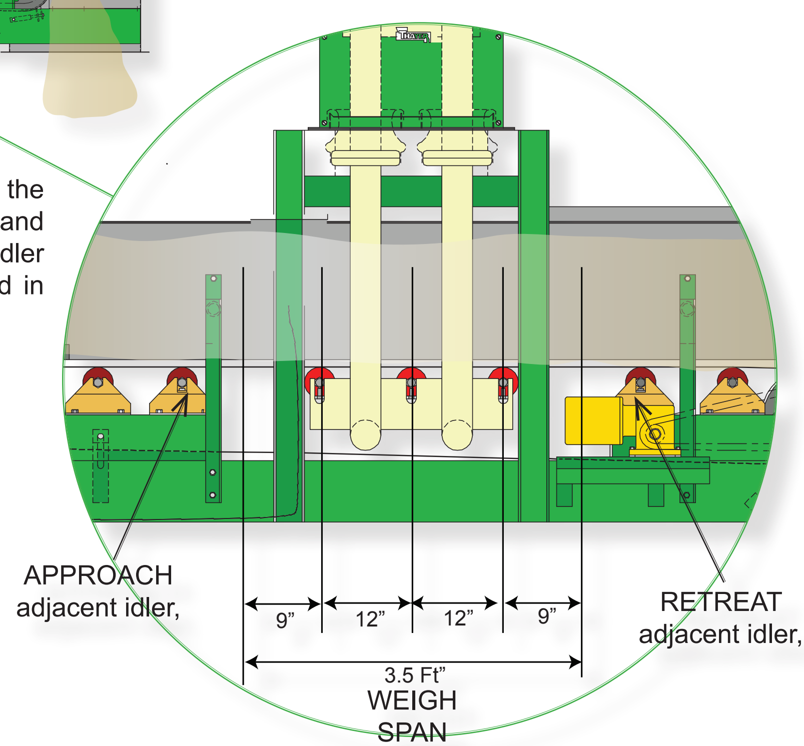
A simplified math model: **$P = nQL + 2Td/L + 24EId/L^3$** (neglecting material beam effects)

P= (material load) + (Tension/misalignment) + (Belt "beam' effect)
P= Forced sensed in pounds
n= number of weigh idlers
Q= pounds per inch belt loading
L=approach and retreat idler spacing (inches)
T=belt tension at weigh idler (pounds)
E=Modulus of elasticity of belting (p.s.i.)
I=moment of inertia of belt cross-section (inches^4)
d=misalignment between scale idlers and adjacent idlers (inches)





Weigh Span
The weigh span begins 1/2 the distance from the approach and adjacent idler to the first weigh and continues to 1/2 the distance from the last weigh idler to the retread adjacent idler, normally measured in decimal feet.



An important rule of "low-density" belt weighing is to maximize "scale" loading, minimize belt tension, minimize belt "beam" stiffness and eliminate as much idler misalignment as possible. Because of the need to address all four of these objectives when dealing with low-density applications, the well-engineered Low Density feeder will look substantially different than the more conventional designs typically used in moderate to high-density applications (i.e. cement industry feeder). A conventional feeder capable of weighing heavier products (typically 50 lb/ft³ and above) to an accuracy of ½% under limited weekly calibration attention, is likely to achieve no better than 3-4% accuracy when weighing material having a density of 5 lb/ft³.

Please keep in mind that Thayer Scale also manufactures a Heavy Industry Cement style Weigh Belts, however it uses many of the same design concepts found in the Low Density "M".

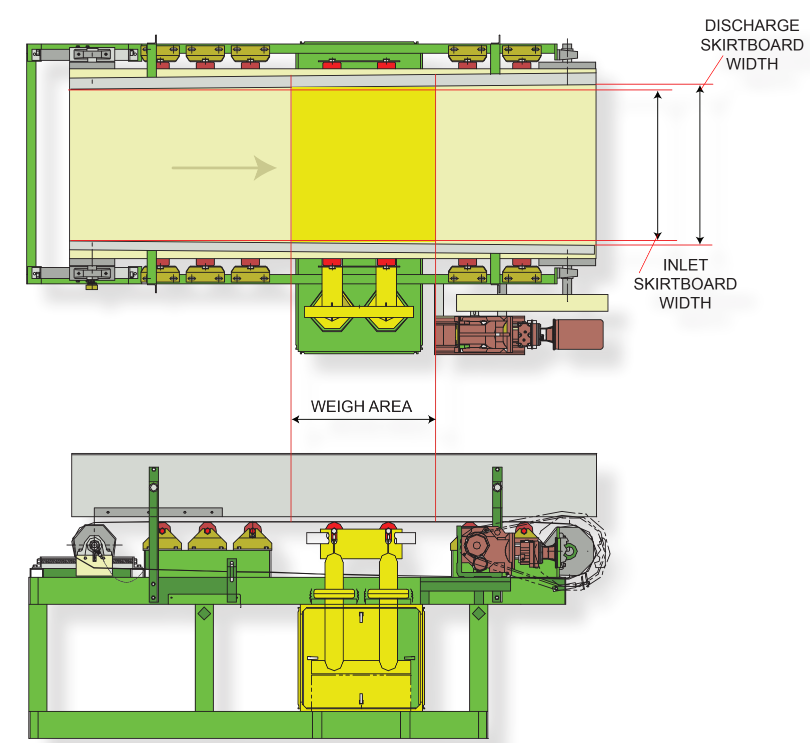
MACHINE ELEMENTS	Cement Style Feeder	THAYER LOW DENSITY FEEDERS
Type of "scale System	Direct Load Cell Support	"FMSS" Technology
Number of weigh idlers	1	2 or more
Idler deflection under load	0.010 inches	0.0005 inches
Load Cell Utilization %	20%	95%
Material Confinement Means	High side wall belt	Flat belt with high skirts
Idler Spacing	18-24 inches	12"
Idler Classification	CEMA	CEMA-Special LOW TORQUE
Individual idlers easily replaced or serviced	Usually not. Requires material clean off and lifting of belt.	Yes. All idlers individually supported on vertical stand offs.
Belt tracking aid	Belt edge guide rollers	Full-width tracking bar or active steering roll set.
Belt loading cross section	Pyramid (shear-shaped)	Rectangular (natural)
Typical infeed arrangement	Hopper w/ shear profile gate	Gravity fed Metering Tube or prefeeder conveyor
Expected "K-Factor" range	± 4.0%	±1.5%
** 20% of K-Factor range represents the expected variation in calibration results over time. 100% of K-Factor represents the possible operating error if no material testing and K-Factoring is done.		

Addressing the problems in sequential order leads to a preferred design:

First we start under the premise that a relatively thin and flexible flat belt running under the lowest possible tension is the most desirable starting point. In order to operate a conveyor while meeting these objectives, most everything else will fall into place.

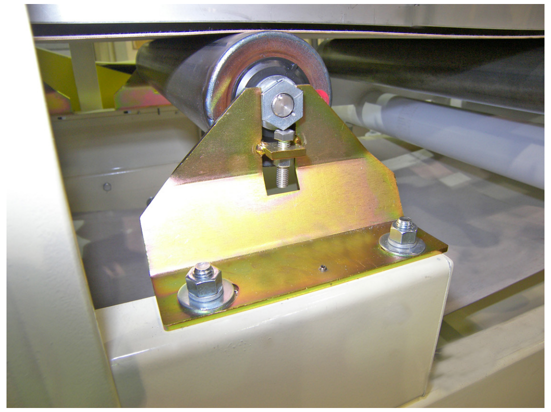
The use of a flat belt and the desire to maximize loading, dictates the use of high skirtboards. (As with all weigh-belt feeders, the gap between belt and the bottom of each skirt and the space between the skirts themselves will increase in the direction of flow.)

Because the chosen belting is to operate under the lowest possible tension and has virtually no "beam" strength, the idlers that support the belt must be grouped close together so the possibility of belt sag between the idlers and the resulting "pinching" of product against the belt would not cause erroneous weight measurement. Also, by eliminating sag, the torque required at the drive shaft to convey the material is lowered resulting in even lower belt tension.



Because the belt will operate in a near-slack state, the crowning or tapering of the head pulley will have less effect on tracking the belt. Since the belt is very light and thin, it cannot be effectively guided using vertical edge-guide rolls. Besides these would accelerate the failure of such a belt. Thus a special full-width tracking bar on the return side of the belt is incorporated. As an alternative in some designs, an active steering idler is positioned on the return strand.

To further reduce tension requirement, the flat idlers will be selected to have lower torque requirements than standard CEMA idlers. It is important that the idlers turn under no load so that calibration of zero can be accomplished to the highest degree possible. Occasionally these idlers will need servicing to assure that they will turn under no load. It is, therefore, important the individual idlers can be visually inspected when operating and that they can be individually removed and replaced without having to dismantle other conveyor parts. Also, if idlers need to be removed or replaced in the weighing vicinity, some means needs to be provided to accurately and precisely adjust their vertical alignments. Note the individual idler support brackets with built-in jack screws.

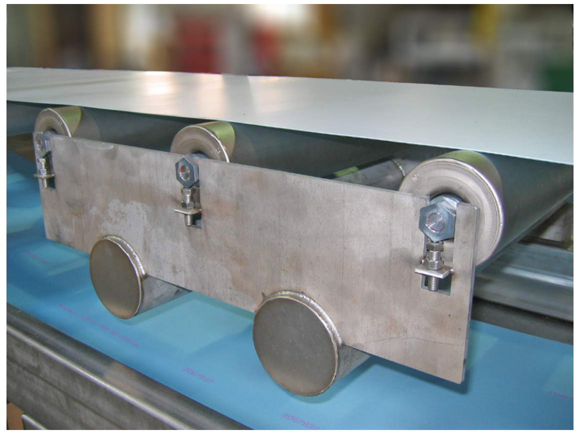


When loading material onto a low-density weigher, it is important that no additional “profiling” (cross section “shaping”) be attempted since the additional shearing forces builds up tension in the belt. This is why it is important to use a metering tube in feed design or charge the weigh belt with a prefeeder of some sort.

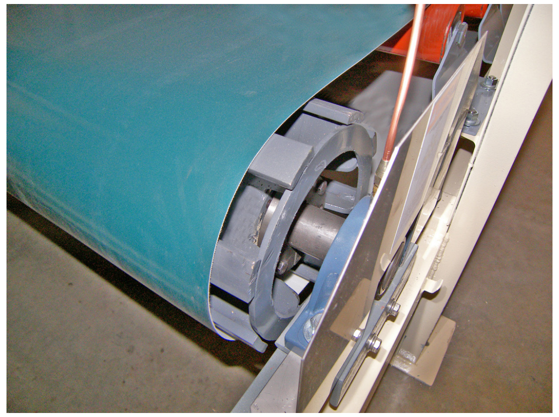
Weigh Span
The weigh span of the scale system should be as long as possible to increase the amount of material being weighed, thus reducing the significance of the belt effect errors that occur in the regions of the approach and retreat idler gaps. Also, special attention should be made to the deflection characteristics of the weighbridge used since it is highly desirable that both the zero-calibration runs and the test-load runs operate under identical alignment conditions. As can be seen from the simplified math model, it is particularly important to weigh a group of idlers rather that a single idler when the conveyor idlers are intentionally closely grouped, as they are here, to reduce belt sag and its effects on weighing accuracy.

Thayer’s “FMSS” technology (Force Measurement Suspension System) permits full mass counterbalancing of tare loads, immunity to undesirable off-center and side-loading effects and ultra-low platform deflection (0.0005 in.). These designs make it easy to incorporate an automatic test weight placement device to further automate the calibration auditing process.

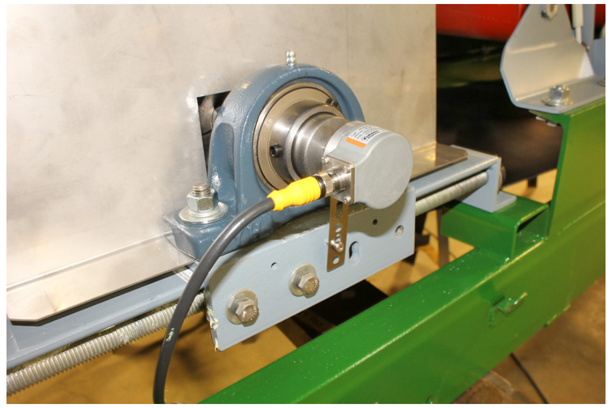
Of particular significance in low-density applications is the structural integrity of the entire conveyor structure including the extending throughout the weighbridge itself. Special attention to low-deflecting support structures is a key point in the design. The mass counterbalancing provided permits the use of a heavier and more rigid weighbridge while assuring full utilization of the load sensor.



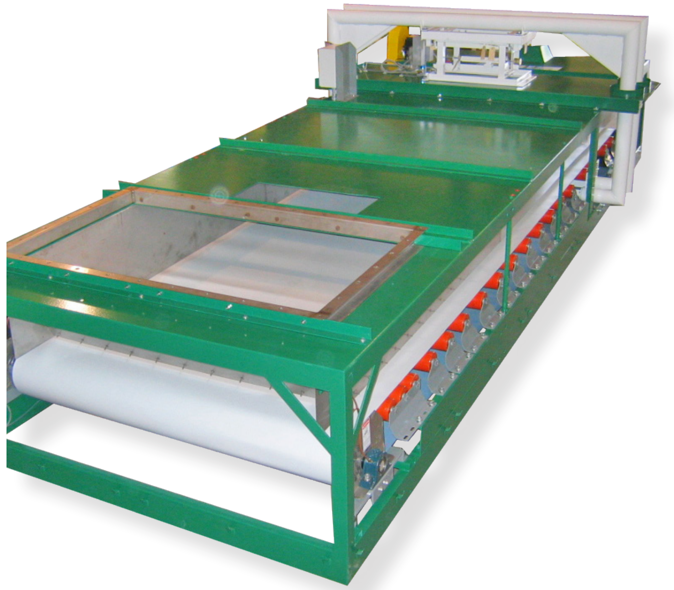
Head Pulley Drive and Wing Tail Pulley
Unlike conventional weigh belt feeders Thayer’s Model M utilizes a combination of a driven head pulley and an idling/self-scavenging winged tail pulley. This arrangement allows the belt tension to operate at the actual (lower) demand levels required for continuous operation, and only provide the additional “break-away” tension when it is encountered at start-up with a full bed of material. Most importantly, the combination of head pulley drive and a self-scavenging tail pulley eliminates the need to pre-center the belt and thoroughly clean its top surface before encountering the drive pulley. This also eliminates the need for the additional and troublesome appendages such as belt tensioners, tracking devices and internal belt cleaning devices.

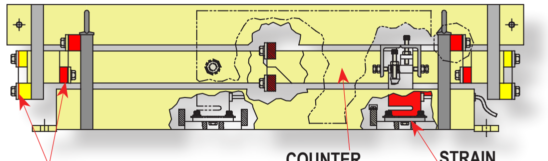


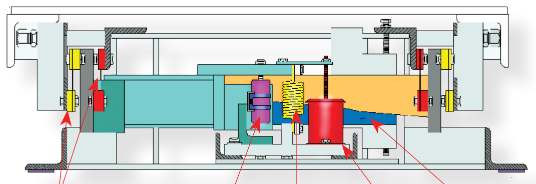
Belt Travel Pulser
Belt speed sensing is accomplished through a digital pulser (that is directly coupled to tail pulley) measures speed at the idling pulley. This design measures the true speed of the belt via rotation of the idling pulley, not an inferred belt speed based on motor speed. The advantages of this design are that speed is measured accurately over the entire range of operation and belt slippage or breakages are immediately detected because the idling pulley is not rotating.

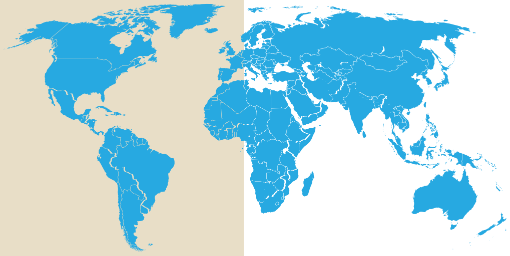


THAYER FLEXURE PLATE SUSPENSION SCALE
Thayer’s Flexure-Plate Suspension system utilizes a series of steel flexure plates to transmit gravimetric loads vertically from the load receiving element through levers to the specifically selected controls. The combination of mass counterbalancing against tare loads, frictionless flexure-mounted levers and a high resolution transducer produces a force measuring system beyond compare. Of significance is the fact that infinite weighments may be made without maintenance or calibration, regardless of atmospheric or factory conditions. In many instances, THAYER Flexure Plate Suspension Systems placed in operation in 1950 are still working without maintenance or adjustment. Two scale designs are available, either LVDT or Strain Gauge.









MADE IN USA

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