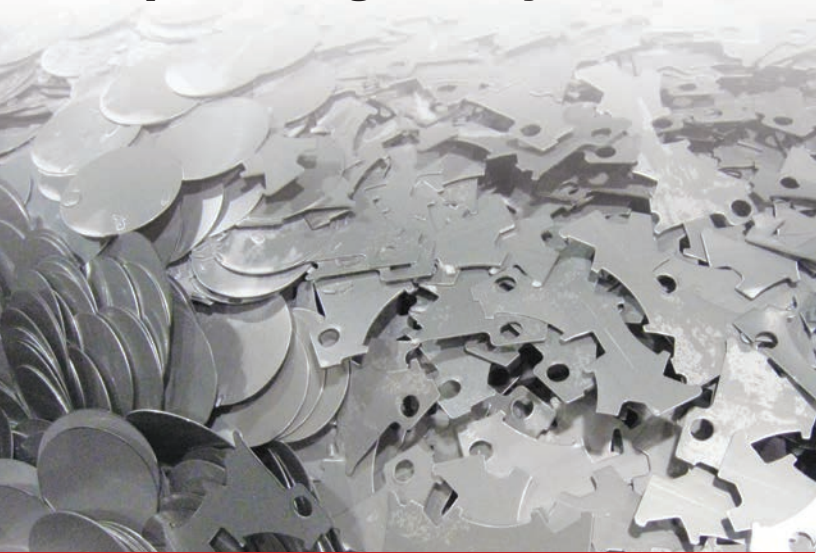


**PRAB**

# **The Selection of Metal Scrap Handling Conveyors**



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## **Introduction**

When choosing any conveyor, whether it is a single unit or a complex system, there are always several basic goals to be achieved. Among the goals are:

1. An effective solution to the specific conveying need.
2. The greatest economy commensurate with reliable operation.
3. Low operating cost and minimum maintenance.
4. Flexibility to meet future needs.

The first step toward fulfilling these goals is to clearly identify the need factors and relate them to the particular advantages or disadvantages of the many types of conveyors available.

The purpose of this handbook is to help you do just that. In it, you will find a basic selection chart and a brief description of all the available metal scrap handling conveyors along with an overview of several scrap handling systems. There is no attempt to provide an exhaustive treatise on the subject of metal scrap conveyors or conveyor systems because the subject is too broad. Individual situations almost always involve unique characteristics so that judgment, based on experience, usually plays an important role.

## Section I

# Metal Scrap

## Conveyor Selection Chart

The accompanying chart relates various types of ferrous and non-ferrous metal scrap to the metal scrap handling conveyors available. It primarily indicates the suitability or unsuitability of a particular conveyor to the materials and conditions noted.

You will find, among the more than one hundred situations covered, that more than one type of conveyor can be used in most cases. In practice, when the solution to your need involves more than a short conveyor run, two or more conveyors used in combination often provide the best result.

Section II and Section III provide details of material and equipment characteristics which stand behind the judgments illustrated in the chart.

SCRAP	COOLANT VOLUME	STRAIGHT-LINE PRIMARILY HORIZONTAL				COMB. STRAIGHT & INCLINE				MULTI DIRECTION PATH				VERT. PATH		
		OSCILLATOR	SCREW	HARPOON	TROUGH BELT	HINGE BELT	COMPACTOR	DRAG	SCRAPER	MAGNETIC	GRAB	TUBULAR/EN-MASSE	PNEUMATIC	HYDRAULIC	DUMPER/LIFTER	BUCKET ELEVATOR
Die Casting	—	X				X			X						X	
Bushy Steel	Low			X		X	X		X		X				X	
	High			X		X	X		X						X	
Broken Steel 3" Max.	Low	X	X	X	X	X	X	X	X	X		X	X	X	X	X
	High			X		X	X	X	X	X		X		X	X	
Bushy Aluminum	Low			X		X	X		X		X				X	
	High			X		X	X		X						X	
Broken Aluminum	Low	X	X	X	X	X	X	X	X			X	X	X	X	X
	High			X		X	X	X	X			X		X	X	
Bushy Brass	Low			X		X	X		X		X				X	
	High			X		X	X		X						X	
Fine Brass	Low	X	X	X	X		X	X	X			X	X	X	X	X
	High			X			X	X	X			X		X	X	
Cast Iron	Low	X	X	X	X		X	X	X	X		X		X	X	X
	High			X			X	X	X	X		X		X	X	
Stampings	Dry	X			X	X			X	X	X				X	
	Sticky	X				X			X	X	X				X	

## Section II

### Types of Metal Scrap

The efficient collection and disposal of scrap is a matter of growing importance to the profitability of all high production metal working plants. Labor savings, scrap value, energy consumption, oil conservation, workers' safety and water pollution are all factors that will be affected, for better or worse, by the layout and design of the scrap handling system.

As the conveyor selection chart indicates, there may be more than one good solution to any scrap handling requirement. The best solution will be the one which avoids the greatest number of potential problems. All scrap conveyor types have been developed to handle specific problems, but unfortunately they are commonly misapplied when chosen on the basis of minimum cost and inexperience. Failure to study the type of scrap to be moved is a prominent cause of misapplication. Scrap is normally not a homogenous material with reliable characteristics. The worst possible combinations of coolant flow or lack of it, fine and coarse materials, and large and small foreign matter must be taken into consideration before final product selections are made.

Unless the scrap drops directly from the production machine into the conveyor, the conveyability of the scrap may be changed by crowding or packing it into containers. If something bad can happen, it will happen, and suitable provision to handle it in the conveyors is a must.

## Characteristics of Various Types of Metal Scrap

### Bushy Steel Scrap

*(Machine Shop Turnings & Borings)*

This scrap will include some fine particles but mostly consists of spirals of various lengths and cross sections generated by turning and boring. A typical machine department will generate spirals ranging from very fine hair-like pieces up to heavy brittle helixes. Unless this material is conveyed away from the machine as generated, it develops into large wads, bundles, or "Brillo" pads in containers. Cutting lubricants and coolants will commonly make up a considerable amount of the weight of this material -up to 30%. Bulk density ranges from 5 to 20 pounds per cubic foot.

### Broken Steel Chips

*(Shoveling Chips)*

Bushy chips which have been passed through a continuous crusher will usually be classified as shoveling chips with a particle size no more than 2 or 3" in the major dimension. Milling machines, broaches, or lathes fitted with chip breakers can also generate this type of scrap. Due to the irregular nature and large surface area, a great deal of coolant or lubricant can be included. Bulk density ranges from 20 to 100 pounds per cubic foot.

### Bushy Aluminum Chips

Generated in the same manner as bushy steel chips, this material is very light and fluffy with an extreme tendency to tangle on itself. Density range can be as low as 2 pounds per foot up to 10 pounds per cubic foot.

## **Broken Aluminum Chips**

Generated in the same way as steel shoveling chips, this material is not necessarily any higher in density than the bushy chips. Cornflake type particles are extremely difficult to move by gravity.

## **Bushy Brass Scrap**

Generated by the same methods as bushy steel and aluminum, it is generally more brittle and more easily reduced to fine particles by crushing. Density range 5 to 20 pounds per cubic foot.

## **Fine Brass Scrap**

Many brass machining operations generate fine particles and dust. This material is very sticky, especially after lubricants have been removed. Bulk density 50 to 100 pounds per cubic foot.

## **Cast Iron Scrap**

Machining operations generate particles of various sizes ranging from a maximum of around 1/8" down to fine dust. A considerable amount of coolant - generally water soluble - can be carried. Bulk density ranges from 60 to 100 pounds per cubic foot.

## **Stamping Scrap**

Particle size can range from very small discs which are generated by perforating operations up to fairly large heavy gauge irregular pieces which are the result of trimming automotive parts. Electric motor lamination scrap is a particularly difficult material due to the thin gauges and tiny scrap particles. Lubricant content ranges from very small amounts on stamping operations to very large amounts used on deep draw forming operations. Bulk density from 50 to 150 pounds per cubic foot.

## **Die Casting Scrap**

This material consists of sprues, gates, risers, etc. trimmed from die castings after they are removed from the die casting machine. It also includes scrap parts. A small amount of die lubricant will usually adhere to the material, although not in sufficient quantities to severely limit remelt operations. Particle size may range from small chunks to long awkward pieces of irregular shape. Due to sharp edges, thin projections, and irregular shapes, die casting scrap has a tendency to catch on conveyors and tangle. This applies to aluminum, zinc, brass and magnesium scrap.

## Section III

### Types of Metal Scrap Handling Conveyors

The following paragraphs provide a resume of the different scrap handling conveyors, pointing out their capabilities, their strengths and weaknesses. It is important to remember that most of these units are manufactured in a great range of sizes and operating capacities. As with most mechanical equipment, they also have optimum performance characteristics within their total range; characteristics which are dependent on the type of scrap being handled.

In this context, we would like to point out that only PRAB, Inc. makes all of the basic conveyor types shown and can, therefore, offer broad practical experience in the use of each type along with the freedom to make recommendations related to your particular application.



#### Scrapveyor

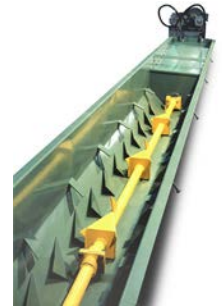
The most universal metal scrap conveyor, it handles curly turnings, tangled bundles, large or small stamping scrap - including motor laminations - die castings or die casting scrap or any combination of these materials whether they are wet, dry or flooded with coolant. Basically a single-chain drag conveyor, its flights are hinged to ride over jams, skimming part of the material. Successive flights reduce the jam and gradually eliminate it. For short or long runs, straight or inclines up to 45°.

### Harpoon Conveyor

A liquid tight trough is fitted with barbs to prevent backward movement of material, a track or wear plate to support the moving harpoon, a harpoon assembly is fitted with equally spaced pusher devices, and an actuating device - usually a long stroke hydraulic cylinder - provides a reciprocating slow speed movement of approximately five feet in each direction.

This type of conveyor is usually mounted in or below the floor and covered by a series of floor plates except at input points. It is suitable for horizontal movements only and can be made in extremely long lengths with a single drive - upwards of 500 feet. Common sizes range from 12 x 12 up to 36 x 36 depending on capacity required. It can be installed on a grade either with or against the flow of material to provide coolant drainage. Where coolant flow is extremely high, side baffles can be provided to protect against possible flooding of coolant onto the factory floor, or starving the coolant return system.

This type of conveyor is especially well suited to handling bushy turnings and mixtures of fine and bushy chips. It can be fitted with pressure relief valves, timers, etc. which signal jam-ups which might be caused by bar ends or foreign material preventing damage to the conveyor itself. This type of conveyor is low in cost and has extremely low maintenance and operating costs.



## Drag Conveyor

The usual form of drag conveyor consists of a rectangular trough 18" or more in width fitted with wear bars and support angles to accommodate parallel strands of chain in the upper and lower corners of the trough. Drag plates or flights are flexibly attached to the chains at a spacing commonly ranging from 12 to 24" depending on the application. Drive is through a headshaft fitted with suitable sprockets and driven at a very low speed - usually to provide a flight speed of around 10 feet per minute. This type of conveyor is well suited to handling finely divided materials with or without coolant flow in either direction. It is also capable of conveying on an incline, commonly less than 45°. Material is carried on the bottom run of chain. The return portion of the chain runs back over the top of the carrying area. For this reason any material that clings to the chain or flights is automatically recirculated and given another chance to discharge. Thus the drag conveyor compares with other "single path" conveyors in that carry-over problems are minimized. Maintenance on this type of conveyor is easy, since all components are visible when the cover plate is removed.

Multiple discharge points are easily provided on drag conveyors, since the carry-run is on the bottom side and simple discharge gates are easily incorporated in the design.



## Tubular Conveyors

*(En-Masse or Tubular Drag)*

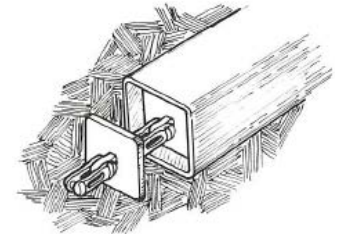
Similar in function to the double chain drag conveyor, the tubular conveyor is designed with a single strand of chain, usually of the universal jointed type. This construction permits changes in direction along both horizontal and vertical planes. Extra fluid capacity can be obtained by proper sizing of the conveyor casing.

Tubular conveyors have several major application advantages. First of all, a single conveyor with a single drive can serve several different locations and alignments. Because the movement of the chain is in a loop configuration, it is possible to use all of the conveyor effectively rather than only one half of it as is the case in "over and under" conveyor types such as belt conveyors and double chain drag conveyors.

Providing the material to be conveyed is reasonably dense, a high capacity conveyor can be installed in a relatively small and easily accessible trench. Narrow floor plates can be used to cover the trench, giving convenient access to the conveyor at any point on its length.

An elevating section can usually be provided as part of the collection conveyor, and this feature incidentally provides easy access to the drive.

This type of conveyor should not be used for masses of curly stringy turnings.





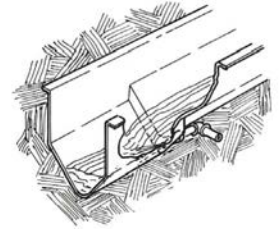
## Oscillating Conveyors

A horizontal trough of any desired shape is reciprocated at a small angle to the horizontal with a frequency ranging from 400 to 600 cycles per minute. This action provides steady movement of material at speeds in the range of 15 feet per minute, plus or minus, depending on the nature of the material being conveyed. Ample capacity within a relatively small space is provided by suitable proportioning of the trough. Sticky fluid may impede material movement, since flow is not positive. This type of conveyor is very low in first cost and has very low maintenance cost due to the small number of moving parts. Oscillating conveyors must be solidly anchored to the floor, otherwise material flow is reduced and progressive destruction of the conveyor and its mountings will occur. Only horizontal or downward sloping material movement should be planned with oscillating conveyors.



## Hydraulic/Sluice Conveyors

Crushed scrap can be conveyed along sluicing trenches providing ample coolant is available and the trenches are carefully planned to avoid hang-up points. Velocity nozzles are arranged at strategic points along the trench to maintain material flow. This type of conveyor is very simple and maintenance free. However, it is only feasible in connection with large amounts of coolant and a considerable energy output is required in order to keep the material moving.



## Screw Conveyor

Heavy duty screw conveyors, operating at relatively low speeds, have proven to be very effective in the straight-line conveying of crushed or flowable metal scrap. It should be emphasized that light duty agricultural type screw conveyors cannot be used in this application. Moderate upward slopes can be negotiated. This conveyor is particularly well suited for multiple discharge or continuous distribution.



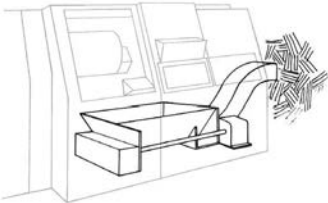
## Hinge Belt Conveyor

More versatile than any other type of metal scrap conveyor, the hinged belt conveyor can be used to handle any type of metal scrap from bushy material to fines, wet or dry, in any volume, and in a wide variety of conveyor paths. It is capable of combining horizontal and elevating movements. Counterbalancing these benefits is the fact that the hinge belt conveyor has a great many moving parts and a tendency to jam up and self-destruct unless it is very carefully applied. It serves best as an elevating conveyor on wet or dry materials that do not contain a large percentage of fines.



## Compacveyor

Compresses turnings, recovers oil, elevates scrap to conveyor or tote-bin and discharges either right, left or straight ahead. Increases production by eliminating clean-out time and has a superior ability to handle both fines and stringy bundles.



## Magnetic Conveyor

A magnetic chip conveyor has a sealed frame with a stainless steel top surface which is a fixed part of the frame.

There are no external moving parts except for the headshaft and sprocket. The magnet assemblies, moving inside the frame below the stainless steel carrying surface, attract the particles of metal and move them toward the discharge area.

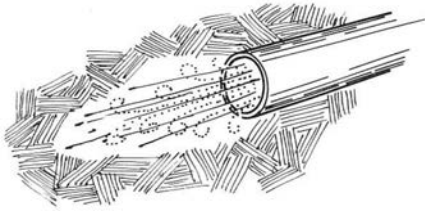
This type of conveyor is particularly suitable for applications involving very small particles, metallic sludges, or submersion in coolant tanks. Since very fine particles can be handled, action of the conveyor has a filtering effect on the coolant.

Sheet metal scrap in particular may contain very fine pieces with sharp corners which tend to hang up in the moving parts and cracks to be found on hinge belt conveyors. Although much costlier than a hinge belt conveyor, the magnetic conveyor may be less expensive in the long run when such fine particles predominate.



## Pneumatic Conveyors

Crushed steel, crushed aluminum, brass, cast iron, etc. can be conveyed successfully in high velocity pneumatic conveyors. Pressure type conveyors are ordinarily used to move fairly large volumes of chips over long distances. For example, crushed and dried chips conveyed from the chip house to overhead railroad storage hoppers. Specially reinforced elbows are a must due to the abrasive action. This equipment is very cost effective on long runs at high capacities.



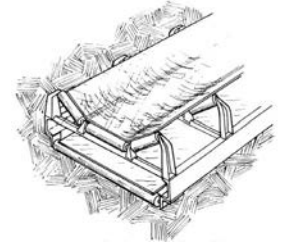
## Hydraulic Grab

Originally developed for log handling, these units have been used successfully in loading tangled material into crushers. Also used for loading sheet metal scrap into rail cars. Powered by a self contained electric-motor-driven hydraulic power unit, these grabs are relatively inexpensive and very rugged. Individual operators are required.



## Troughing Belt

Most kinds of metal scrap can be handled successfully on heavy duty high speed troughing belt conveyors. They are suitable for long runs and gradual elevations not exceeding 20°. Normal applications are outdoors, because this type of conveyor has a tendency to spill material and a certain amount of carry-over has to be expected due to sharp particles sticking to the relatively soft belt surface. Not suitable for impact of heavy objects or large bundles of tangled turnings.



## Dumper/Lifter

Commonly employed to elevate tote bins of metal scrap for dumping into a processing operation such as crushing or wringing. Low in cost, requires little floor space. Effective use requires a standardized type and size of tote bin.

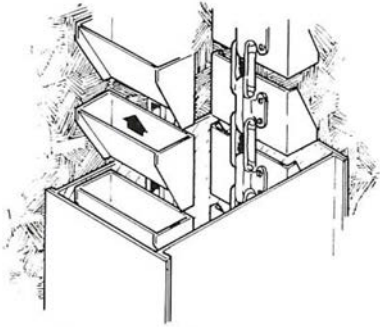


## Bucket Elevator

When vertical movement of material is a requirement of a system layout, a heavy duty chain type bucket elevator can be used. A single or double strand of high strength chain is fitted with closely spaced hardened steel buckets.

Material to be conveyed is received in the boot section, and the buckets literally dig the material out of the boot section, then elevate and discharge with a centrifugal action.

High chain speeds are possible in this type of conveyor resulting in high capacity for the amount of cost involved. However, it should be emphasized that light duty agricultural type bucket elevators cannot be used for this application. Further, if material tends to pack, jamming in the boot section becomes a problem.



## Section IV

### Typical Scrap Handling Conveyor Systems

In order to illustrate some of the ways in which basic conveyor types can be applied - either singly or in combination - to create systems, the following pages diagram some of the PRAB Metal Scrap Handling Systems now in operation. Among them you will find large and small systems, combinations of equipment and methods of handling various types of commonly encountered metal scrap. Again, the units shown are not intended to be exhaustive of the possibilities. They are simply an indication of the potential for moving metal scrap more efficiently in modern plants.

Applications shaded below are described in this section

SCRAP	COOLANT VOLUME	STRAIGHT-LINE PRIMARILY HORIZONTAL				COMB. STRAIGHT & INCLINE				MULTI DIRECTION PATH			VERT. PATH			
		OSCILLATOR	SCREW	HARPOON	TROUGH BELT	HINGE BELT	COMPACTVEVOR	DRAG	SCRAPVEVOR	MAGNETIC	GRAB	TUBULAR/EN-MASSE	PNEUMATIC	HYDRAULIC	DUMPER/LIFTER	BUCKET ELEVATOR
Die Casting	---	X				X			X							X
Bushy Steel	Low			X		X	X		X		X					X
	High			X		X	X		X							X
Broken Steel 3" Max.	Low	X	X		X	X	X	X	X	X		X	X	X	X	X
	High					X	X	X	X	X		X		X	X	
Bushy Aluminum	Low			X		X	X		X		X					X
	High			X		X	X		X							
Broken Aluminum	Low	X	X		X	X	X	X	X			X	X	X	X	X
	High					X	X	X	X			X		X	X	
Bushy Brass	Low			X		X	X		X		X					X
	High					X	X		X							X
Fine Brass	Low	X	X		X		X	X	X			X	X	X	X	X
	High						X	X	X			X		X	X	
Cast Iron	Low	X	X		X		X	X	X	X		X		X	X	X
	High						X	X	X	X		X		X	X	
Stampings	Dry	X			X	X			X	X	X					X
	Sticky	X				X			X	X	X					X

Note: Additional application layouts, showing the use of other types of conveyor systems, are available on request from PRAB, Inc.

## Application Example # 1

### Steel Stamping Press Scrap

This is one of three similar systems installed in a roller bearing plant. The systems are designed to move stamping scrap resulting from bearing retainer production. The scrap is relatively fine in nature and rather oily in some parts of the plant. While oscillating conveyors are not suitable for extremely sticky materials, this oily scrap is handled successfully in an oscillator/steel belt system.

#### Conveyor System Purpose

To collect scrap from production areas and discharge it into an open-top trailer outside the plant. The discharge conveyor was designed to distribute the load as it accumulated, avoiding any concentrated pile-up which might have to be shifted manually.

#### Design Outline

Three types of conveyor have been interconnected to produce a system which fulfills the purpose while overcoming some particular operating hurdles.

The main run consists of a series of oscillating conveyors which were chosen because they are low in first cost, low in maintenance costs, able to handle surges in material flow and are relatively quiet when solidly anchored as they must be.

Since the length of oscillating conveyors is limited to approximately 80 feet to avoid heavy drive loads, this system uses several sections. The height and width of the conveyors is altered at each interchange to avoid pinch-points in the system which might create a resistance. This is important in oscillating conveyors since the flow of material is not positive and pinch-points create jams.

Hinged Steel Belt Conveyors are located outside the plant wall to elevate the discharge from the oscillating conveyor to the receiving trailer height in a very short horizontal distance.

Applications shaded below are described in this section

SCRAP	COOLANT VOLUME	STRAIGHT-LINE PRIMARILY HORIZONTAL				COMB. STRAIGHT & INCLINE				MULTI DIRECTION PATH			VERT. PATH			
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Die Casting	—	X				X			X							X
Bushy Steel	Low			X		X	X		X		X					X
	High			X		X	X		X							X
Broken Steel 3" Max.	Low	X	X		X	X	X	X	X	X		X	X	X	X	X
	High					X	X	X	X	X		X		X	X	
Bushy Aluminum	Low			X		X	X		X		X					X
	High			X		X	X		X							
Broken Aluminum	Low	X	X		X	X	X	X	X			X	X	X	X	X
	High					X	X	X	X			X		X	X	
Bushy Brass	Low			X		X	X		X		X					X
	High					X	X		X							X
Fine Brass	Low	X	X		X		X	X	X			X	X	X	X	X
	High						X	X	X			X		X	X	
Cast Iron	Low	X	X		X		X	X	X	X		X		X	X	X
	High						X	X	X	X		X		X	X	
Stampings	Dry	X			X	X			X	X	X					X
	Sticky	X				X			X	X	X					X

Because of the oily nature of this scrap, there is a tendency for the scrap to carry beyond the discharge point which can create two problems. (1) It can accumulate on the underside of the steel belt to create damaging jam-ups or, (2) It may discharge, by gravity, at random points where it is not wanted.

The solution was two-fold. The top-horizontal run of the hinged steel belt conveyor was designed to be longer than usual, giving over-running scrap more room to discharge by gravity before it might cause problems.

A hinged steel belt shuttle conveyor was added. Moving along the length of the receiving trailer, it distributes the load evenly. It also catches over-run scrap from the horizontal run of the elevating conveyor.

## Application Example # 1

### Steel Stamping Press Scrap

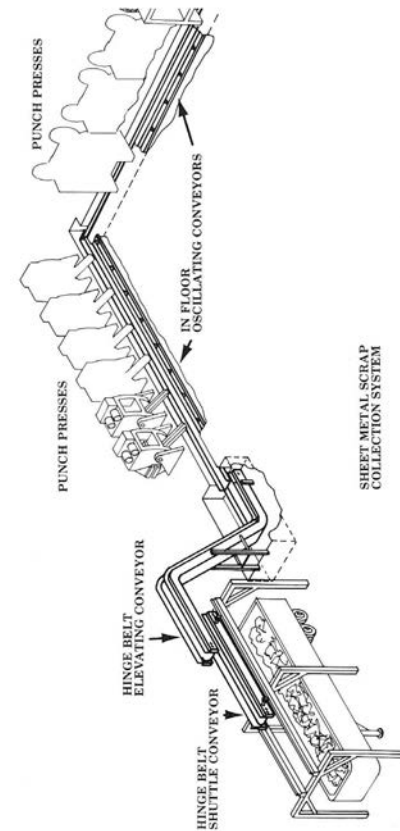
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Because of the oily nature of this scrap, there is a tendency for the scrap to carry beyond the discharge point which can create two problems. (1) It can accumulate on the underside of the steel belt to create damaging jam-ups or, (2) It may discharge, by gravity, at random points where it is not wanted.

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A hinged steel belt shuttle conveyor was added. Moving along the length of the receiving trailer, it distributes the load evenly. It also catches over-run scrap from the horizontal run of the elevating conveyor.



## Application Example # 2

### Oily Brass Turnings, Fine

Sometimes it is possible to predict with accuracy the exact nature of the scrap material to be conveyed. This drag conveyor system was designed and successfully put into use with a sure knowledge that the scrap to be conveyed would be only fine oily brass scrap with occasional small sized bar ends.

#### Conveyor System Purpose

To provide an in-floor system to collect oily brass scrap from two lines of automatic screw machines, convey to bar end separator, from bar end separator to continuous centrifuge, then elevate for discharge.

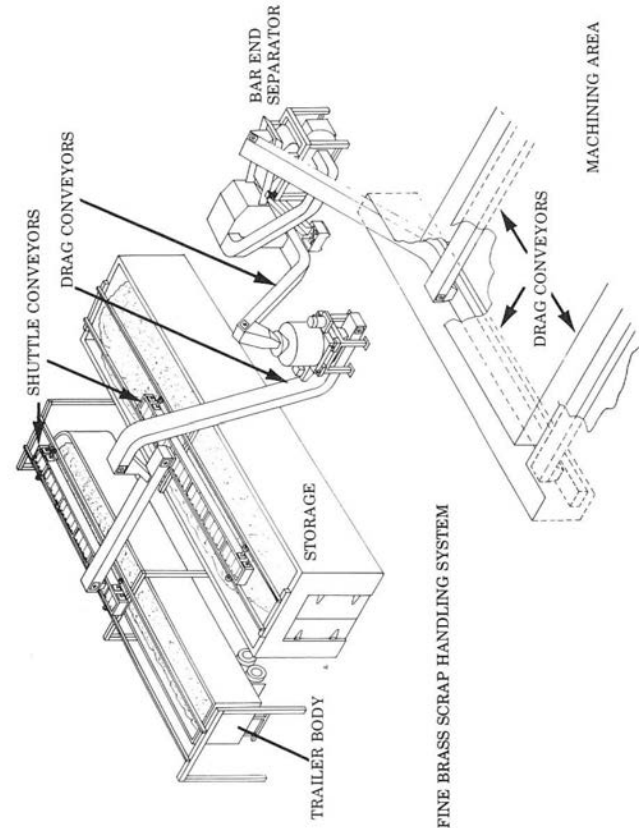
#### Design Outline

All conveyors in this system are PRAB heavy duty drag conveyors built around double strands of rivetless forged steel chain fitted with floating type drag flights. This type of conveyor was adaptable to all runs so a high degree of parts interchangeability was possible.

Brass scrap is a high value product, and it was considered necessary to provide a secure storage area for the material to accommodate the production flow when it was not possible to load directly into a trailer truck.

The dry chips from the centrifuge are elevated to a horizontal conveyor which discharges into either one of two shuttle discharge conveyors. The shuttle conveyors are so arranged as to move fore and aft over a rectangular area to achieve uniform loading over the entire length of the area. The shuttle conveyor above the loading dock distributes the scrap into an open-top trailer body. The shuttle conveyor in the storage area is similarly arranged to distribute the material in the area for a maximum use of the space.

When no truck is available for loading at the dock, scrap is loaded in the storage area and then later transferred to a truck by means of a front-end loader.



## Application Example # 3

### Cast Iron Turnings and Borings

Tubular drag or “en-masse” conveyors can also be used to advantage to handle relatively finely divided metal scrap which is predictable in nature.

Consisting of rectangular flights connected by a single chain, the tubular drag conveyor can change direction in two planes. This makes it possible to arrange the conveyor in loops rather than straight lines, therefore making full use of the conveyor rather than devoting one half of the conveyor length to the chain return side which has no functional value.

#### Conveyor System Purpose

To collect cast iron chips and borings from two lines of automatic turning and chucking machines, then elevate the scrap to sufficient height above floor to accommodate standard chip bins.

#### Design Outline

The loop arrangement shown in figure #3 serves the entire conveyor requirement with one unit. Due to the universal jointed chain used, it is possible to elevate from the subfloor loop without twisting the chain.

Due to the high density of cast iron chips, it is possible to convey a sizable quantity of chips in a relatively small and compact conveyor. This factor combined with the convenience of a loop layout rather than a carry and return layout makes it possible to put the conveyor in a very shallow and narrow trench close to the floor level. (See Figure #1) The conveyor casing is grouted in place, and is covered between machines with narrow and therefore lightweight floor plates.

When access to the conveyor is required, it is easy to lift one of the floor plates and see what is going on in the conveyor.

Tubular conveyors of this type are widely used by major manufacturers of tractors, farm machinery, and heavy industrial engines in departments where cast iron exclusively is machined. The wear factor has proven to be negligible as compared to other conveyor types, and this fact, combined with the basic simplicity and efficiency of the system, results in very low overall costs for the function and benefit provided.

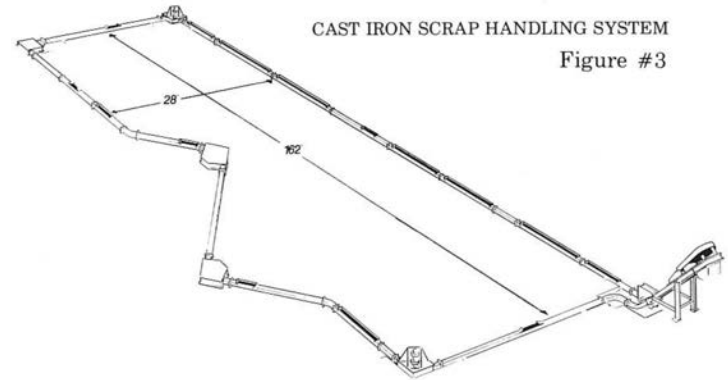


Figure #3

## Application Example # 4

### Die Casting Scrap

This is an integrated, plant-wide system for handling die casting scrap in the new facilities of a prominent chain saw manufacturer. It involves a classic combination of oscillating and steel belt conveyors to create a system which *reduces initial costs by one-third* compared to a 100% steel-belt system and greatly diminishes operating and maintenance costs as well.

#### Conveyor System Purpose

To collect scrap from trim presses and return it to a bank of three remelt furnaces.

#### Design Considerations

- 1) In this high-production plant, smooth production flow is of primary importance so one basic concern was to create a system that will accommodate occasional localized interruptions without causing a general shut-down.
- 2) The die-casting trim being conveyed has many sharp, thin sections to jam moving equipment and is of varying overall size.

#### Conveyor System Application

The oscillating conveyors, used in all horizontal runs, are scaled to accommodate the largest pieces conveyed, a dimension established by the distance between the tie-bars of the die casting machines. Since the cost of such conveyors is not materially affected by increased width, ample size is not costly.

The maximum practical length of a single oscillating conveyor is approximately 80', so a series of units are combined in sequence to achieve the desired total length. Each successive trough is progressively wider to eliminate spillage and avoid the need for costly and troublesome baffles or shields.

The choice of oscillating conveyors also provides storage capacity within the system to accommodate problems that may arise at the discharge end of any scrap return system. Should trucks or hoppers have to be changed, a furnace shut down or some other maintenance undertaken, it is a simple matter to create a dam by turning the elevating conveyor off while the oscillating conveyors continue to run. (Given a conveyor 100' long, three feet wide and eight inches deep, 150 cu. ft. of scrap can be accumulated within the system; five or more tons depending on the bulk density of the material involved.)

The hinged steel belt elevating conveyor must be at least 6" wider than the oscillating conveyor feeding it - preferably 12" wider - to minimize spillage. The maximum incline is 45° and a 4" pitch or greater is necessary to provide adequate height for the side wings. Since a certain amount of scrap carry-over to the underside of a steel belt is unavoidable, provision is made for a scrap accumulation and clean-out area. This avoids jam-ups or equipment damage.

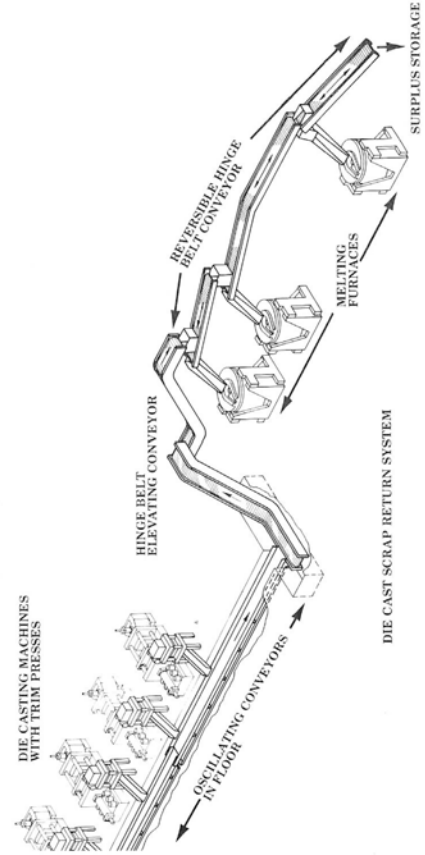
Since this system required selective discharge into any one of three furnaces or to a storage location, the elevating steel belt conveyors feed a cascade system of three reversible steel belt conveyors.

To deliver material to the storage area all of the reversible conveyors run in a forward direction. To feed the last furnace, the last conveyor is reversed. To feed the second furnace, the second conveyor is reversed, and so on. This arrangement provides positive flow of material, and requires no gates or other obstructions which might cause the material to hang up.

**NOTE:**

There is much discussion about the sound levels of oscillating conveyors that calls for clarification.

In themselves, PRAB oscillating conveyors are quiet as a result of design innovations. Sound can be generated from the material being conveyed, through improper anchoring or as a result of being run too fast. Both anchoring and operating speed are solved by proper system design and, where the material being handled creates the problem, trench installations lower the sound below any objectionable level in the working environment.



## Application Example # 5

### Crushed and Dried Steel Turnings

Two different applications of 12" diameter screw conveyors are illustrated in Figures #5 and #5a.

#### Conveyor System Purpose

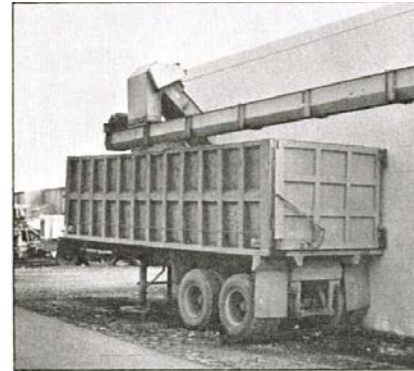
In each case, the screw conveyor is receiving steel scrap which has been crushed and centrifuged so that it is a dry, flowable, uniform product without foreign matter. In Figure #5 the conveyor is used to discharge to a trailer truck body and automatically level the load.

Instead of a conventional screw conveyor trough, an open bottom frame is used. Initially, the material falls directly past the screw conveyor into the truck body until it builds up to the level of the helix. From that point on, the rotating screw pushes material toward the open area of the truck until a satisfactory quantity of material has been evenly loaded.

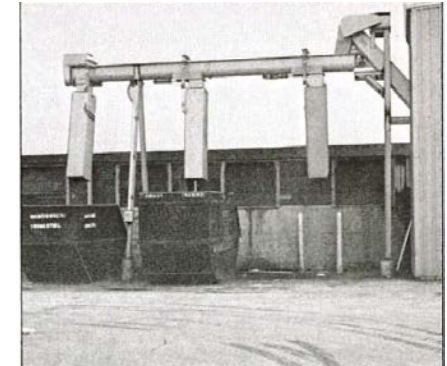
In Figure #5a the conveyor is set up to discharge selectively to anyone of three scrap bins. Air operated slide gates are provided to permit selection of the discharge point. Each discharge is fitted with a pneumatically actuated swiveling discharge chute to permit leveling of the load in the container.

#### Design Considerations

Screw conveyors were selected for this application due to their low cost, light weight, and simplicity of application. While screw conveyors are not normally thought of as being suitable for metal scrap handling, they are durable and reliable providing the scrap to be conveyed is relatively finely divided, and free of foreign objects which could damage or jam the rotating helix.



#5

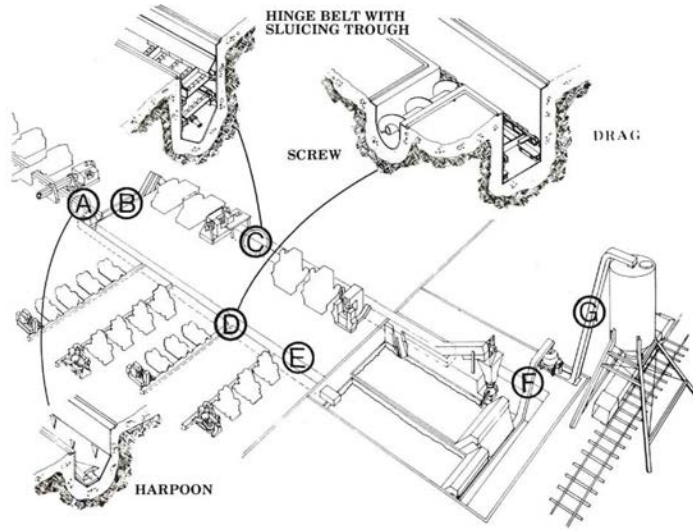


#5a

## Application Example # 6

### Steel Chips of All Types

This system is unusual in that it is a multi-purpose system and involves five different types of chip conveyors, each one selected to best perform its assigned function.



STEEL CHIPS and TURNINGS COLLECTION SYSTEM

### Conveyor System Purpose

To collect steel chips of three different kinds from three different areas, separate the two kinds of coolant oil from the chips and channel them to separate filtration units, then feed all the chips through processing equipment and elevate the crushed dried chips to a storage hopper above a railroad track. Total capacity 3000 pounds per hour.

### Design Outline

Three machining areas are involved. Area #I consists of bar machines which generate bushy steel turnings coated with heavy coolant oil. Area #II consists of 90 gear hobbers and shapers which generate fine chips coated with heavy coolant oil.

Area #III consists of chuckers and Bullards which generate bushy steel chips and fine steel chips coated with water soluble coolant.

Conveyor A is a harpoon conveyor, 100' long, selected because it is the most troublefree method of conveying bushy steel chips combined with coolant. This unit feeds into Conveyor B, and at this point it is desired to have the chips go in one direction toward the bushy chip side, while the oil goes in the other direction toward the heavy oil side.

Consequently, Conveyor B is a hinge belt conveyor with a sloping configuration so that the oil on the chips will drain through the perforated belt to the bottom cover of the conveyor. From there it drains back into Conveyor E. The bushy chips proceed to Conveyor C.

Conveyor C is also a hinge belt conveyor, 230' long, but it is combined with a hydraulic/sluice conveyor running beneath it.

Large quantities of very flowable water soluble coolant oil wash through the perforated hinged belt, taking with them a sizable quantity of fines. The combination of water soluble oil and fines is propelled to the filter unit by means

of high velocity nozzles strategically placed along the length of the sluice. These nozzles receive fluid from the filter unit.

Conveyor C has an inclined section at the discharge end. It feeds a crusher which then directs the crushed bushy chips into the filtration unit.

Conveyors D are screw conveyors, selected as the most economical means to handle a combination of fine steel chips and heavy oil. These screw conveyors vary in length from 80 to 120 feet, and serve 90 machines.

The fine oily chips are fed into Conveyor E which is a double chain drag conveyor, 200' long, providing ample capacity for the total quantity of heavy oil generated by the system as well as all of the fine chips. This conveyor then discharges its entire load into the heavy oil filtration unit.

Conveyor F is a double chain drag conveyor, selected for its capability to elevate the combination of crushed bushy chips and fine chips into centrifuge.

Conveyor G is a hinge belt conveyor which elevates the dried chips to a storage hopper.

This system represents the thoughtful consideration of both functional and cost factors in order to achieve system objectives at minimum cost and with minimum operating headaches. This example points up the fact that scrap handling systems should be purchased from companies having the ability to supply every type of equipment that can be used to advantage in handling chips.

