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OF CANADA

OFFICIAL PROCEEDINGS

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PROCEEDINGS OF THE CENTRAL RAILWAY AND ENGINEERING CLUB OF CANADA MEETING.

PRINCE GEORGE HOTEL, TORONTO, September 20, 1910.

The President, Mr. Duguid, occupied the chair.

Chairman,—

As it is now twenty minutes after eight, I think it would be well to get through the business of the meeting so as to allow of plenty of time for the reading of the paper and discussion of same.

The first order of business is the reading of the minutes of the previous meeting, and as you have all had a copy of the minutes it will be in order for someone to move their adoption as read.

Moved by Mr. Baldwin, seconded by Mr. Jefferis, that the minutes of the previous meeting be adopted as read. Carried.

The second order of business is the remarks of the President.

I never detain you very long with my remarks but I would like to say that there are a number of members who think that the meeting should start sharp at eight o'clock. We have allowed a little lee-way to-night, as this is the first meeting since the spring, but in future the meetings will start sharp at eight o'clock and I hope that the members will all try and be present so that we may start punctually.

The Executive Committee report that the Picnic held last June was a great success and was the means of bringing in a number of new members. We not only had a good time, but anything that brings new members into the Club is a good thing. I might mention that there are a good many members behind with their dues for 1908, 1909 and 1910, and it would be a good way to start the new session by paying up back dues.

I would like some of the members to volunteer to give papers, so that the Secretary can get their names and the title of their paper. There are a whole lot of members who are able to give papers on interesting subjects, but through modesty they do not come forward, and unless the Secretary happens to drop on them they never get up a paper, but I hope they will overcome their modesty along that line and come forward and offer to give papers and in that way we would probably get better class of papers than we would get by any other means. Many of the Club members know what kind of papers are required and it is up to them to come forward and offer to read a paper.

The paper to-night is on "The economical handling of material by machinery," by Mr. J. A. W. Archer, manager of the Jeffrey Manufacturing Co., Toronto. The paper at the next meeting will be on "Railroad Signalling", by Mr. C. L. Hackett, of Montreal.

A good many of the members might think that this paper will not be of much interest to them, but it will not hurt anybody to hear a paper on Railroad Signalling, as it will give them an insight into the method of signalling on a railroad.

The next order of business is the announcement of new members.

NEW MEMBERS.

Mr. R. Woodward, Boilermaker, G.T.R., Toronto.
Mr. G. Dickson, Electrician, G.T.R., Toronto.
Mr. G. Wilson, Electrician, G.T.R., Toronto.
Mr. O. Shier, Electrician, G.T.R., Toronto.
Mr. W. Patton, Engineer, G.T.R., Stratford.
Mr. W. J. Hayes, Engineer, G.T.R., Stratford.
Mr. F. Adams, Engineer, G.T.R., Stratford.
Mr. A. Jones, Machinist, G.T.R., Stratford.
Mr. J. Fraser, Machinist, G.T.R., Stratford.
Mr. F. Scott, Timekeeper, G.T.R., Toronto.
Mr. D. Cairns, Draughtsman, Consumers Gas Co., Toronto.
Mr. C. Johnson, Clerk, Consumers Gas Co., Toronto.
Mr. J. Jackson, Boilermaker, Consumers Gas Co., Toronto.
Mr. J. S. Adam, Fitter, Canada Foundry Co., Limited, Toronto.
Mr. J. L. Bigley, Member of firm of R. Bigley Mfg. Co., Toronto.
Mr. G. H. Wright, Representative R. Bigley Mfg. Co., Toronto.
Mr. R. A. Girouard, Civil Engineer, Gaul & Girouard, Toronto.
Mr. W. G. Adams, Representative Frank Williams & Co., Buffalo, N.Y.
Mr. G. Young, Electrician, Toronto.
Mr. G. Dingwall, Representative Philip Carey Mfg. Co., Toronto.
Mr. R. Burns, Superintendent Philip Carey Mfg. Co., Toronto.
Mr. W. E. Ritchie, Motor Car Engineer, Toronto.
Mr. A. Fraser, Foreman Drill Hand, Chapman Double Ball Bearing Co., Toronto.
Mr. A. Pype, Machinist, Chapman Double Ball Bearing Co., Toronto.
Mr. A. Wessel, Steel Fitter, Chapman Double Ball Bearing Co., Toronto.

Mr. F. Westran, Millwright, Chapman Double Ball Bearing Co., Toronto.

Mr. S. Cowan, Machinist, Chapman Double Ball Bearing Co., Toronto.

Mr. H. B. Whitney, Toolmaker, Chapman Double Ball Bearing Co., Toronto.

Mr. C. R. Leake, Electrical Engineer, Factory Products Co., Toronto.

Mr. W. Schadel, Machinist, Newcomb Piano Co., Toronto.

Mr. F. Ritz, Electrical Engineer, H. W. Johns-Manville Co., Toronto.

Mr. R. H. Merriman, Secretary B. Greening Wire Co., Hamilton.

Mr. J. J. Comlin, Engineer, S.S. "Kingston," Toronto.

Mr. W. H. Robb, Representative Anchor Packing Co., Montreal.

Mr. C. Schadel, Gentleman, Toronto.

Mr. N. D. McIntyre, Superintendent of Construction, Canada Foundry Co., Limited, Toronto.

Mr. Jas. Morton, Erecting Engineer, Canada Foundry Co., Limited, Toronto.

Mr. E. L. Purvis, Representative Philip Carey Manufacturing Co., Toronto.

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J. Duguid.	J. McWater.	E. G. Southam.
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C. G. Keith.	W. David.	D. Campbell.
W. H. Rice.	G. Kyle.	F. H. Jarm.
J. S. Grassick.	G. A. Young.	J. Jackson.
J. T. Fellows.	D. Cairns	J. Lewkowicz.
C. B. Johnson.	G. D. Bly.	C. O'H. Craigie.
E. Walker.	H. Cross.	G. Shand.
J. W. Griffin.	M. McGrath.	W. Schadel.
F. Campbell.	J. Herriot.	H. E. Rowell.
E. A. Wilkinson.	E. L. Purvis.	E. Blackstone.
J. Greville.	A. T. Bliss.	G. S. Browne.
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W. McRobert.	H. G. Fletcher.	J. S. Adam.
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H. O. R. Horwood.	S. Cowan.	C. G. Herring.
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C. A. Jefferis.	G. Baldwin.	R. Woodward.
J. A. W. Archer.	L. S. Hyde.	C. L. Worth.

The thanks of the Club are due to the following who so kindly donated prizes which were competed for at the Third Annual Picnic held at Beaverton Beach on June 18th, 1910.

Philip Carey Manufacturing Co., Toronto.
The Garlock Packing Co., Toronto.
Mr. G. A. Bronder, New York, N.Y.
Rice Lewis & Son, Limited, Toronto.
Baines & Peckover, Toronto
Polson Iron Works, Limited, Toronto.
The Lunkenheimer Co., Cincinnati, Ohio.
Watson Pattern Works, Toronto.
Mr. A. H. Reid, of Reid & Brown, Toronto.
Gutta Percha & Rubber Manufacturing Co., Toronto.
Downer Pattern Works, Toronto.
Jas. Morrison Brass Manufacturing Co., Toronto.
Canadian Rubber Co., Limited, Toronto.
Central Electric and School Supply Co., Toronto.
Dunlop Tire & Rubber Goods Co., Limited, Toronto.
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Ontario Soap & Oil Co., Toronto.
Treloar, Blashford & Co., Toronto.
Canadian Oil Co., Toronto.
Sanderson, Pearcy & Co., Limited, Toronto.
Queen City Oil Co., Toronto.
Drakes, Limited, Halifax, England, per Mr. Thompson.
British American Oil Co., Toronto.
The Canadian Fairbanks Co., Limited, Toronto.
Reid & Co., Toronto.
H. W. Petrie Co., Limited, Toronto.
R. Bigley Manufacturing Co., Toronto.
N. L. Piper Railway Supply Co., Toronto.
William Jessop & Sons, Limited, Toronto.
C. & W. Walker, Dommington, Salop, England, per Mr. Gardner.
Murray Printing Co., Toronto.

Chairman,—

The list of new members speaks for itself, and it is unnecessary for me to make any comment on it. If we got a list like this at every meeting we should soon have a very large Club.

The next order of business is the reading of papers and the discussion thereof.

We have with us to-night Mr. J. A. W. Archer, manager of the Jeffrey Manufacturing Co., of Toronto, who will read a paper on "The economical handling of materials by machinery," and I am sure we shall all have great pleasure in listening to this paper, and I hope that when Mr. Archer is through we shall have a lively discussion without my having to call on members individually.

THE ECONOMICAL HANDLING OF MATERIALS BY MACHINERY.

BY J. A. W. ARCHER, MANAGER JEFFREY MANUFACTURING CO., TORONTO.

As the title of this paper indicates I am dealing with a very large subject and my endeavor will be simply to explain and demonstrate the various standard appliances used to elevate and convey materials, and describe some actual installations.

Probably the simplest conveying equipment in use to-day is the Belt conveyor, illustrated Fig. 1, which consists of a belt, usually rubber or canvas running over pulleys at either end and supported at intervals by guide pulleys to take the weight of the belt and material being handled. When used for carrying such materials as coal, ashes, crushed ore, rock, grain, etc., it is the usual practice to trough the carrying side of the belt by means of troughing idlers as shown, Fig. 2, the return strand being supported by flat idlers. The troughing idlers are generally spaced four or five feet centres and the return idlers eight or ten feet centres.

The head and tail pulleys are usually about two inches wider across the face than the width of the belt and crowned as for transmission purposes. As belting of any kind has a certain amount of stretch, which must be taken care of, a belt tightener must be provided. This tightener arrangement must be in the form of take-ups, which are used on the tail end of the conveyor. It is good practice to provide long adjustment take-ups. They are manufactured with standard lengths of adjustment from twelve inches up to five feet.

Where rubber belting is used for carrying such gritty material as coal, ashes, crushed stone, etc., the general practise is to use a belt with a 1-16 inch or $\frac{1}{8}$ inch carrying face, that

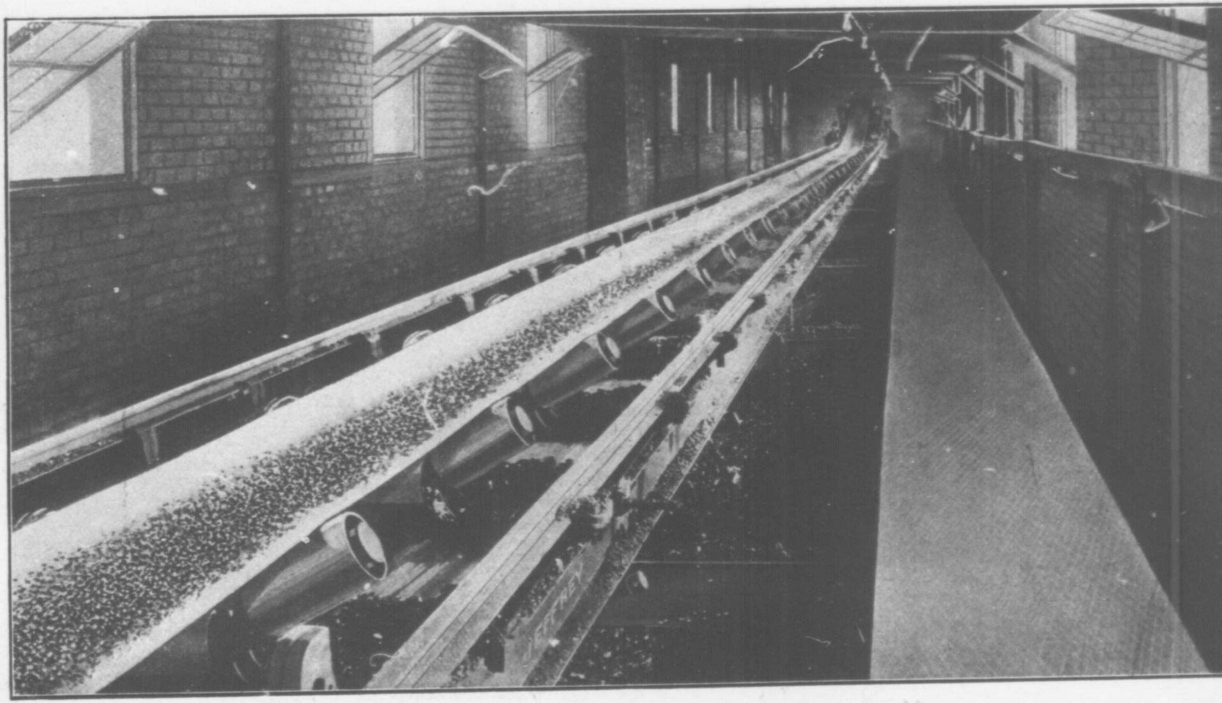


Fig. 1.

is the belt is made up in plys as for ordinary use and finished off on one side with a 1-16 or ⅛ inch face of solid rubber to provide a wearing surface for carrying the material.

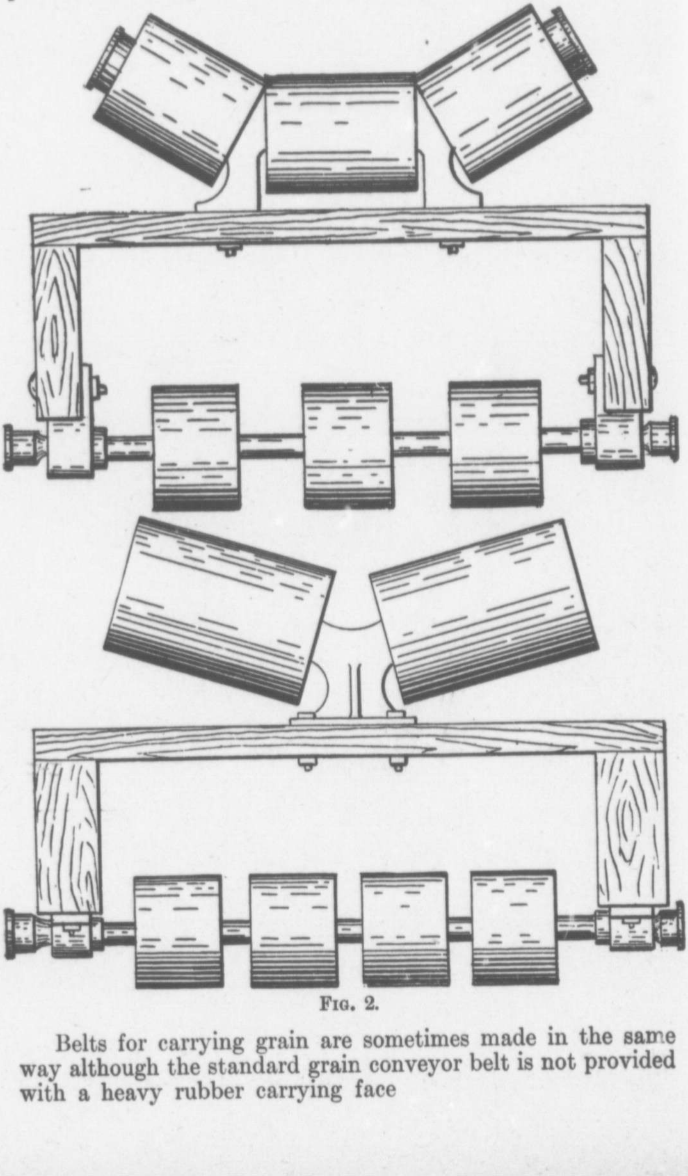


FIG. 2.

Belts for carrying grain are sometimes made in the same way although the standard grain conveyor belt is not provided with a heavy rubber carrying face

Red stitched Canvas Belting is also greatly in favor for conveyor belts. They have the advantage of costing about one half as much as the rubber belt and often last almost as long. I have in mind now, two red stitched canval belts, 30 inches wide each 420 feet long which are used to carry crushed tone. They are doing good work and handling an immense tonnage of material—about 150 tons per hour.

The feed. The material should be fed on to the belt through a chute inclined at an angle of not more than 35 degrees and pointed in the direction in which the belt is travelling so that the impact of the product falling on the belt will not injure the surface in any way. The neglect of this point has destroyed many a good belt.

The discharge. Belt conveyors can be made to discharge at almost any point between the head and tail pulleys or over the tail pulley.

Where a belt conveyor runs over and is used to fill storage bins as in a grain elevator or coal shed it is necessary to provide a tripper arrangement so that any bin can be filled within the length of the conveyor. This tripper arrangement is sometimes provided for by means of a tilting roll—somewhat similar to the troughing carrier and made so that one side of the angle pulley arrangement will drop down and allow the belt to sag on one side which allows the material to fall off. This arrangement is not always satisfactory especially for large belts handling capacities.

In such cases what is known as a belt tripper is used. This is a device running on a track, through which the belt runs. It consists of two, three or four pulleys as the case may be, the belt running over the first pulley and discharging the material by centrifugal force into a chute which carries it out on one or both sides the belt then running down and around a lower pulley out of the way.

Trippers run on four wheels on a track and can be moved either by power or by hand over any bin into which the material is to be discharged.

The speed of a Belt Conveyor depends on the material being handled. For coal, ashes, sand, gravel, crushed stone, etc., it is safe to run at from 200 to 250 feet of travel per minute where as for grain they can safely run at as high as 600 feet per minute.

Belts are sometimes used for handling light parcels and packages. In this case they are not troughed but run flat between side guide plates to keep the parcels from falling off and where the capacity warrants it they form a much cheaper method of handling light packages than trucks.

The T. Eaton Co. have a parcel conveyor of this kind installed in their mail order department. The belt is 30 inches wide and must be over 150 feet long running in some places at an angle of 25 degrees. It is giving splendid satisfaction.

The Scraper Conveyor. This conveyor consists of one or two strands of sprocket or coil chain with steel flights spaced at regular intervals such as 18 inches or 2 feet and is used to scrape such material as coal, etc., through a steel trough.

When one strand of chain is used the scraper is fastened in the centre while with two strands the scraper is attached at each end. Scraper conveyors are used for handling large capacities of coal especially at slow speeds. Where a double strand of chain is used it is usual to supply a roller chain, the rollers being larger than the chain link thus enabling the chain to run along a flat iron track which overcomes friction and prevents wear.

The Hamilton Steel & Iron Co. have a Scraper Conveyor at work, about 200 feet centres. The scrapers are 26 inches wide running in a steel trough and are attached to the chain at the ends. The chain is 8 inch pitch with 3½ inch rollers, and the whole equipment will handle run of mine coal where the lumps run from dust up to 18 or 20 cubic inches.

Scraper Conveyors are generally used for unloading coal from railroad cars and conveying to to storage piles, etc. The unloading of coal from railroad cars generally presents an economical handling proposition where the number of cars per day is considerable and one of the points which demands attention is how to get the coal from the car onto the conveyor without an excess of human labor.

This is accomplished automatically. When the coal is shipped in hopper bottom cars; the coal being discharged through the bottom of the cars into a large hopper under the track and with a scraper or belt conveyor running under the hopper the coal is fed thereon by means of a plate feeder and carried away to the storage bins.

It is possible in this way with properly designed machinery for one man to look after the unloading of coal at the rate of 100 tons per hour.

Where coal is shipped in flat bottom coal cars it would be necessary to unload them by means of a grab bucket. A one ton grab bucket of the Clam Shell Type is capable of unloading a 50 ton car in about 45 minutes, the only human labor necessary being a man to clean out the corners of the car.

The apron conveyor, (see Fig. 3) is another style used to handle such products as boxes and barrels, etc. It consists of two strands of chain, usually roller chain, in matched sections running on a flat or angle iron track with slats attached at each end to the chain. The slats being attached at every link or at intervals as the case may be.

This style of conveyor can be made to run level with the

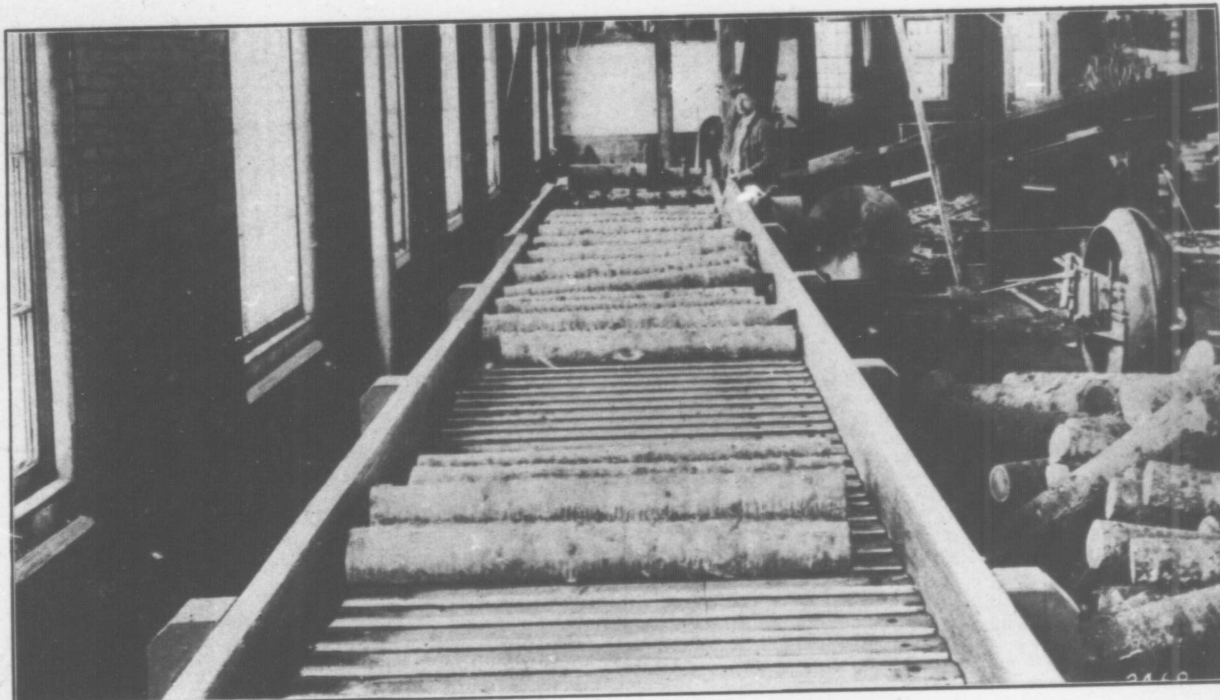


FIG. 3.

floor or raised up according to conditions. It is frequently used in large warehouses where a large number of packages are being handled and is much cheaper in its operation than ordinary trucking. It usually runs at a speed of 100 to 200 feet of travel per minute.

The Beaded flight conveyor is a varation of the apron conveyor. It consists, like the apron conveyor, of two strands of chain to which are attached steel flights which overlap each other and an end piece is often bolted to the end of the flight thus forming a moving steel trough. It is used for handling loose materials such as grain, etc. It is very popular with the cereal food manufacturers for carrying their products through ovens, the speed being timed to roast or bake the grain while passing through the oven a given number of times.

The wire cable conveyor (Fig. 4) is another method used to carry materials over considerable distances. It consists of a wire cable to which are attached cast iron discs running in a suitable trough. The discs are spaced at regular intervals such as 3, 4 or 5 feet and the sheaves at either end are made with gaps to correspond with the spacing of the discs.

Wire cable conveyors are used extensively in pulp and lumber mills and kindred industries to handle lengths of pulp wood—refuse-slabs, etc. Also used in such places as coal mines to retard coal running down inclines or to convey along a horizontal plane or up grades. It is economical for long distances, but not for short distances as the terminals constitute the bulk of the cost. We have them running up to 1,300 foot centres, but more frequently from 300 to 600 foot centres.

Other conveyors used in saw-mill work are the log haul-ups, consisting of a chain made generally of steel or malleable iron, running over guides or supports so that the chain will not sag on the carrying side. To the chain is attached spurs spaced about eight feet apart which catch the log out of the water and haul them up an incline into the mill where they are discharged onto skids or the saw carriage to be sawn into lumber.

Then we have the transfer chain to transfer the lumber from the saw to the various departments for further operations. This consists of malleable chain with a solid roof top and is used to transfer sawn boards around the mill.

There are several forms of saw-dust conveyor, sometimes an ordinary malleable sprocket chain is used with attachments every 12 or 18 inches to which wood slats are attached and these drag along a wooden trough and scrape the saw-dust and refuse to wherever it is necessary to discharge them. Another style to do the same work is an open link chain 6 or 8 inches wide running in a trough which scrapes the material along in the same way.

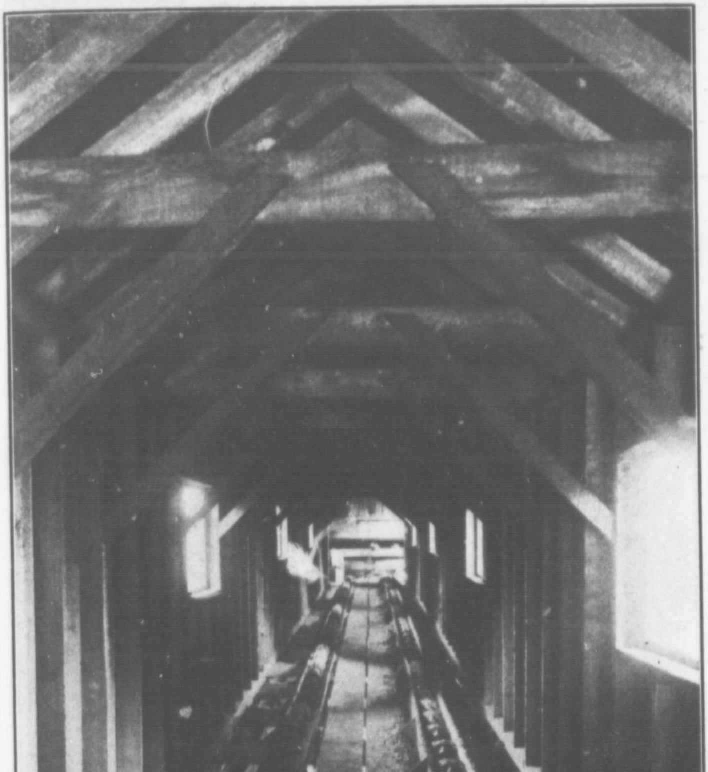


Fig. 4

We next come to the pan conveyors and bucket carriers.

These consist of pans attached to a double strand of roller chain running on tracks. The buckets or pans are made in standard sizes and have many uses such as:

Overlapping steel buckets to carry horizontally or up an incline for coal, earth, gravel, sand, etc.

Cast Iron Overlapping pans for hot material such as cement, clinkers, ashes, ore, etc.

Overlapping steel pans with wood lining for ore and other heavy or gritty materials.

Wooden base with iron frame for packages and bundles, and many other styles.

They are also made so as to automatically discharge their load at a given point by means of a trip or a drop in the track or some such method as the local conditions warrant.

Spiral Conveyors. These consist of a ribbon of metal wrapped around a central core similar to the threads on an ordinary wood screw. They are made right and left hand—in all diameters from 3 inches to about 18 inches and in standard lengths from 6 feet to 12 feet, according to the diameter. They run in a trough with a lining to conform to the diameter of the flights, the clearance being very slight.

Spiral conveyors are used to handle grain, flour, coal, etc. Their advantage lies in the fact that they take very little room and are easily driven. They run at speeds from 75 revolutions per minute up to 400 varying with the material being handled, running at a high speed for grain and slower for heavier materials such as coal. Spiral conveyors should not be used for handling ashes, sand or such gritty material as the abrasion and friction wears the lining out in a very short time. There is sometimes no other alternative, however, and spiral conveyors must be used for ashes, such as where the space is limited. When this is the case it is the practise to put in spiral conveyor with heavy cast iron flights and to use chilled lining in short sections to line the trough so that they can be easily replaced. Even under these conditions the wear is rapid and their use should be avoided as much as possible.

Under ordinary conditions spiral conveyor is manufactured in standard lengths—for instance 6 inch spiral conveyor 10 feet long—12 inches—12 feet long, etc., and these lengths are coupled end to end with a bearing in each length, thus giving any length required.

There are various styles of troughing for spiral conveyors, the usual practise being to supply a wood trough with a steel lining. This style is cheap and when worn out the lining is easily replaced. Another steel is an all steel trough about No. 12 gauge usually with an angle iron stiffener along the top edge. These are used principally for handling gritty materials such as coal, moulding sand, etc. You will doubtless be interested in knowing how the spiral conveyor is supported in the trough. The ends are supported by solid end bearings which fit into the end of the wood or steel box and with each length of conveyor a bearing is supplied which fits over the box and hangs down sufficiently far to allow the conveyor to clear the lining and no more. The clearance for ordinary work is about $\frac{1}{8}$ inch. For discharging out of the end of the trough a discharge end bearing is used. This has an opening through which the material is forced. For discharging at intermediate points through the bottom of the trough ordinary slide or hinged valves are used.

Spiral conveyors generally run at 75 to 300 revolutions per minute according to the material being handled and can either be driven straight off a driving shaft or at right angles by means of a counter shaft box end which consists of a box end with a pair of mitre gears to drive at right angles to the conveyor all contained in a solid iron frame. These conveyors are made right and left hand and in this way can convey material in either direction.

I think I have touched on the conveying field rather fully. We will now consider appliances for elevating materials.

We will first consider the bucket elevator. You all are familiar no doubt with an ordinary belt to which are attached buckets at regular intervals, used principally in flour mills. Their use is now extending to almost every industry where granular materials are being handled.

There are many styles. Oftentimes the material being handled will injure a belt. In such cases some style of sprocket chain is used. Ordinary detachable sprocket chain was at one time popular, but is now gradually being replaced by more permanent styles of chain. Detachable chain has an open joint into which gritty materials work and abrasion quickly wears out the joint. A better style of chain is what is known as Hercules chain. This consists of a solid malleable link with steel side bars, is much stronger than detachable chain and the material being handled cannot work into the joint. Bucket elevators are made to handle all capacities—as small as with a 2 inch by 2 inch bucket to handle a fraction of a ton an hour up to 5 feet by 3 feet bucket to handle 400 tons of crushed rock per hour.

A bucket elevator consists of a head shaft running at thirty-five to forty revolutions per minute; a wood, cast iron or steel boot with takeups and foot pulley or sprocket over which runs the belt or sprocket chain with buckets attached either at intervals or continuously as the case may be. The material is fed into the boot through a regulating gate and the buckets elevate up to whatever height is required and discharge it over the head pulley. Where large buckets are used to handle gritty materials a single strand of chain is unsatisfactory, two strands of chain in matched sections being preferable. Standard sized chain are manufactured with attachments, which can be fitted in continuously or at intervals to which the buckets are bolted. Generally speaking bucket elevators are made in the following types:

Single Strand with buckets at intervals.
Double Strand with buckets at intervals.
Belt Type with buckets at intervals.
Continuous with buckles placed close together.

Especially when handling dusty or gritty materials bucket elevators are encased either with wood or steel. Wood casings are a simple matter—merely a long box with a head on which the bearings set the lower end setting on the elevator boot. Steel casings are much more expensive. They are generally constructed of plates 12, 14, or 16 gauge with angle stiffening shapes at corners and joints, the head and discharge spout as well as the casing being of the same construction. This makes a very superior construction which will give lasting satisfaction.

There is another style of Bucket elevator which should be mentioned while we are on the subject and that is the open back bucket elevator. (Fig. 5).

This consists of a bucket elevator running with a double strand of chain, the special feature being that the back of the bucket is hinged and runs on a wood or steel guide. This guide has a gap at intervals and when the bucket comes to these gaps the back opens and the material is discharged into a chute.

This style was designed for retail coal yard work especially, it having been found that more or less breakage occurs when coal is carried up and discharged over the head pulley as is usually the case, the idea of the new style of elevator being to start discharging near the boot and raising the point of discharge as the pile increases.

We will next consider package—bag and barrel elevators. These consist of two strands of chain in matched sections from which arms project at intervals of every five to ten feet as the case may be. These arms are made in several styles, such as straight for boxes and cases and curved for bags and barrels, where large numbers of cases or bags or barrels are being handle a tray elevator of this kind is very economical—does not take up much room—is automatic—can be made to discharge at a given point, etc.

They are made in two styles—with arms or carriers projecting from the chain or belt and with the trays centrally hung between the two strands of chain. With the latter

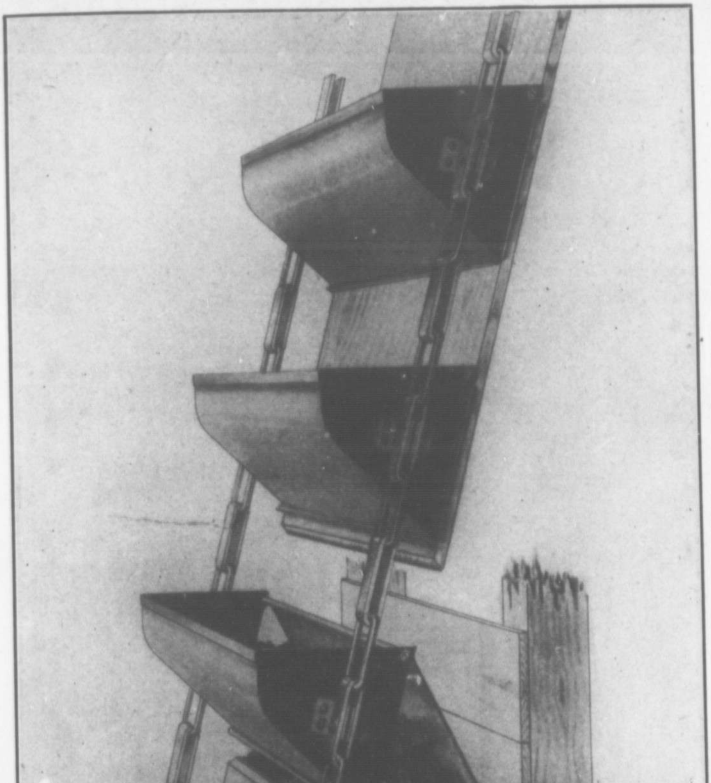


FIG. 5.

type it is possible to both elevate and lower material and discharge the load automatically at any floor either up or down stairs.

The same idea is utilized in the Humphrey automatic passenger elevator commonly used in flour mills. The passenger standing on a platform attached to the belt and steadying himself thereon by means of a handle attached to the belt at the proper height—and then watching and stepping off at the right place when the belt is slowly moving either up or down.

I will not attempt to say anything about passenger or freight platform elevators as these are entirely out of my field. Other methods of handling material are by buckets and tubs on cables, etc., and by means of cars on a track system often pulled along by wire cables, etc., but I will adhere strictly to elevating and conveying machinery.

A combination of the systems I have endeavored to describe are often units in a complete installation. For instance a bucket elevator or a grab bucket may discharge onto a belt conveyor which in turn can discharge into a screen or crusher and from thence taken by another elevator or conveyor and discharged into bins. To illustrate the idea and give an illustration of the saving effected I would like to describe an actual installation of elevating and conveying machinery as follows.

The unusual conditions prevailing at the power house of the Peoria Gas and Electric Co., a corporation operating over 4,100 horse power of boilers, supplying the light and power at Peoria, Ill., necessitated a special type of mechanical equipment for the conveying of their coal directly from the cars to the fires under the boilers and handling the ashes from the ash pits.

It was designed to handle fifty tons of either coal or ashes per hour, but as a matter of fact it is frequently handling double that tonnage.

The fuel that is being used is "run-of-mine" coal, which is delivered alongside the plant in 30-ton railway cars. The cars may be either dumped into a track pit or unloaded direct from the car by a grab bucket, (see Fig. 6), which is operated by cable and electrically driven double drum hoist situated on a cantilever tower.

The coal is dumped from the bucket through a receiving hopper placed in the tower to a two-roll crusher, electrically driven. This is accomplished by means of a reciprocating plate feeder equipped with a perforated bottom, which allows the fine coal to by-pass around the crusher, delivering only the large lump coal to the crusher rolls. The coal passing through the rolls is delivered to a belt conveyor, which deposits

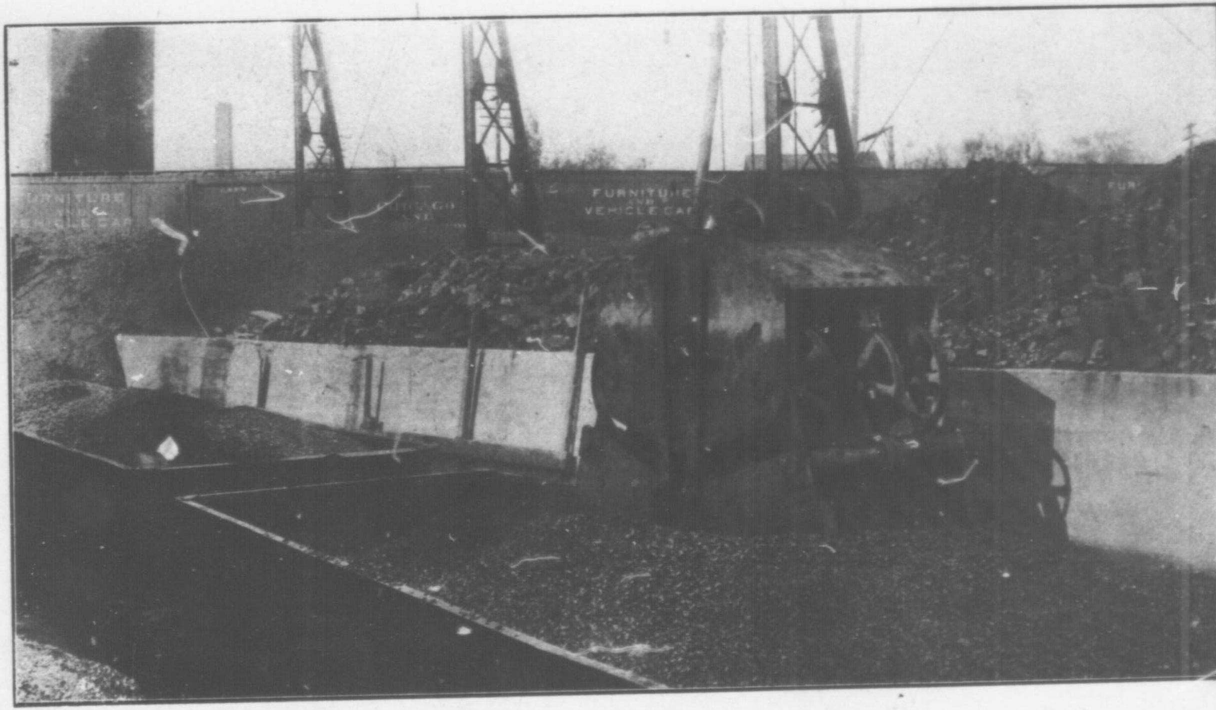


FIG. 6.

the crushed coal into the storage bunkers by means of a travelling tripper. The bunkers, having a capacity of over 750 tons of coal storage, are so constructed that they feed the coal directly to the automatic stokers by gravity.

The conveyor is 225 feet between centres and is 20 inches wide, and is a 6-ply standard canvas belt. The top strand of this belt is carried on a three-pulley troughing idler; the return strands being carried on two pulley straight face idlers. This conveying belt is equipped with an automatic self-propelling and self-reversing tripper, provided with a brush for cleaning the belt and also a two-way discharge spout for distributing the coal evenly along the storage bunker.

The operator on the tower has his station in the cab and operates two controllers, two clutch levers and one foot lever to handle and control all the movements of the buckets. Windows are provided in the tower to enable the operator to look in all directions. A single laborer is needed part of the time in the car to clean up the coal that cannot be reached by the grab bucket. The bucket will handle nearly every particle of coal, and at no time will more than one-quarter ton remain in the car

A tower is built of structural steel, weighing approximately 65,000 pounds, towering in height 71 feet. A cantilever truss is a trifle over 30 feet long and is counterbalanced by the machinery house The method adopted for the removal of the ashes is simple, the ashes coming from the ten fires in deep steel barrows and dumped into the ash pit, where they are loaded to the railway cars by the grab bucket

The results of the official tests made by the engineers in charge for the Peoria Gas and Electric Co. have also been made known and indicate that a car containing 30 tons of fine coal, was unloaded by the grab bucket in 25 trips, averaging one and two-tenths tons of coal per trip, in less than twenty-five minutes. The total cost of labor and actual power consumed for the entire 30 tons amounted to less than 40 cents. The cost per ton for handling the coal for the previous three months ending March 31st showed a total net saving of over 16 cents per ton, compared with the former methods, when only hand labor had been used for this same purpose, and the actual saving of over $10,000 for the first year with the use of this modern installation

Another equipment which has proven very economical for unloading coal is what is known as a run around conveyor, the featuring being a V-shaped bucket which will either elevate or scrape along through a trough thus making a combination elevator and conveyor.

My talk to-night has been very general, my object being, as I explained before, merely to describe standard methods of handling material by elevating and conveying machinery. Such a subject can only be treated in a general way. Specific problems must be considered on their merits from an engineering standpoint, but I hope that you will find my paper instructive and that some at least of you will go farther into the subject and that labor saving handling machinery will be the result. I thank you gentlemen for your attention

Mr. Jefferis,—

The company which I serve have now in operation twenty-eight lines of conveyors. I might say that these conveyors were not installed by the firm that Mr. Archer represents, but I will say that his firm is one of the best in the United States.

The greatest bug-bear in the use of conveyors is the cost of maintenance. Where gritty material, such as coke and the like is used the problem of maintaining conveyors, I think Mr. Archer will bear me out, is a big one.

Proprietors and managers of different companies when they intend to install a system of conveyors in their plants should always go very carefully into the cost of maintenance. For instance, I was talking, some time ago about the upkeep of conveyors with the president of one of the largest conveyor companies in America, and I mentioned that the cost of maintenance was one of the greatest difficulties we had to deal with, and he told me that when they go to a man and tell him that they will install a system of conveyors for him which will save him so much money, the contract is made and in goes the machinery. After the whole plant is installed he informs the buyer that he had better get a mechanical engineer to look after it. He immediately says: "We have never had to do anything like that before." "We have got a stationary engineer, who looks after our boilers, etc., let him look after the conveyors." In a great many instances they refuse to get a mechanical man to look after the conveyors, and the consequence is that the conveyors work all right for a time, and the first time any little thing happens the manager or proprietor wires to the conveyor people to send a man over at once to put the conveyor right. The conveyor company sends a representative over who, in a short time gets everything all right until something else happens. It is one of the greatest difficulties to persuade proprietors to have anyone to look after conveyoring machinery and to realize how much time and money they would save by doing so.

We have eight conveyors each capable of handling fifty tons of coal per hour easily. Mr. Pearson the last time you made a test unloading fifty cars how long did it take to unload them?

Mr. Pearson,—

Forty-eight minutes on an average.

Mr. Jefferis,—

We handle the coal, crush it, and store it. In fact the coal is handled in machinery from the time the coal is put over the hoppers until we are through with it. If we could get cars enough to handle them continuously, I think three to four men could handle between 900 to 1,000 tons in nine hours, but the trouble is that we cannot get the cars placed properly so as to have them unloaded continuously.

With our coke conveyors which is a more difficult proposition, we quench the coke, convey it, crush it, store it, and measure it to the purchaser by machinery entirely. Of course we have a very large installation at both of our plants, and I would like to extend a cordial invitation to any member of the Club to come down at any time to either plant and see just what we are doing. I can show him then, perhaps, in detail just how much can be saved by the installation of conveyors.

Mr. Wickens,—

I am sure it has given me very great pleasure to listen to this paper on the handling of various substances.

There is one point in the paper that I do not quite grasp. Of course in handling crushed stone or coal if you handle it with a belt the sides of the belt are curved, and when you want to unload the material into a certain bin you put a tripper on and spill the material into the bin. The point that struck me was, that the tripper would hurt the belt, or would not clean it off properly, and I would like to know how the belt could be unloaded at different places successfully without injuring it. There is another point which is very often inquired about, especially with belt conveyors, as to how much elevation you can give the belt and move stuff along. These are points I would be very pleased to get a little information on, as I do not know enough about the matter to make an intelligent answer when asked.

There is no question that if conveyors are used that are incased, in place of belts, either a worm or scraper conveyor, openings can be made in these cases, and material put in bins at various places without so much injury to the conveyors.

There is no question in anybody's mind who has followed mechanics that the mechanical handling of material is very much better than the handling of material by hand.

A few years ago the first elevators were used for handling material in saw mills, the first thing we saw was the log jack, aside from elevating material in flour mills or other soft material which is easy to handle was the log jack, and I believe that was the father of handling all other goods by power. But I would like very much if Mr. Archer could tell us how we could unload a belt at various places without injuring the belt, and also how much elevation to give the belt in order to carry the material over succe,sfully.

Mr. Archer,—

The question of discharge from belt conveyors at various points has always been a difficult one. The solution to the problem has been a reversible belt tripper. The belt tripper consists of an iron frame into which pulleys on shafts are set. (Mr. Archer made a sketch on the blackboard of a reversible belt tripper.

In reference to the inclination of conveyors, there has always been a certain amount of discussion. In our practice we consider 25 degrees is the maximum. Over 25 degrees you run a certain amount of risk, we have them running as high as 32 degrees, but they are liable to give trouble.

Mr. Lewkowicz,—

In reference to handling coke by inclined belt conveyors we found that we could not handle it at 20 degrees. At 15 degrees we found we could handle it without any difficulty. We also found that no matter at what speed we ran the belt, the coke would have a tendency to slip, and only a certain percentage of it would come up, and the belt wore out very rapidly. Of course coke is very hard to handle under any circumstances

Mr. Archer,—

The handling of coke is a proposition we do not like to discuss. It is one of the few materials which are very difficult to handle by means of conveyors.

Coke and ashes present the most difficult problems in the conveyor line.

On an incline conveyor where cinders are to be handled, which present the same difficulties as coke, we use beaded flight conveyors, details of which I explained earlier in the evening.

Mr. Lewkowicz,—

At what angle was this conveyor run?

Mr. Archer,—

At about 25 degrees. The beads across the belt seemed to help, and prevent the cinders from slipping. The beaded flight conveyor can be used for handling coke, the beads being about one inch across the flights. (Mr. Archer gave a sketch of this conveyor on the blackboard.)

Mr. Lewkowicz,—

The only way we found that we could handle coke on steep inclines satisfactorily was by continuous bucket conveyors. We have to handle them at about 50 degrees. I should like to know if there is any means of raising coke in a belt conveyor above 15 degrees?

Mr. Archer,—

The only method by which you can handle coke with a belt on an incline is to put straps across the belt, or beads, as I said before where the angle of inclination is such as to cause the coke to give trouble.

Mr. Jefferis,—

I would like to say for the benefit of the members, and also Mr. Archer, that the handling of coke by machinery is one of the most difficult propositions that I know of, and after battling with this problem for about eight years, with the very able assistance of Mr. Lewkowicz, I think we have hit on a coke conveyor that is second to none. I have visited the largest plants in the United States that do a similar class of work and I have never seen anything to touch it.

We quench the coke while it is travelling in the hot coke conveyor. We then crush it and convey it to storage bins. The conveyor we have necessitates the use of fans, etc., on account of the steam rising from the quenching of the coke. I think Mr. Lewkowicz has got as near perfection in the matter of handling hot coke as anything on the market.

Mr. Lewkowicz,—

If I can be of any assistance to Mr. Archer I should like to make a sketch on the blackboard, and describe the hot coke conveyor that we have in use. (Mr. Lewkowicz made a sketch on the blackboard, and described the hot coke conveyor.)

Mr. Lewkowicz,—

I should like to know what is the cost of handling material per ton, per mile, or 1,000 feet getting it down to some unit, also the cost of maintenance per ton, per mile or 1,000 feet so that we can find out from these figures whether we are working in the right direction to eliminate the troubles of the people to whom we furnish conveyors. If there is anybody here who can give me a little enlightenment along these lines, I shall be pleased to hear from him, so that we can get some particulars to compare one with another.

Mr. Archer —

The only details I have before me to-night are the details of the Peoria Gas and Electric Co., and in that case we handled 30 tons at a cost of 40 cents.

Our friends have reported to us that they are saving $10,000 per year on the installation. We have not any figures on the cost of maintenance, but we know there is a tremendous saving. I have referred to an ash conveyor. Before the installation of that conveyor our friends had four or five men to elevate their ashes to the street, and after the installation of the conveyor it was necessary to have only one man to shovel ashes into the hopper. From there it was taken automatically and elevated 48 feet and discharged into a cart, and after we have had the system running for a while we should be able to give you some very interesting figures on the cost of handling ashes by machinery in this case.

Mr. Herring,—

You spoke of the life of the belt. I should like to know how the tripping apparatus will affect this

With regard to the rollers at the end of the drums, these are say 30 inches in diameter and ample for minimum bending. There is a double bending movement in the belt, bending first one way and then the other over the tripping apparatus. This is a very quick operation and I would like to know how it affects the life of the belt.

Mr. Archer,—

I cannot give you any definite information on this point. We have a large number of belts running from three years and up. We have some 42 inch belts 1,200 feet centres in a Montreal grain elevator, and to my personal knowledge these belts have been in four years and show no signs of wear. On the other hand a Hamilton concern has a 30 inch belt handling crushed stone which only lasted a few months, owing to the fact that they did not discharge the stone properly on to the belt.

It is an important point when designing belt conveyors to be very careful to place your chutes in such a way as to prevent a product, such as crushed stone, from cutting the belt. The life of a belt varies according to the material handled.

Mr. Dabner,—

I would like to inquire what experience you have had in handling of red hot material, such as red hot clinkers from cement furnaces, where you cannot cool it off.

Mr. Archer,—

The handling of hot clinkers requires very careful consideration. Usually the hot clinkers of cement plants are handled by what is known as the pivoted bucket conveyor, which consists of buckets hung centrally on two strands of chains the material being discharged into the buckets holding possibly half a cubic foot. This has been the most successful method of handling hot clinkers in cement factories

Mr. Jefferis,—

Replying to Mr. Lewkowicz's remarks as to the saving made by conveyors. I may say that there is one point against the contractor or conveyor manufacturer, that is, in the majority of cases he does not have continuous work for his conveyors, that is, the conveyors cannot be worked to their utmost capacity continuously, therefore you do not get the greatest benefit that could be derived from their continuous operation.

I know of one firm which during twelve months of operation of conveyors have been able to save by the conveyors over the old method of handling by cars and ordinary labor, $40,000, so that when the question comes up, "Do conveyors pay?" the answer is, "They do if properly managed."

Any man who goes into a large institution where conveyors are in operation and thinks for a moment what it would mean if the material had to be handled by the old style methods and the length of time it would take to do it, he would not need to have an expert tell him whether conveyors save money for the company or not.

Mr. McRobert,—

In short distances do the conveyors work, say the distance is about 10 or 20 feet?

Mr. Jefferis,—

The conveyor is made to operate at any distance, but for the short distance you mention if you can get elevation it would be better to put in a chute.

Mr. Archer,—

For the short distance mentioned where there is sufficient elevation a chute is the most desirable. The law of gravity is the best conveyor we have, but if you cannot get elevation it is best to put in a small elevator and discharge it over the head pulley or sprocket.

Mr. McRobert —

There is plenty of elevation.

Mr. Archer —

Then the best method is a chute.

Mr. Lewkowicz,—

There is one thing that was overlooked. It was not only the cost of material that I was seeking information about, but also the cost of maintenance, the fact that the conveyor is only used during a part of the day does not, I think, increase the cost of maintenance. It was the average of the two that I was trying to get some information about.

I have put in a number of conveyors in a great many plants, and they have ordered more, but we have never been able to find out what they save on the cost of labor, and I have not gained any further information to-night.

Mr. Baldwin,—

I would like to move a very hearty vote of thanks to Mr. Archer for the very able paper which he has read to-night. Seconded by Mr. Fletcher, carried unanimously.

Secretary,—

I would like to say that Mr. Archer has been kind enough to come forward and offered to give us another paper on some other subject at a future meeting.

Mr. Baldwin,—

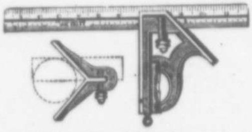
You will notice on the list of orders of business there is one order, which, to my mind has been left out, and that is "General Business." With your permission I would like to move under the head of "General Business," Mr. Chairman, that you appoint the Executive Committee to act in conjunction with the Entertainment and Reception Committee to arrange for a Smoking Concert to be held some time in October, and for this Committee to report at our next meeting.

Mr. Lewkowicz,—

I heartily second that motion. Carried.

Moved by Mr. Lewkowicz, seconded by Mr. Wickens, that the meeting be adjourned. Carried.

"CANADA'S LEADING TOOL HOUSE"



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