July 12, 1966 L. M. SHERIDAN 3,260,352

RAILWAY ELEVATOR FOR TRANSPORTING MATERIAL UP AN INCLINE

Filed Sept. 25, 1964 3 Sheets-Sheet 1

FIG. 1

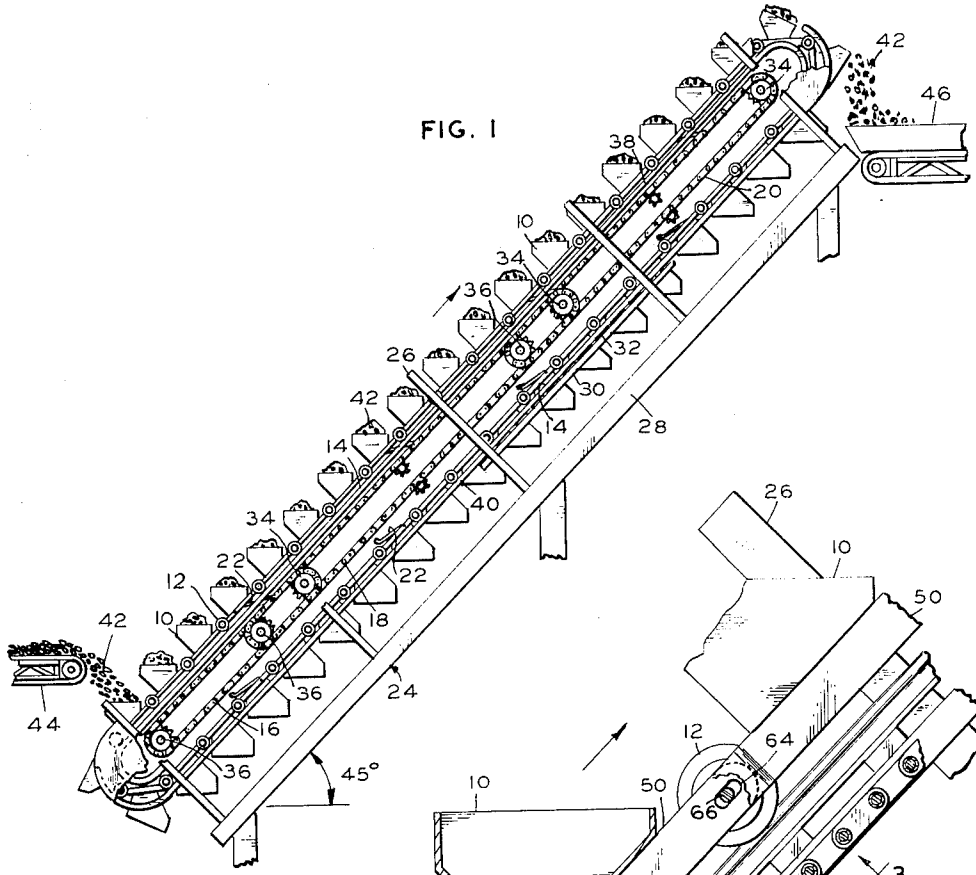

FIG. 2

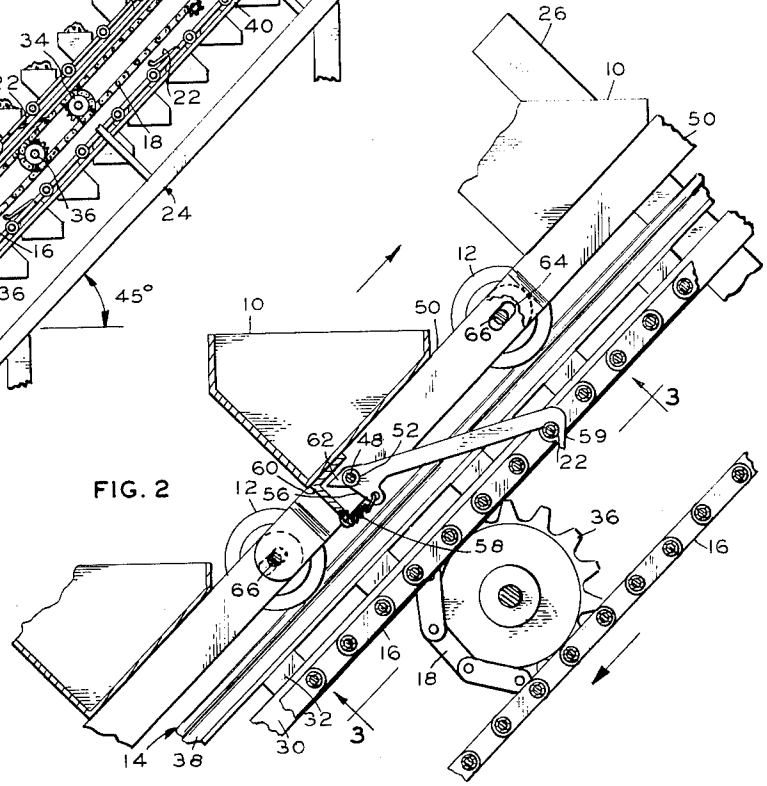

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FIG. 3

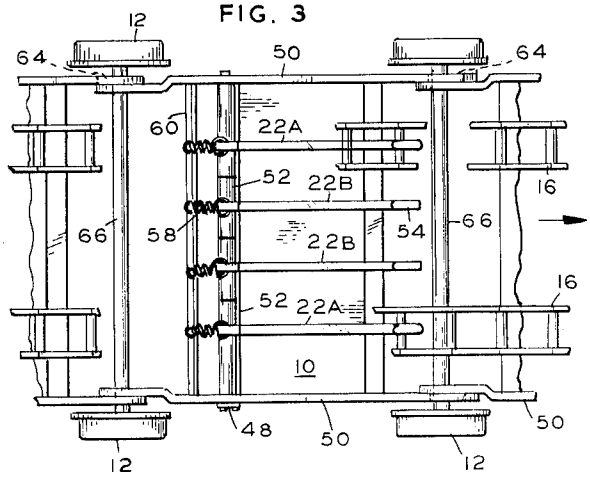


FIG. 4

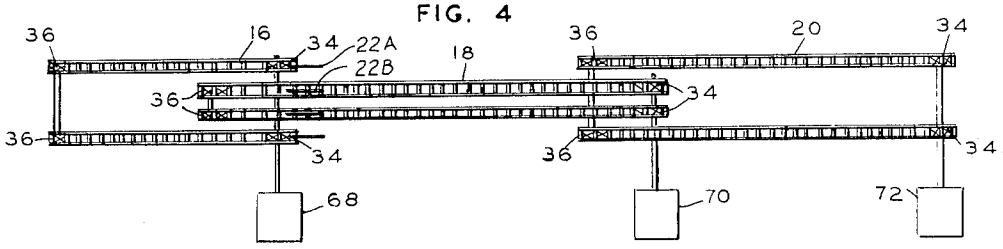


FIG. 4A

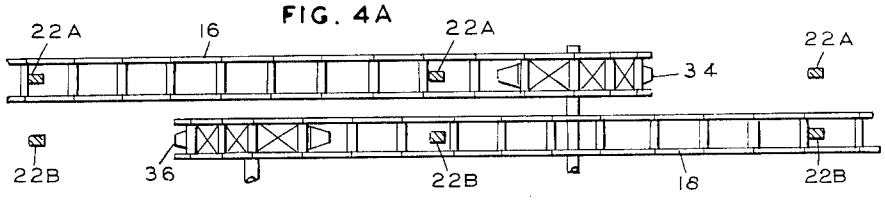


FIG. 5

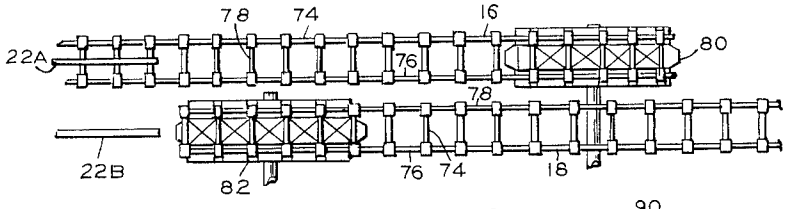
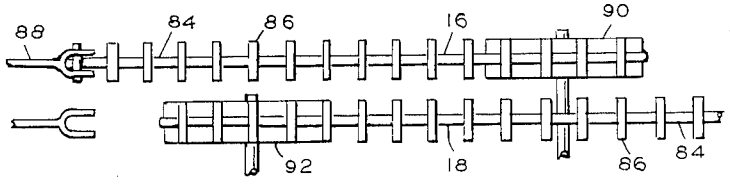


FIG. 6



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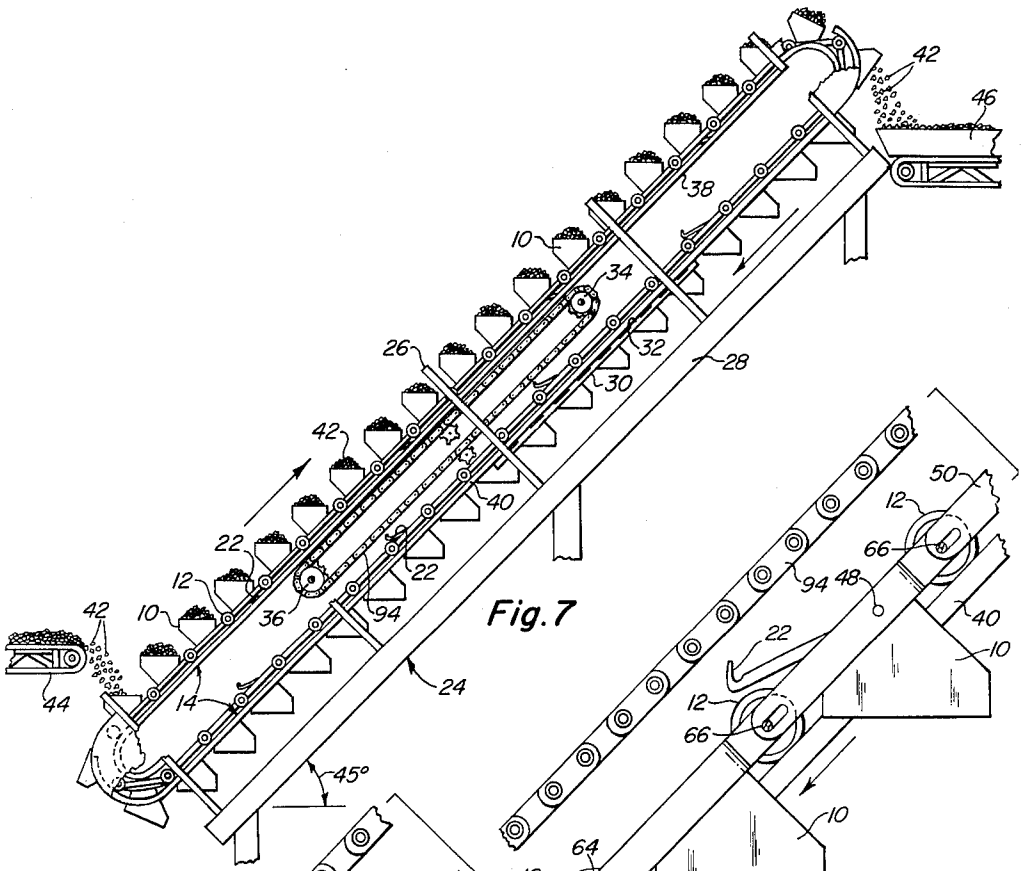

Fig. 7

Fig. 8

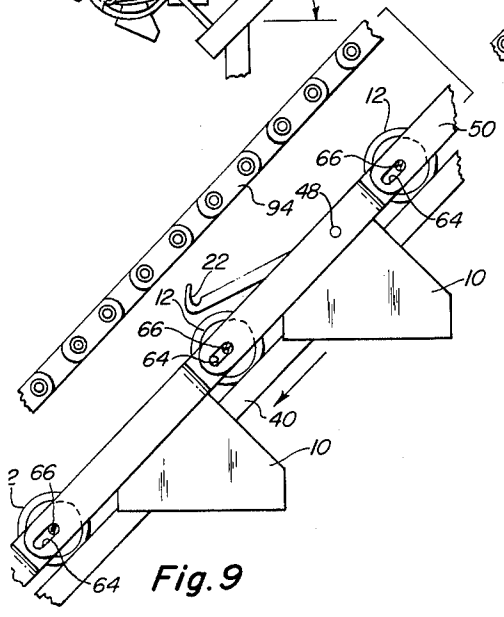

Fig. 9

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3,260,352

RAILWAY ELEVATOR FOR TRANSPORTING MATERIAL UP AN INCLINE

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Filed Sept. 25, 1964, Ser. No. 399,240
11 Claims. (Cl. 198—140)

The subject matter of the present invention relates generally to transportation devices for bulk material, and in particular to a railway elevator including an endless train of interconnected bucket containers which are moved on wheels along an inclined track by a single drive system, or a plurality of overlapping drive systems and means for transferring the containers from one drive system to another.

The bucket elevator railway of the present invention is especially useful in open pit mining to transport the mined ore over great vertical distances from the bottom of the pit up an incline to the top of such pit, or to some other elevated position, where the ore can be loaded into trucks for further transportation. This elevator eliminates the necessity of providing and maintaining a roadway down the side walls of the pit sufficient to enable trucks to travel to the bottom of the pit for loading and to haul the ore back to the top of such pit, and is much faster than attempting to transport the ore out of the pit by means of such trucks. However, the elevator may also be used over shorter distances to feed material at a fast rate to blast furnaces in steel mills, or the like.

The bucket elevator of the present invention has several advantages over conventional bucket elevators due to the fact that it employs lost motion connections between at least some of the buckets which reduce the tension in the train of buckets and uses tracks to distribute the load of the bucket train between the track and drive means. In addition, one embodiment of the present elevator employs several overlapping endless drive systems. This allows the present bucket elevator to carry heavier loads at faster speeds up longer vertical distances than conventional bucket elevators having components of the same size. There is less shock transmitted to the bucket train at the upper and lower ends of the elevator because the train travels around a semicircular track portion at such ends, instead of around a chain sprocket as in conventional bucket elevators. The lost motion connections between bucket links compensate for any tendency of the bucket train to elongate because of wear so that no take up adjustment is required. Also, the lost motion connections compensate for any differences in pitch length between the bucket links or between the drive chain links caused by manufacturing tolerances or differential wear so that such differences do not prevent the bucket hooks from properly engaging the drive chains. Furthermore, the lost motion connections reduce the shock transmitted to the bucket hooks and the drive system when the hooks engage such drive system because due to the slack in such connections at the beginning of the drive system, the weight of only one bucket is picked up at a time by the drive system. The weight of the next following bucket in the group is not picked up until the drive chain moves a few inches forward from the position of initial engagement with the attachment hooks of such group.

One embodiment of the bucket elevator of the present invention employs the lost motion connections between bucket containers to enable the containers to be transferred from one drive system to another without breaking the connection between such containers. This allows different groups of bucket containers, separated

by sets of hooks attached to such containers for engagement with the drive systems, to be effectively driven by different drive systems so that the total force exerted on each one of the plurality drive systems is substantially less than that which would be exerted on a conventional single drive system. Heretofore, when material was to be transported up a steep incline for a long distance, it was necessary to provide several intermediate reload station between conventional bucket elevators or conveyor systems, because it was not practical to make one large conventional conveyor system which was capable of transporting a heavy load over this great a distance. The present bucket elevator will accomplish this with a single drive system over a distance of about 200 to 400 feet without the need for reload stations since there there is less tension in the train of buckets and less load carried by the drive means. However, when a plurality of overlapping, standard size drive systems are employed to distribute the load between such drive systems, the present elevator is capable of transporting 40 tons of ore per minute up an incline of 45° for a distance of 600 feet or more. In addition, the present bucket elevator is of a simple and reliable construction which is inexpensive to manufacture and requires little maintenance.

Therefore, one object of the present invention is to provide an improved device for transporting bulk materials.

Another object of the invention is to provide an improved railway elevator capable of transporting a heavier load up an incline over longer distances.

A further object of the present invention is to provide an improved bucket elevator capable of transporting bulk material up an incline continuously at a high rate of speed.

A still further object of the invention is to provide an improved elevator including a train of buckets connected together by lost motion connections and driven by a drive system up an incline along a track to decrease the tension in the bucket train and to decrease the load on the drive system in order to enable such elevator to be of a greater length.

Still another object of the invention is to provide an improved bucket elevator of simple and reliable construction which is relatively inexpensive to manufacture and requires less maintenance.

An additional object of the present invention is to provide an improved bucket elevator in which a plurality of overlapping drive systems are employed, along with a plurality of bucket containers which are fastened together by lost motion connections in order to transport heavy loads over greater vertical distances than conventional bucket elevators.

Additional objects and advantages of the present invention will be apparent from the following detailed description of a preferred embodiment thereof and from the attached drawings of which:

FIG. 1 is a side view of the preferred embodiment of the bucket elevator of the present invention with parts broken away for clarity;

FIG. 2 is an enlarged view of a portion of FIG. 1 with parts broken away for clarity;

FIG. 3 is a view taken along the line 3—3 of FIG. 2;

FIG. 4 is a schematic diagram of one embodiment of the conveyor drive mechanism employed in the bucket elevator of FIG. 1;

FIG. 4A is an enlarged view of a portion of the drive mechanism of FIG. 4 showing the position of the bucket hooks with respect to the chain links of such drive mechanism during transfer of the bucket containers from one conveyor system to another;

FIG. 5 is a schematic diagram of a portion of another embodiment of the drive mechanism of FIG. 4;

FIG. 6 is a schematic diagram of a portion of a third embodiment of the drive mechanism of FIG. 4;

FIG. 7 is a side view of another embodiment of the bucket elevator of the present invention;

FIG. 8 is an enlarged view of a portion of the bucket train of FIG. 7 adjacent the upper end of the down side of such train with parts broken away for clarity; and

FIG. 9 is a view similar to FIG. 8 of a portion of the bucket train adjacent the lower end of the down side of such train.

The bucket elevator of the present invention includes briefly a plurality of bucket containers **10** that are capable of holding large quantities of bulk material, such as crushed ore rock, which are mounted on wheels **12** and connected together in a manner hereafter described to form a continuous train of bucket containers. These containers are moved on their wheels around a closed path along an inclined track **14**. The drive mechanism for the bucket containers **10** is in the form of a plurality of overlapping drive systems which may include a first drive system **16**, a second drive system **18** and a third drive system **20**. A plurality of sets of hooks **22** are attached to certain ones of the bucket containers **10** in order to divide such containers into groups which may each include four or five containers, and to connect each of such containers to one of the conveyor systems so that movement of the drive systems causes such bucket containers to move up the incline track **14**.

A support frame **24** may be provided to support the track **14** and drive systems **16**, **18** and **20** above the ground on an incline of, for example, 45 degrees. This support frame may includes a plurality of posts **26** extending perpendicularly to a base member **28** and positioned in spaced relationship along the track **14**. A plurality of beams **30** are attached between the posts **26**, substantially parallel to the base **28** at positions slightly below the upper and lower portions of the track so that the rails forming such track may be supported on a plurality of support elements **32** similar to railroad ties which are attached to the top of the beams. Of course the support elements **32** do not extend completely across the track because the hooks **22** must travel between the track rails. The drive and idler sprockets **34** and **36**, respectively, of the conveyor systems are also supported on the frame **24** by attachment of the opposite ends of their shafts to the beams **30**.

The track **14** may be in the form of a pair of parallel metal rails which are supported on an incline to provide a continuous, closed path for the wheels **12** of the bucket containers. The track includes an upper portion **28** and a lower portion **40** which extend in substantially straight parallel lines along opposite sides of the conveyor systems until they reach the lower end of the first conveyor system **16** and the upper end of the third conveyor system **20** where they curve inward toward each other to form semicircular end portions. The radius of curvature of each of the ends of the lower track portion **40** is greater than that of the ends of the upper track portion **38** and these ends overlap for a sufficient distance to allow transfer of the wheels of the bucket containers from one track portion to another as such containers move around the corners of the track. Thus, as the empty bucket containers **10** travel by gravity down the lower track portion **40** in an upside-down position and reach the lower curved end of such track portion, the wheels of the bucket containers are guided around the corner of the track until such wheels are transferred to the curved lower end of the upper track portion **28**. As the empty bucket containers turn to a right-side-up position and proceed up the track, the hooks **22** engage the drive chains of the first conveyor system **16** and such containers are filled with crushed ore rock or other load material **42** by passing beneath the usual loading device **44**. This loading device may be in the form of an apron feeder having a discharge chute for directing the flow of material from such feeder into the bucket containers. The filled containers are driven up the inclined track by the drive system **16**, **18** and **20** until they reach the upper end of track portion **28** which is curved to guide the wheels **12** of the containers around the corner of the track and to trasfer such wheels to the lower track portion **40**. This causes the bucket containers to turn upside down and to discharge their contents into the receiving chute of the conventional transporting device **46** which carries the material away from the bucket elevator. It should be noted that after discharge of the load material **42**, the bucket containers travel on down the lower track portion **40** by the force of gravity since the hooks **22** connecting them to the drive chains of the third drive system **20** are disengaged when such hooks pass over the drive sprockets **34** of the third drive system.

As shown in FIG. 2 and 3, each set of hooks **22** includes two pairs of hooks **22A** and **22B** which are mounted for pivoting about a shaft **48** that is rigidly secured at its ends between a pair of connecting links **50**. The connecting links are attached to the sides of the bucket containers in a spaced parallel relationship so that they extend from the front to the rear of such containers. The hooks **22** are uniformly spaced along the shaft **48** by four spacer sleeves **52** which are mounted for rotation on such shaft and may be secured to the hooks intermediate ends of such hooks by welding or the like. One end of each of the hooks **22** is provided with an outwardly extending prong portion **54** which forms an angle of approximately 90° with the main portion of such hook and is shaped to engage the connecting rollers of the drive chains. Each of the hooks **22** may also be provided with an outwardly extending arm portion **56** adjacent the spacer sleeve **52**. A coil spring **58** is employed to resiliently urge each of the hooks toward the drive chains of the drive systems. This spring has one end secured in an opening through arm portion **56** and its other end secured through an opening in an L-shaped bar **60** which is suitably secured between the connecting links **50** thereof at a position slightly behind and above the hook shaft **48**. Thus the coil spring **58** is under tension and exterts a force upon the hook **22** which pivots such hook clockwise, downward into engagement with the conveyor chain. The rear end of the hook **22** is provided with a stop surface **62** which engages the stop side of the L-shaped bar **60** remote from the spring **58** when the hook end portion **54** is not in engagement with a conveyor chain, such as when the bucket containers are riding on the lower track portion **40**.

The connecting links **50** are each provided with an elongated slot **64** in the front end portion of such link through which the axle **66** of one pair of wheels **12** extends. This same wheel axle also extends through a smaller circular opening in the rear end portion of the next preceding connecting link. The rear end portion of the connecting links **50** is displaced slightly inward from the front end portion but extends parallel thereto in order to allow the front portions of consecutive links **50** to lie in substantially the same plane. Thus, the elongated slot **64** at the front end of each of the connecting links **50** provides a lost motion connection between the bucket containers **10**. This lost motion connection allows slack movement between the bucket containers to enable the transfer of such containers from one drive system to another and to reduce the shock transmitted to the first drive system and the bucket hooks when the weight of the buckets is first applied to the drive system for the reasons mentioned above.

As shown in FIG. 4, the three drive systems **16**, **18** and **20** are positioned so that they overlap with the drive chains of the first and second drive systems being positioned outside opposite ends of the second drive system **18**. The two outside hooks **22A** are positioned so that

they can only engage the chain links in first and third drive systems **16** and **20**, while the two inside hooks **22B** are positioned so that they will only engage the chain links of the second drive system **18**. Thus, the groups of bucket containers **10** are first driven up the track **14** by the drive chains of drive system **16** due to engagement of the outer pair of hooks **22A** with such chains. The inner pair of hooks **22B** is disengaged until they reach the overlap portion of drive system **16** with drive system **18**. As shown in FIG. 4A, the inner pair of hooks **22B** is resiliently urged by springs **58** into position between the rollers on the chain links of the second conveyor system **18** after passing over the idler sprocket **36**. However, the inner pair of hooks **22B** does not engage such rollers until after the outer pair of hooks **22A** are disengaged from the first drive system **16** when they pass over the drive sprocket for such first drive system. In order to prevent the prong ends of the inner pair of hooks **22B** from striking the top of the rollers of the chain of drive system **18** or from otherwise engaging such rollers during the overlap portion of the first and second drive systems, the chains of such drive systems are driven out of phase with each other.

After the teeth of the drive sprocket **34** have pushed out the prongs of the outer pair of hooks **22A** from engagement with the chains of the first drive system **16**, the group of bucket containers moves back a short distance until the inner pair of hooks **22B** engages the chains of the second drive system **18**. This backward movement is cumulative in that the total amount of movement increases for each transfer of the bucket containers from one drive system to another due to the fact that such backward movements are added together. Thus, if the lost motion connection afforded by slot **64** were not present to allow slack movement between the bucket containers, the connecting links **50** would eventually break.

As shown in FIG. 4, the drive sprocket **34** of each of the drive systems **16**, **18** and **20** may be driven by a separate electric motor **68**, **70** and **72**, respectively. The chains of the first drive system **16** may be shorter than that of the remaining systems so that the length of such drive system is appropriately equal to that of one group of bucket containers. The chains of the first drive system may be driven at a slightly greater speed than that of second drive system **18** in order to introduce slack into the lost motion connections between the bucket containers in the groups of buckets driven with the second drive system by pushing such bucket containers together with the group of buckets driven with such first drive system. This allows the chain of the third drive system **20** to move at substantially the same speed as that of the second drive system while permitting the transfer of bucket containers from the such second drive systems to the third drive system. Of course, the second and third drive systems may be driven at the same speed by connecting the drive sprocket of the second drive systems to the idler socket of the third drive system with appropriate gearing. In addition it is also possible to move the second drive system **18** at a faster speed than the first drive system **16** and at a slower speed than the third drive system **20** so that the hooks **22** of the bucket chain are transferred from one drive system to another before they reach the head sprockets of the drive systems to eliminate the wear on the sprocket teeth and hooks caused by camming action of such teeth removing the hooks from the drive chains. Also, more than three drive systems may be employed and the size of the groups of containers can also vary.

Another embodmient of the drive mechanism **16**, **18** and **20** is shown in FIG. 5 which includes a pair of cables **74** and **76** connected together by a plurality of links **78** in place of each drive chain. The links are rigidly secured to the cables at the opposite ends of such links to prevent their movement on such cables. For a more positive drive these links **78** may be provided at regular intervals along such cables and toothed pulleys **80** and **82** may be provided in place of the drive sprocket **34** and idler sprocket **36**, respectively. This may be advantageous since such a cable drive will provide greater tensile strength and may be more economical to operate than a chain drive.

Still another embodiment of the drive mechanism is shown in FIG. 6 which includes a single cable **84** having a plurality of lugs **86** attached thereto in place of each drive chain. The lugs **86** may be attached at regular intervals along the cable **84** and extend from both sides of such cable. Such lugs may be engaged by a modified hook **88** which has a Y-shaped prong end so that each hook is provided with a pair of hooked prongs adapted to fit on opposite sides of the cable **84** in engagement with the lug **86**. In order to provide positive drive for the cable **84**, it may be necessary to employ a pair of notched pulleys **90** and **92** for the driver sprocket and idler sprocket, respectively.

Another embodiment of the bucket elevator or conveyor of the present invention is shown in FIGS. 7, 8 and 9 and is similar to that of FIG. 1 so that the same reference numerals have been used to identify corresponding parts. The bucket elevator of FIG. 7 differs from that previously described by using only a single drive system **94** which may be in the form of a double chain or cable, such as that shown in FIGS. 4, 5 and 6. This drive system is supported adjacent the up side of the bucket train between the upper and lower ends of such train so that the hooks **22A** of the bucket train engage the upper side of the drive system in a similar manner to that shown in FIGS. 2 and 3. Of course, the second pair of hooks **22B** can be eliminated when a single drive system is employed because they are no longer used to transfer the buckets to another drive system.

In the bucket elevator of FIG. 7, the lost motion connections provided by the slots **64** in links **50** still serve a function since they reduce the amount of tension in the bucket train. The weight of the empty buckets **10** on the down side of the track **14** acts to pull the filled buckets located on the up side of the track between the drive system and the upper end of the track, around the upper end of such track and causes the links **50** of these buckets as well as those of the empty buckets on the upper portion of the track to be pulled apart so that the wheel axles **66** engage the leading end of the slots **64**, as shown in FIG. 8. At the same time the weight of the empty buckets acts to push the empty buckets around the lower end of the track and to push the filled buckets up the track toward the drive chain **94**, and causes the links of these buckets to be pushed together to move the wheel axles to the other end of the slots, as shown in FIG. 9. Thus, the bucket train is under compression at the lower portion of the train and is under tension at the upper portion of such train. This produces slack in the lost motion connections at the beginning of the drive system **94** to reduce the shock transmitted to such drive system and to the bucket hooks when the weight of the buckets is initially applied to the drive system, for the reasons discussed above. At the equilibrium position about midway of the down side of the track the bucket links change from the tension condition of FIG. 8 to the compression condition of FIG. 9. Therefore, the weight of only about one half of the empty buckets acts on the links under tension, and the stress of such tension is greatly reduced. In addition, the weight of the entire bucket train is distributed between the drive chain **94** and the track so that much of such weight is supported by the upper and lower ends of the track. As a result, the bucket elevator of FIG. 7 can carry heavier loads up greater vertical distances at faster rates of speed than conventional bucket elevators having components of comparable size.

It will be obvious to those having ordinary skill in the art that many changes may be made in the details of

the preferred embodiment of the present invention without departing from the spirit of the invention. For example, lost motion connections need not be used between every pair of bucket links, and the hooks 22 could be replaced by lugs on the drive chains or cables which engage members on the bucket train for imparting movement to such train. Therefore, the scope of the invention should be determined by the following claims.

I claim:

1. Elevator apparatus, comprising:
a plurality of container members,
connection means for connecting said container members together in succession to enable movement of said container members together in a common closed path having upward and downward inclined portions and including lost motion connections to permit slack movement between at least some of said container members,
drive means supported along the upward inclined portion of said common path to provide a drive at the upward inclined portion for moving said container members along said common path, and
attachment means for releasably attaching said container members to said drive means so that the container members are moved upward attached to the drive means and are moved downward by gravity to produce slack in the lost motion connections at the beginning of the drive means.

2. Elevator apparatus, comprising:
a plurality of bucket container members,
connection means for connecting said container members together in an endless train to enable movement of said container members together in a common closed path of fixed length having upward and downward inclined portions and including lost motion connections between at least some of said container members to permit slack movement between said container members,
guide means for limiting the movement of said container members to said common path,
endless drive means supported along the upward inclined portion of said common path to provide a drive at said upward inclined portion for moving said container members along said common path, and
attachment means for releasably attaching said container members to said drive means so that the container members move upward attached to the drive means and move downward unattached to said drive means at least during the lower portion of the downward path to enable the production of slack in the lost motion connections at the beginning of the drive means.

3. Railway elevator, comprising:
a plurality of container members mounted on wheels,
connection means for connecting said container members together in a train to enable movement of said container members together in a common path of fixed length having an inclined portion and including slotted links as lost motion connections to permit slack movement between at least some of said container members,
a track having an inclined portion and supported adjacent said common path in position to engage the wheels of said container members,
drive means supported along the upper side of said inclined portion of said track to provide a drive for moving said container members along said common path, and
attachment means for releasably attaching said container members to said drive means so that the container members move upward attached to the drive means and move downward unattached to said drive means at least during the lower portion of the downward path to enable the production of slack in the lost motion connections at the beginning of the drive means.

4. Elevator apparatus, comprising:
a plurality of container members,
connection means for connecting said container members together in succession to enable movement of said container members together in a common path having an inclined portion and including lost motion connections between at least some of said container members to permit slack movement between said container members,
a plurality of drive means supported consecutively along said inclined portion of said common path for moving said container members along said common path, and
attachment means for releasably attaching said container members to said drive means at points spaced along said drive means so that some of said container members are driven by one of said drive means and other of said container members are driven by another of said drive means, and for transferring said container members from one drive means to another along said common path, said attachment means being of a type so that the container members move upward attached to the drive means and move downward unattached to said drive means at least during the lower portion of the downward path to enable the production of slack in the lost motion connections at the beginning of the drive means.

5. Elevator apparatus, comprising:
a plurality of container members,
connection means for connecting said container members together in a train to enable movement of said container members together in a common closed path of fixed length having an inclined portion and including lost motion connections between at least some of said container members to permit slack movement between said container members,
a plurality of separate endless drive systems supported consecutively along the upper side of said inclined portion of said common path for moving said container members along said common path, and
attachment means for releasably attaching said container members to said drive systems at points spaced along said drive systems so that some of said container members are driven by one of said drive sysems and other of said container members are driven by another of said drive systems, and for transferring said container members from one drive system to another at their overlapping portions, said attachment means being of a type so that the container members are moved upward attached to the drive means and are moved downward by gravity to produce slack in the lost motion connections at the beginning of the drive means.

6. Elevator apparatus, comprising:
a plurality of container members,
connection means for connecting said container members together in a train to enable movement of said container members together in a common closed path having an inclined portion and including lost motion connections between at least some of said container members to permit slack movement between said container members,
a plurality of separate drive means supported consecutively along said inclined portion of said common path to provide a substantially continuous drive for said container members along said inclined portion of said common path,
attachment means for releasably attaching said container members to said drive means at points spaced along said drive means so that some of said container members are driven by one of said drive means and other of said container members are simultaneously driven by another of said drive means, and for transferring said container members from one drive means to another of their overlapping portions to move said container members along said common path, and

power means for moving at least some of said drive means at different speeds to drive the container members so that said container members move along said common path without exceeding the limits of said slack movement between said container members.

7. A bucket elevator, comprising:

a plurality of bucket containers,

means for connecting said containers together in succession to enable movement of said containers in a common closed path having an inclined portion and including lost motion connections between at least some of said containers to permit slack movement between said containers,

a track having an inclined portion and supported to guide the movement of said containers along said common path,

a plurality of separate endless drive devices supported consecutively along at least said inclined portion of said track so that a portion of each of said drive devices overlaps a portion of the next consecutive conveyor device to provide a continuous drive for moving said containers along said track,

means for releasably attaching said containers to said drive devices at points spaced along said drive devices so that some of said containers are driven by one of said drive devices and other of said containers are driven by another of said drive devices, and for transferring said containers from one drive device to another at their overlapping portions, and

means for moving a first one of said drive devices at the bottom of said track at a higher velocity than a second one of said drive devices to cause slack in the connection between containers driven by said second drive device to drive the containers so that said containers move from one conveyor device to another along said common path without exceeding the limits of said slack movement between said containers.

8. Railway elevator apparatus, comprising:

a plurality of material carriers connected together to form a train of carriers, each of said carriers including a container, a pair of support members attached to the opposite sides of said container so that said support members extend substantially parallel to each other from the front to the rear of said container, a shaft secured between said support members at one end thereof, and a pair of wheels secured to the opposite ends of said shaft for rotation, said carriers being connected together by an elongated slot through each of said support members adjacent the other end thereof through which the wheel shaft of the next consecutive carrier extends to form a lost motion connection which permits slack movement between said carriers,

a track of fixed length for said carriers having an inclined portion and including two pairs of rails which are positioned to engage the wheels of said carriers so that one of said pairs of rails forms an upper track portion and the other of said pairs of rails form a lower track portion to provide a common closed path for the movement of said carriers,

a plurality of separate endless drive systems supported adjacent said one pair of rails consecutively along said inclined portion of said common path, with a portion of each of said drive systems overlapping a portion of the next consecutive drive system to provide a continuous drive for said carriers along said upper track portion, and

means for releasably attaching certain of said carriers to said drive systems so that each of said drive systems drives at least one of said certain carriers, and for transferring said carriers from one drive system to another to move said train of carriers along said tracks.

9. Railway elevator apparatus, comprising:

a plurality of material carriers connected together to form an endless train of carriers, each of said carriers including a bucket container, a pair of support members attached to the opposite sides of said container so that said support members extend substantially parallel to each other from the front to the rear of said container, a shaft secured between said support members at one end thereof, and a pair of wheels secured to the opposite ends of said shaft for rotation, said carriers being connected together by an elongated slot through each of said support members adjacent the other end thereof through which the wheels shaft of the next consecutive carrier extends to permit slack movement between said carriers,

an inclined track of fixed length for said carriers, including two pairs of rails which are positioned to engage the wheels of said carriers so that one of said pairs of rails forms an upper track portion and the other of said pairs of rails form a lower track portion to provide a common closed path for the movement of said carriers,

a plurality of separate endless drive systems supported at the upper side of said track adjacent said one pair of rails consecutively along said common path, each of said drive systems including a drive chain, and a portion of each of said drive systems overlapping a portion of the next consecutive conveyor to provide a continuous drive for said carriers along said upper track portion, and a plurality of hooks secured to certain of said carriers which are spaced along the train of carriers to separate them into groups of carriers, at least one of the hooks on each of said certain carriers being positioned to engage one of said drive systems and at least one other of said hooks being positioned to engage the next of said drive systems so that different groups of carriers are driven by different drive systems.

10. Railway elevator apparatus, comprising:

a plurality of material carriers connected together to form an endless train of carriers, each of said carriers including a bucket container, a pair of support members attached to the opposite sides of said container so that said support members extend substantially parallel to each other from the front to the rear of said container, a shaft secured between said support members at one end thereof, and a pair of wheels secured to the opposite ends of said shaft for rotation, said carriers being connected together into a train of carriers by an elongated slot through each of said support members adjacent the other end thereof through which the wheel shaft of the next consecutive carriers extends to permit slack movement between said carriers,

an inclined track of fixed length for said carriers, including two pairs of rails having curved end portions which are positioned to engage the wheels of said carriers so that one of said pairs of rails forms an upper track portion and the other of said pairs of rails form a lower track portion to provide a common closed path for the movement of said carriers,

a plurality of separate endless drive systems supported at the upper side of said track adjacent said one pair of rails consecutively along said common path, each of said drive systems including a pair of drive chains with a portion of the chains of each of said drive systems overlapping a portion of the chains of the next consecutive drive system to provide a continuous drive for said carriers only along said upper track portion,

a plurality of hooks secured to certain of said carriers spaced along the train of carriers to separate them into groups of carriers, at least one pair of the hooks

on each of said certain carriers being positioned to engage the chains of one of said drive systems and at least another pair of said hooks being positioned to engage the chains of the next of said drive systems,

spring means for resiliently urging said one pair of hooks into engagement with said drive chains when said hooks are properly positioned with respect to one of said drive systems, and for enabling the removal of said one pair of hooks from said drive chains after said other pair of hooks is in position to engage said next drive system in order to transfer said groups of carriers from one drive system to another, and

means for moving the chains of said drive systems in synchronism and for moving the lowest drive system at a faster speed than the next drive system to cause slack in the connections between carriers to allow transfer of the groups of carriers from one drive system to another.

11. Railway apparatus, comprising:

a plurality of material carriers connected together to form a train of carriers, each of said carriers including a bucket container, a pair of support members attached to the opposite sides of said container so that said support members extend substantially parallel to each other from the front to the rear of said container, a shaft secured between said support members at one end thereof, and a pair of wheels secured to the opposite ends of said shaft for rotation, said carriers being connected together into a train of carriers by an elongated slot in each of said support members adjacent the other end thereof through which the wheel shaft of the next consecutive carirer extends to permit slack movement between said carriers,

an inclined track for said carriers, including two pairs of rails which are positioned to engage the wheels of said carriers so that one of said pairs of rails forms an upper track portion and the other of said pairs of rails form a lower track portion to provide

a common closed path for the movement of said carriers.

a plurality of separate endless drive systems supported at the upper side of said track said one pair of rails consecutively along said common path, each of said drive systems including at least one drive cable having a plurality of lugs secured at regularly spaced positions along the length of said cable, with a portion of the cable of each of said drive system overlapping a portion of the cable of the next consecutive drive system to provide a continuous drive for said carriers along said upper track portion,

a plurality of hooks secured to certain of said carriers spaced along the train of carriers to separate them into groups of carriers, at least one of the hooks on each of said certain carriers being positioned to engage the lugs on one of the said conveyors and at least another of said hooks being positioned to engage the lugs on the next of said conveyors, and

spring means for resiliently urging said one hook into engagement with said lug when said hooks are properly positioned with respect to one of said drive systems, and for enabling the removal of said one hook from said one drive system after said other hook is in position to engage a lug on the next drive system in order to transfer the drive of said groups of carriers from one conveyor to another.

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