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HIGH CAPACITY BUCKET ELEVATOR

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FIG. 1

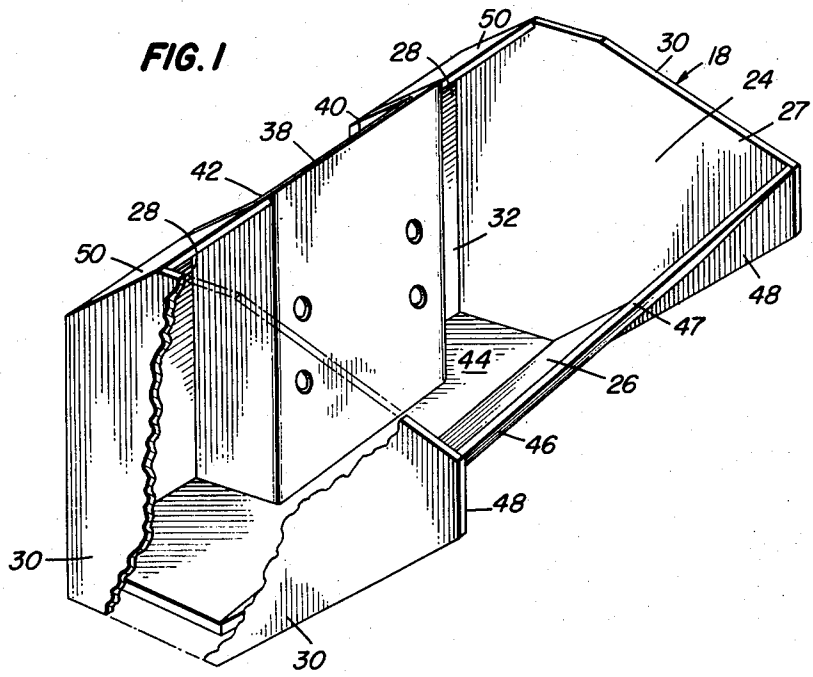
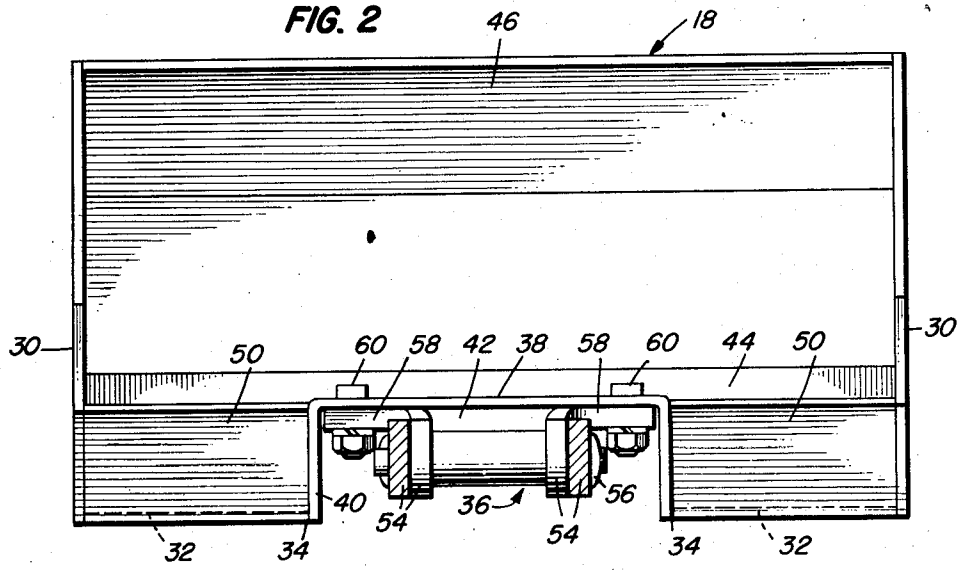


FIG. 2



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FIG. 3

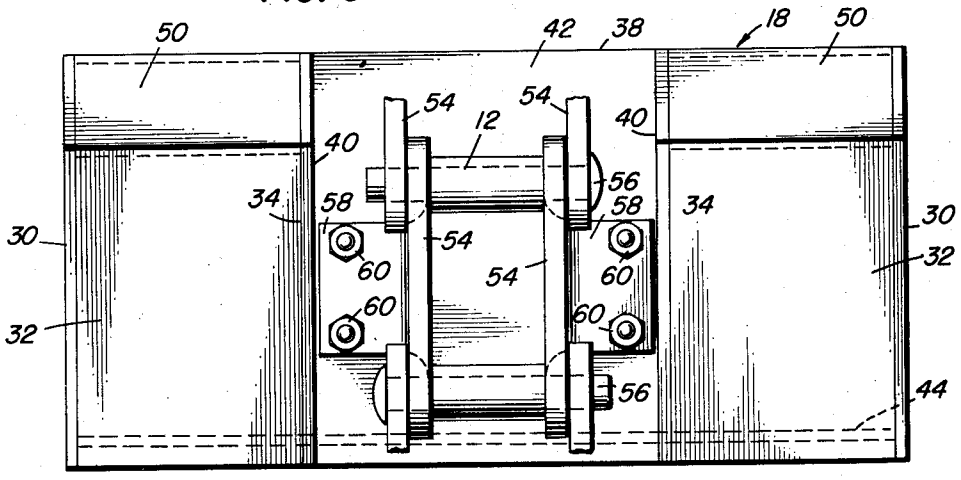
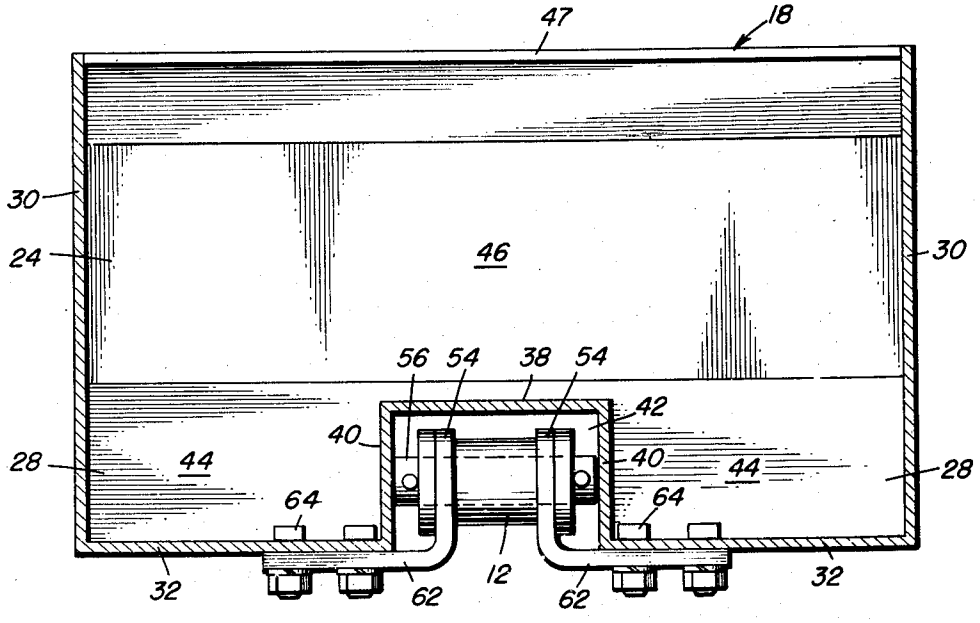


FIG. 4

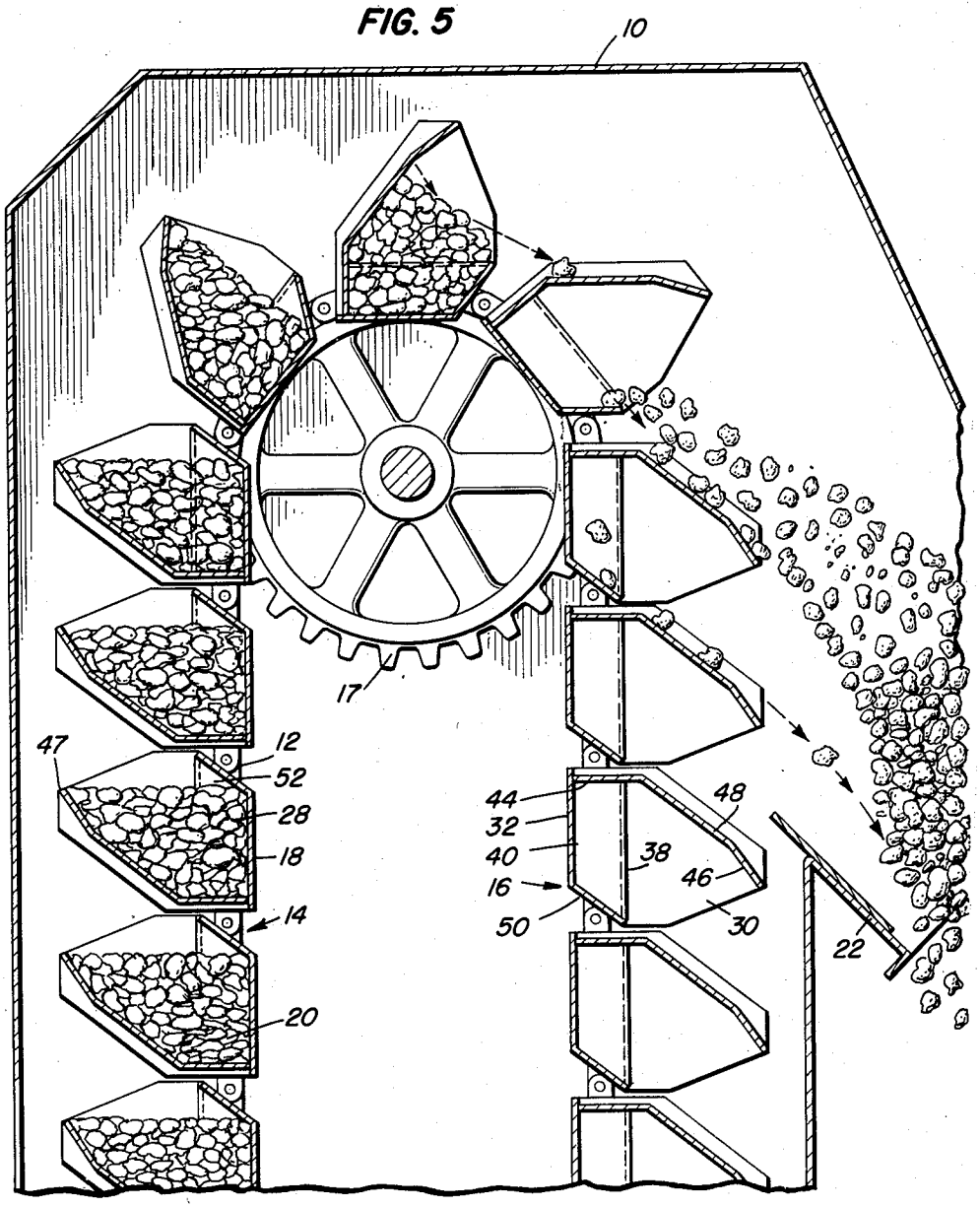


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FIG. 5



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HIGH CAPACITY BUCKET ELEVATOR

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5 Claims. (Cl. 198—152)

This invention relates to bucket elevators, and deals more particularly with the construction of a bucket designed to increase the material handling capacity of such elevators.

Bucket elevators are widely used in industry for lifting loose bulk materials such as coal, grain and cement from one level to another to, for example, allow its flow by gravity to points of further treatment or storage. Usually, these elevators comprise a vertical casing inside of which are one or more endless strands trained around upper and lower sprocket wheels for movement in ascending and descending runs. To the strands, at spaced points along the length thereof, are attached a plurality of buckets which are filled with material in the lower portion of the casing near the foot wheel, carried up the ascending run, and discharged in the upper portion of the casing near the head wheel.

Under normal conditions the amount of material handled by a particular elevator in a given amount of time is determined by, and increases directly with, the capacity of the individual buckets, the number of such buckets attached to a given length of the endless strands, and the rate at which they are carried up the ascending run. Various other considerations, however, put practical limits on the extent to which these determining factors may be increased to obtain an increase in the overall material handling capacity of the elevator. In an elevator having a single bucket carrying strand, for example, the buckets are commonly attached to the strand along their rear surfaces so as to protrude outwardly from the strand. In those instances where these buckets are filled by digging into a pile of material in the bottom, or boot, portion of the casing the buckets first scoop up a charge of material and then plow through the remainder of it to the top surface of the pile. Because of the resistance of the material in the pile, rather large forces are exerted on the buckets by this scooping and plowing action. These forces are applied to a particular bucket in a direction generally parallel to the strand and produce a torque about the point of connection between the bucket and the strand which tends to tear the two apart. As the effective area of the bucket which engages the material is increased by widening or lengthening the bucket dimensions, both the digging forces and the torque produced thereby are accordingly increased, and, unless the means for connecting the bucket and strand are correspondingly strengthened, the buckets may actually be torn from the strand during their filling operation.

Also, in the past an increase in the bucket size beyond that normally used usually required a stronger chain and a reinforced bucket to withstand the heavier loads carried up the ascending run by each bucket.

Aside from these mechanical considerations, an increase in the bucket size also calls for a larger casing to accommodate the bigger buckets, and in instances where the available space is limited this may be a particular disadvantage.

An object of this invention, therefore, is to increase the material handling capacity of a conventional bucket elevator, and, more specifically to do so without jeopardizing its mechanical strength and without increasing the size of the casing required.

A more detailed object of this invention is to provide an elevator bucket having a high material capacity, fabricated as a rigid structure requiring no additional reinforcing, and adapted for connection to a bucket carrying strand of the elevator in a manner which minimizes the torque produced at the point of connection thereto.

Another object of this invention is to provide a bucket for a single strand bucket elevator so constructed as to include material receiving pockets formed therein which extend rearwardly on either side of the strand, and which are in open communication with the major portion of the bucket interior so as to increase the bucket's overall capacity.

A further object of this invention is to provide a bucket of the foregoing character in which the rearwardly extending pocket portions thereof are each covered by a closure, or roof, member which serves to strengthen the bucket and to guide the material from the bucket during discharge in such a manner as to prevent its falling back down the casing.

A still further object of this invention is to provide a high capacity elevator bucket of the foregoing character adapted for use in connection with either low speed gravity discharge type, or high speed centrifugal discharge type, bucket elevators, as may be desired.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a perspective view of an elevator bucket embodying the present invention, a part of one side being broken away to better illustrate structural details,

Figure 2 is a top plan view of the bucket illustrated in Fig. 1,

Figure 3 is a rear elevational view of the bucket illustrated in Fig. 1,

Figure 4 is a sectional view, taken on a horizontal plane, of a bucket embodying the present invention, and illustrates an alternate method for connecting a bucket to an elevator chain, and

Figure 5 is a sectional view of the upper, or discharge, end of a bucket elevator employing buckets embodying the present invention.

In the drawings, wherein for the purpose of illustration are shown the preferred embodiments of this invention, and first particularly referring to Fig. 5, there is shown the upper portion of a bucket elevator. This elevator includes a vertically disposed casing **10** which encloses an endless strand, such as a chain **12**, supported for movement in an ascending run **14** along one side of the casing and a descending run **16** along the other side of the casing. The support for the chain **12** is provided by a head wheel or sprocket **17** rotatably mounted in the upper portion of the casing **10** and a foot wheel or sprocket (not shown) mounted in the lower portion of the casing **10**, around which the chain is trained. Movement of the chain in the ascending and descending runs may be effected by suitable means for driving either the head or the foot sprocket.

To the chain **12**, at spaced points along the length thereof, are attached a plurality of buckets **18** which, during operation of the elevator, are filled with material **20** in the lower portion of the casing **10**. The filled buckets are carried up the ascending run **14** by movement of the chain **12** and are inverted and discharged as they pass over the head sprocket **17**, a suitable spout **22** being pro-

vided in the casing 10 for guiding the discharged material from the top portion of the elevator.

In the particular elevator illustrated in Fig. 5, the buckets 18 are spaced relatively close together along the chain 12 so as to form a substantially continuous series of buckets, and the manner in which the material is discharged as the buckets pass over the head sprocket 17 is shown to be that accompanying a relatively low speed operation. That is, the buckets 18 are moved at such a speed that the discharge therefrom is effected almost entirely by gravity with the material falling freely from the buckets as the latter are inverted, and being guided from the casing by the bottom portion of a preceding bucket in a manner hereinafter described. It is to be understood, however, that the invention also contemplates the elevator being operated at a substantially higher speed with the material being propelled from the buckets by centrifugal forces developed as a result of passing over the head sprocket 17, in which case it may be desirable to space the individual buckets 18 further apart than shown in Fig. 5.

In accordance with the invention, the buckets 18 are provided with pocket portions for increasing the material receiving capacity thereof, these pocket portions extending rearwardly from the chain and being covered by roof portions which add strength to the buckets and prevent material in the pocket portions from falling back down the casing as the buckets are inverted for discharge.

Referring to Figs. 1, 2 and 3, for a detail description of a bucket 18 made in accordance with the invention, it will be noted that the bucket includes a plurality of wall portions arranged to define a structure having a material receiving cavity 24 therein. The cavity 24 includes a first material receiving portion 26 in the forward part of the bucket provided with an open top or mouth 27 and two material receiving pocket portions 28 in the rear part of the bucket which openly communicate with the first portion 26 and add to the overall volume of the bucket. The wall portions comprising the bucket 18 in the present instance are shown as being formed from flat stock pieces secured together by welding. It is to be understood, however, that any other suitable means for forming the wall portions could be employed, and that the bucket 18 could be formed as an integral casting or as a weldment of any desired material.

The wall portions defining the bucket 18 include two opposed end wall portions 30 and two spaced apart back wall portions 32 each connected at the outer end thereof to a rear edge of a respective one of the end wall portions 30. Each back wall portion 32 extends inwardly from its associated end wall 30, toward the other end wall, for some distance and terminates at an inner end 34 which is spaced a substantial distance from the inner end 34 of the other back wall portion 32 so as to form a gap 36 between the two back wall portions 32, the gap being located generally centrally with respect to the two end wall portions 30.

Within the gap 36 is a recessed portion of the bucket defined by a medial or forward wall portion 38 spaced forwardly from the back wall portions 32 in alignment with the gap 36, and two side wall portions 40, each connected to the inner end 34 of a respective one of the back wall portions 32. The side wall portions 40 extend forwardly to the medial portion 38 and are connected thereto. As seen best in Fig. 3, the medial wall portion 38 and the side wall portions 40 extend the full height of the bucket 18, and together with the back wall portions 32 define for the bucket 18 a rear wall having a vertically extending channel 42 formed therein.

The bucket 18 also includes a bottom wall portion 44 adapted to close the lower part of the bucket, and a front wall portion 46 closing the forward part of the bucket and having an upper edge 47 defining the top of the material receiving cavity 24. Preferably, the front wall portion 46 is inclined outwardly and upwardly, when viewing the bucket in an upright position as in Fig. 1, so that the under surface thereof may serve as a downwardly and outwardly directed chute or slide, when the bucket is in an inverted position, for conveying material discharged from a succeeding bucket to the spout 22 in an elevator such as illustrated in Fig. 5. Also, it is preferable that the side edges of the bottom wall portion 44 and front wall portion 46 be positioned somewhat inwardly from the edges of the end walls 30 so that the end walls provide outwardly directed skirt portions 48 which extend beyond the lower surface of the bottom and front wall portions. The skirt portions 48, therefore, may serve as additional guides for confining the material discharged from a succeeding bucket to the chute provided by the under surfaces of the bottom and front wall portions.

The pocket portions 28, as best seen in Figs. 1 and 2, are located one on either side of the recessed portion forming the channel 42 in the exterior of the bucket. It will also be noted that each pocket portion is defined by one rear wall portion 32, part of an end wall portion 30 and a side wall portion 40, and is covered by a roof portion 50 which is connected to the top edge of the rear wall portion 32. The roof portion 50 extends forwardly from the rear wall portion and covers the space between the end wall portion 30 and the side wall portion 40 associated therewith. By welding the roof portions 50 to the top edges of the end wall portions 30 and side wall portions 40 between which they extend, additional rigidity for the bucket may be obtained. Preferably, the roof portions 50 are inclined forwardly and upwardly, as illustrated in Fig. 1, from the rear wall portions 32 and are located or extended above the level of the upper edge 47 of the front wall portion 46, when viewing the bucket in an upright position. If so inclined, the roof portion 50 forms a downwardly and outwardly inclined slide for guiding material forwardly from the pocket portions 28 when the bucket 18 is inverted for discharge. Also, if the roof portions are located above the upper edge 47 the pockets 32 will extend above the normal level of the material carried by the buckets, which level is limited by the height of the upper edge 47, and will provide a covered space 52, as seen in Fig. 5, for receiving and maintaining in the bucket a portion of the material during the first part of the bucket's travel around the head sprocket 17, thereby preventing the material from falling back down the casing 10.

Referring to Figs. 2 and 3 for a detail description of the manner in which the buckets 18 are attached to the chain 12, it will be noted that the chain is positioned within the channel 42 defined by the medial wall portion 38 and side wall portions 40. The chain comprises a plurality of pairs of laterally opposed side bars 54 arranged in longitudinal alignment with adjacent ends of adjacent pairs of side bars being overlapped and joined by a transverse pivot pin 56 extending through the overlapped ends. One of the pairs of side bars 54 is positioned within the channel 42 and is provided with a wing portion 58 extending laterally outwardly with respect to the chain from each of the side bars 54. The wing portions 58 are disposed forwardly of the chain and engage the rear surface of the medial wall portion 38 to which they are rigidly secured, as by bolts 60. With this form of connection between the chain and bucket, it will be observed that a portion of the bucket extends rearwardly beyond the point of connection, and it will be appreciated that the forces applied to this rearwardly extending portion during filling or lifting produce a torque at the point of connection opposite in direction to the torque produced by the forces applied to the forwardly extending part of the bucket, thereby decreasing the resultant torque tending to tear the bucket from the chain.

An alternative method of fastening the bucket 18 to the chain 12 is shown in Fig. 4. In this construction a pair of opposed side bars 54 positioned within the channel 42 is provided with wing portions 62 extending laterally outwardly with respect to the chain formed on each of the side bars 54. These wing portions 62 are positioned rearwardly of the chain 12 and engage the rear wall portions 32 to which they are secured by suitable means such as bolts 64. With this arrangement it will be noted that the wing portions are located outside of the channel 42 and therefore the channel may be made narrower than in the embodiment of Figs. 2 and 3, to increase the capacity of the pocket portions disposed on either side of the channel.

Referring to Fig. 5 for a description of the manner in which the buckets 18 function during discharge, it will be noted that the material 20 fills the buckets to substantially the level of the upper edge 47 of the front wall 46, leaving empty a covered space 52 in the upper part of each of the pocket portions 28. As a bucket rounds the head sprocket 17 the front wall 46 thereof is tipped upwardly with respect to the rear portion of the bucket causing the material to shift toward the rear portion of the bucket as its angle of repose is exceeded. Instead of escaping from the bucket, however, the shifting material fills the empty covered spaces 52 and is maintained in the bucket during the initial part of its inversion. By the time the bucket reaches a position at which the material will flow therefrom it is so located with respect to the preceding bucket that the material discharged falls onto the latter bucket, and is subsequently guided forwardly by the under surfaces of the bottom and front walls of the preceding bucket to the chute 22. The paths followed by portions of the material in a bucket during the various phases of its discharge are indicated generally by the dashed arrows of Fig. 5.

It is to be understood that the forms of this invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, we claim:

1. A bucket elevator comprising an endless chain formed of pivotally connected links supported by a head sprocket for movement in vertical ascending and descending runs, a plurality of closely positioned buckets attached to the links of said chain and adapted to discharge after passing the top dead center of the head sprocket, each of said buckets having end, bottom, front and rear walls forming a material conveying cavity; said rear wall being shaped to define a centrally positioned, rearwardly facing channel extending the full height of the bucket and spaced from the end walls to provide a pocket, on each side of said channel, forming a part of said bucket cavity, and a roof portion covering each of said pockets with the front edges of said roof portions being aligned with a portion of the top edge of said channel to provide a common edge extending the full distance between the end walls over which all of the material from the bucket cavity spills when being discharged, and means for fastening the buckets to their chain links with the latter positioned in said rear wall channels.

2. A bucket elevator as defined in claim 1 further characterized by the bottom surface of the front wall of each bucket being inclined in the direction of travel of the chain link to which the bucket is attached so that said bottom surface will serve as a chute for the material spilled over the said common edge of the next succeeding bucket.

3. A bucket elevator as defined in claim 2 further characterized by the bottom edge portions of the end walls extending beyond the said bottom surface of the front wall to serve as guides for the material moving over the chute formed by said bottom surface.

4. A bucket elevator as defined in claim 2 further characterized by the roof portions covering the said pockets being inclined in the same direction as, and arranged in parallelism with, said bottom surface of the front wall so that the inside surfaces of the roof portions of each bucket will be arranged in the same plane as the bottom surface of the front wall of the next preceding bucket while the buckets are moving in said vertical runs.

5. A bucket elevator as defined in claim 1 further characterized by wing portions formed on the chain links to which the buckets are attached, and means for fastening said wing portions to the innermost portions of the said rear wall channels so that the weight of the material conveyed in the pockets of the buckets will be positioned on the opposite side of the point of connection of the buckets to their chain links than the weight of the material conveyed in the main portions of the bucket cavities.

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