May 10, 1938. A. E. LUNDBYE 2,117,184

CONCRETE PAVER

Filed May 14, 1936 7 Sheets-Sheet 1

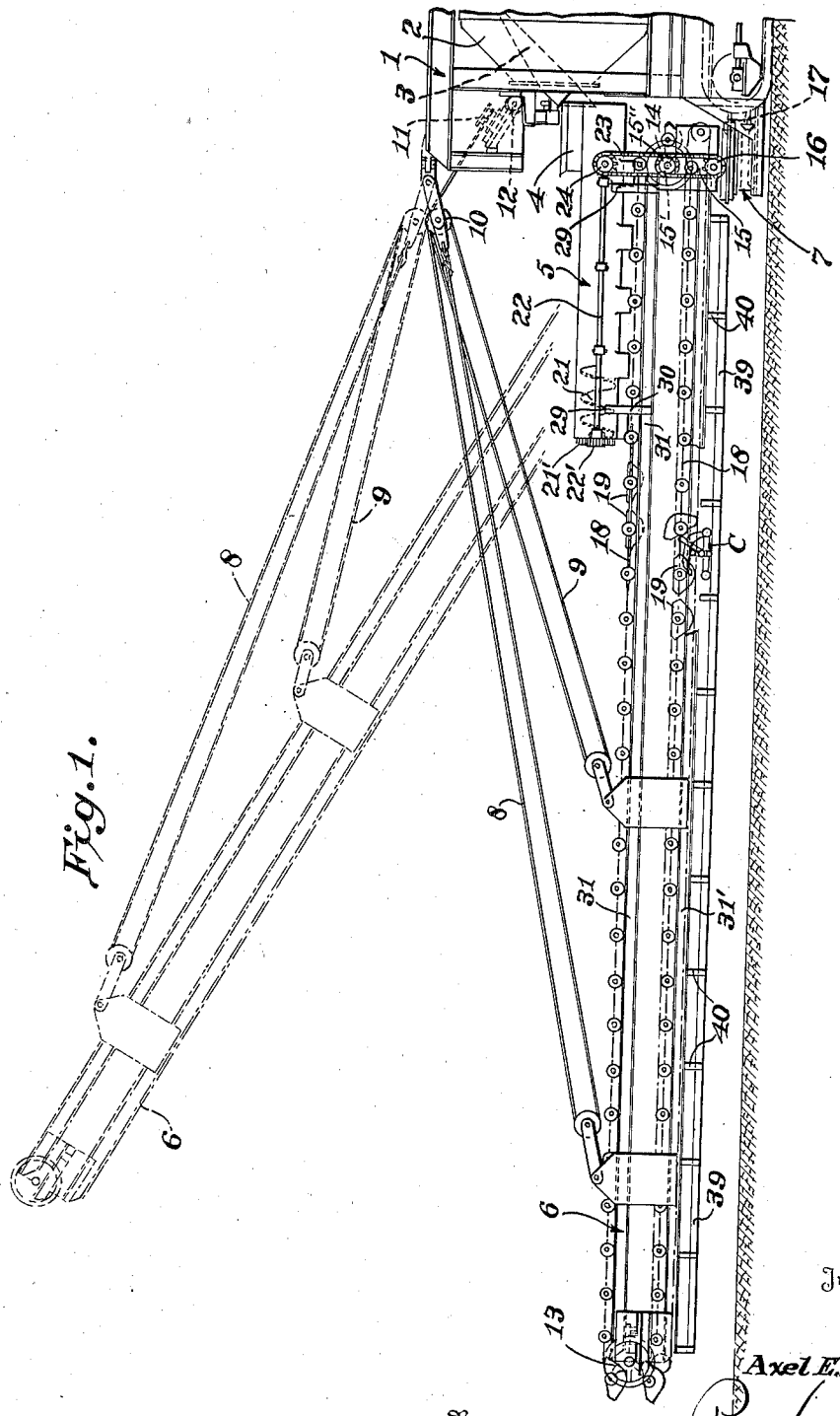


Fig. 1.

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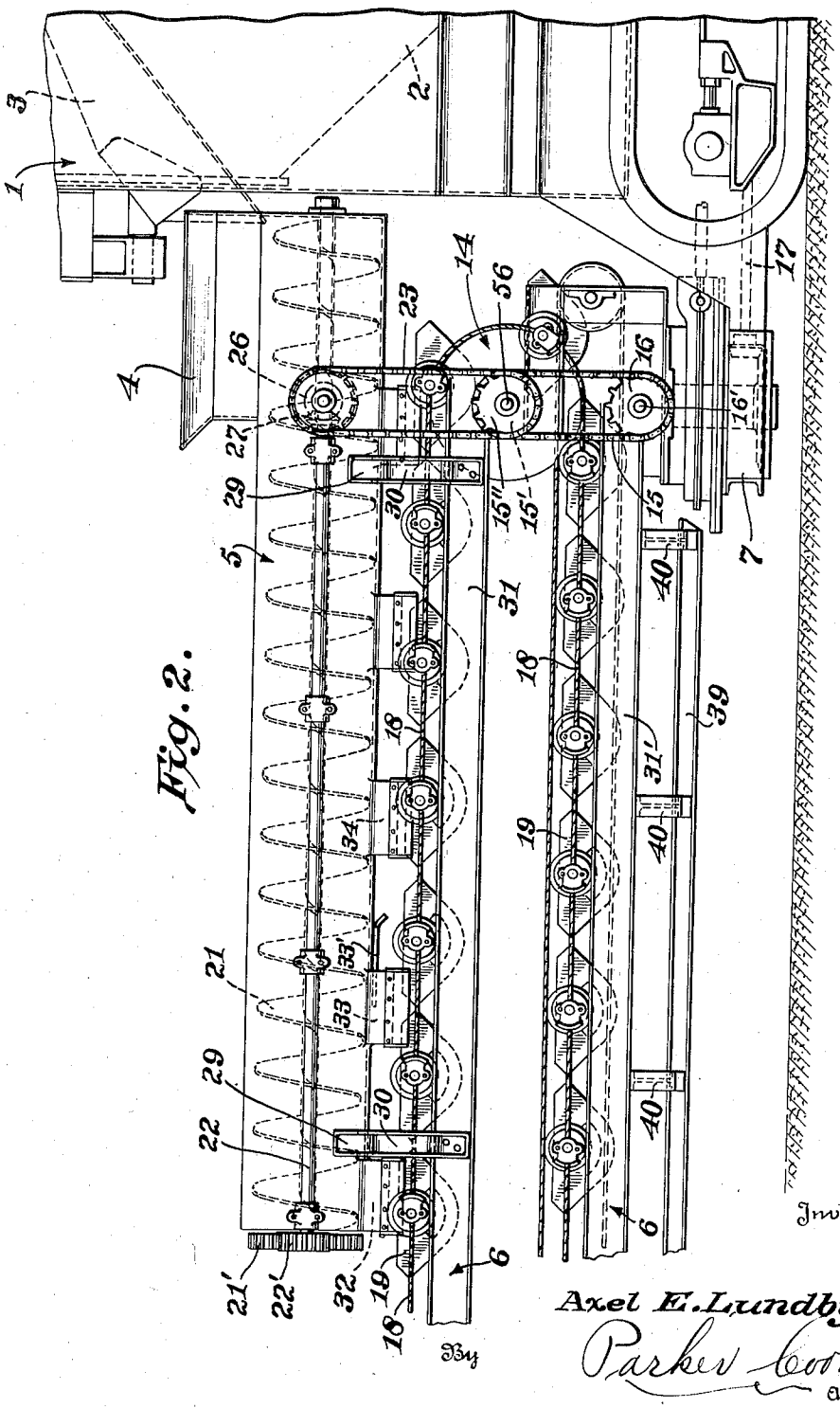


Fig. 2.

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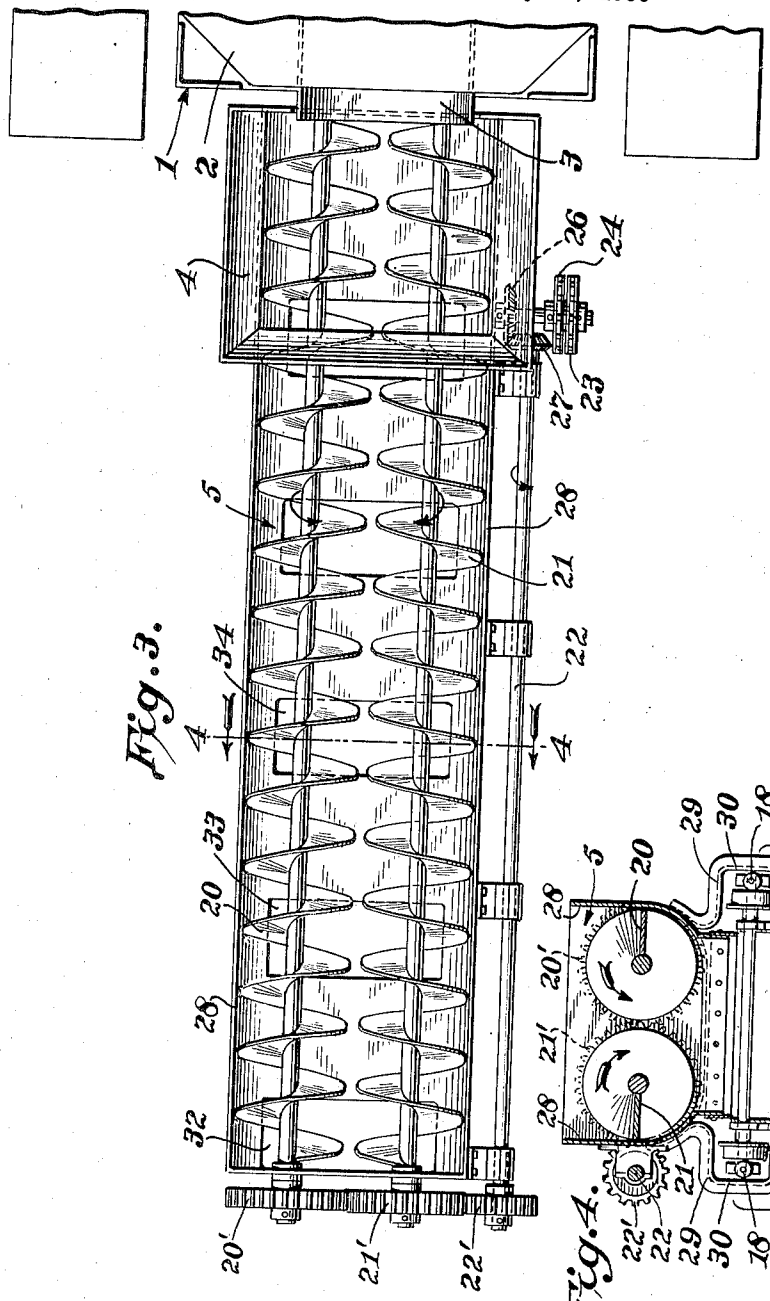


Fig. 3.

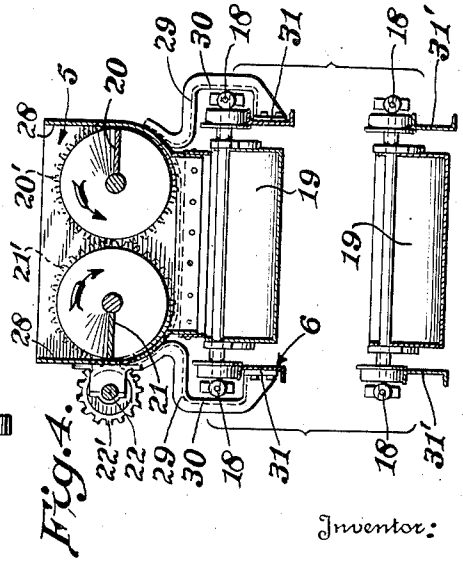


Fig. 4.

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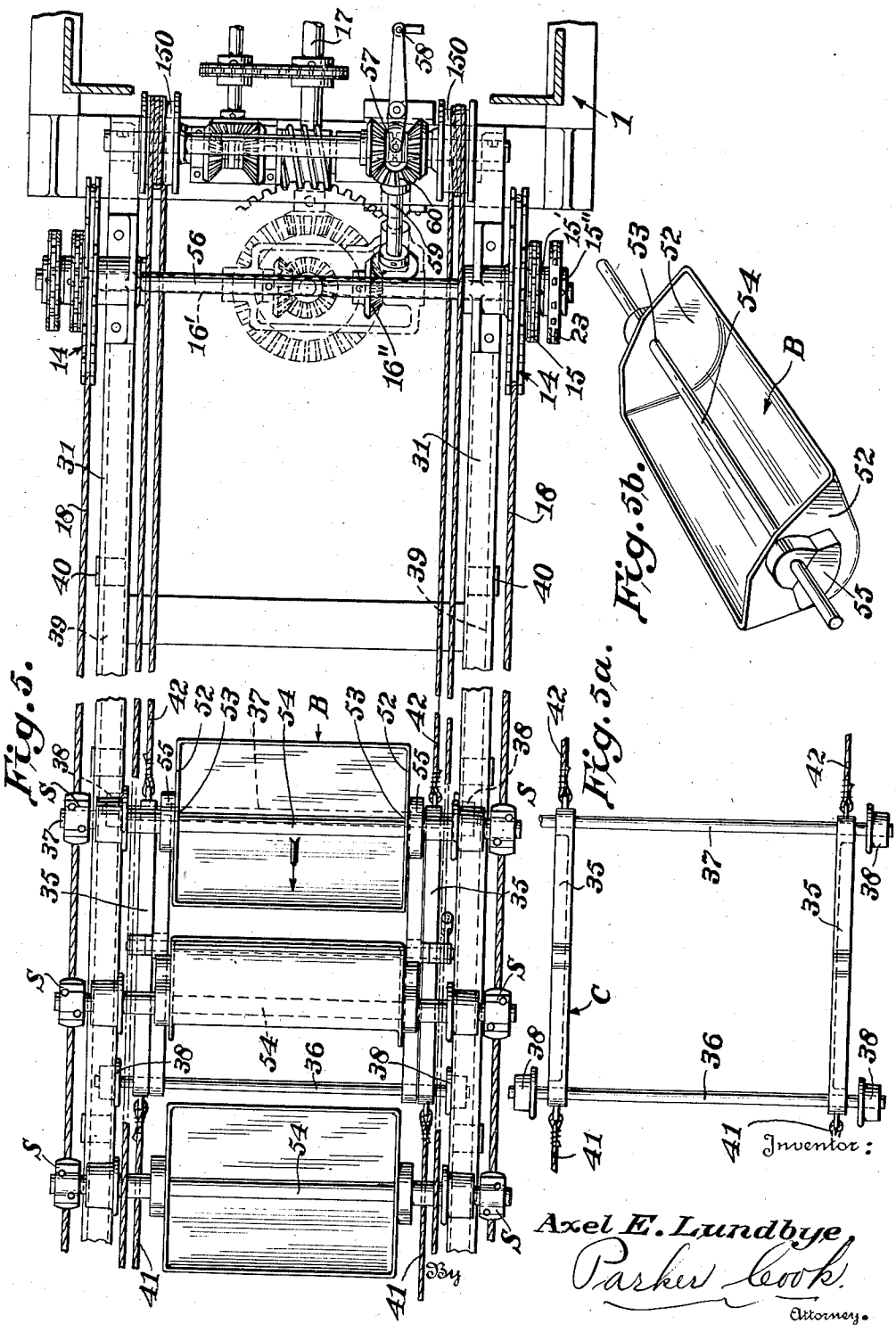
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Fig. 6.

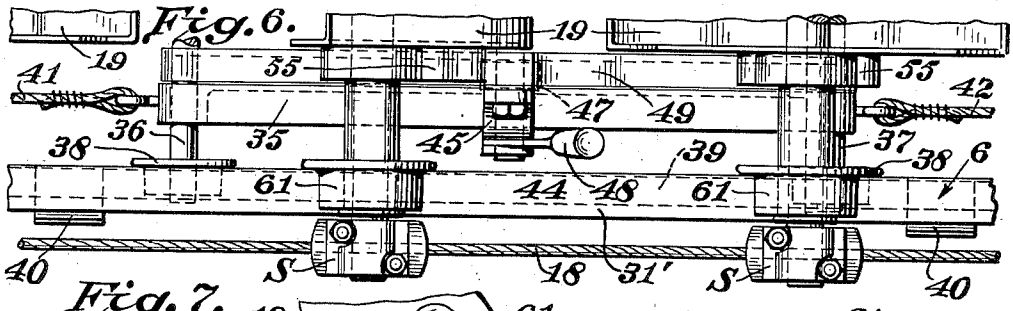


Fig. 7.

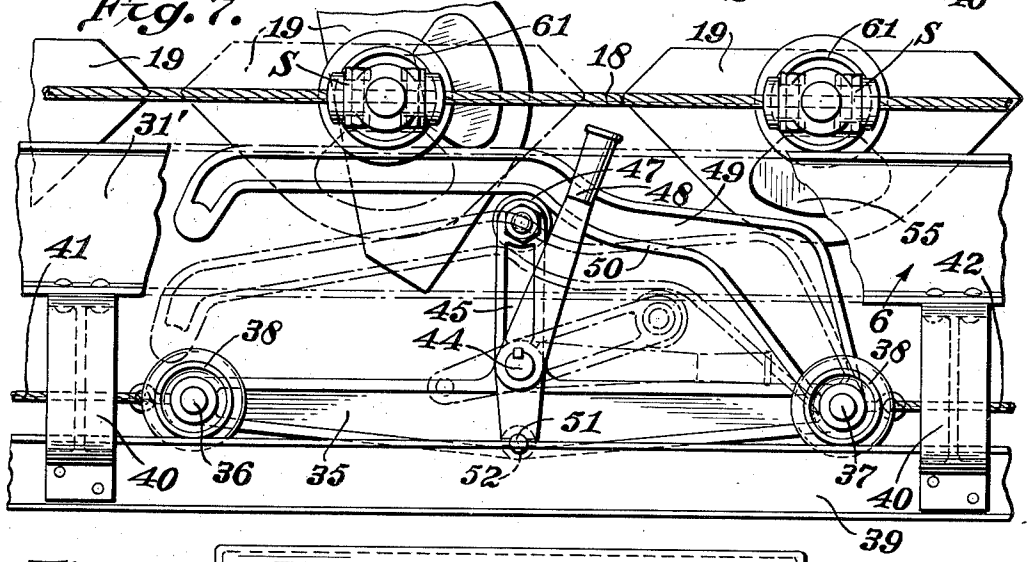
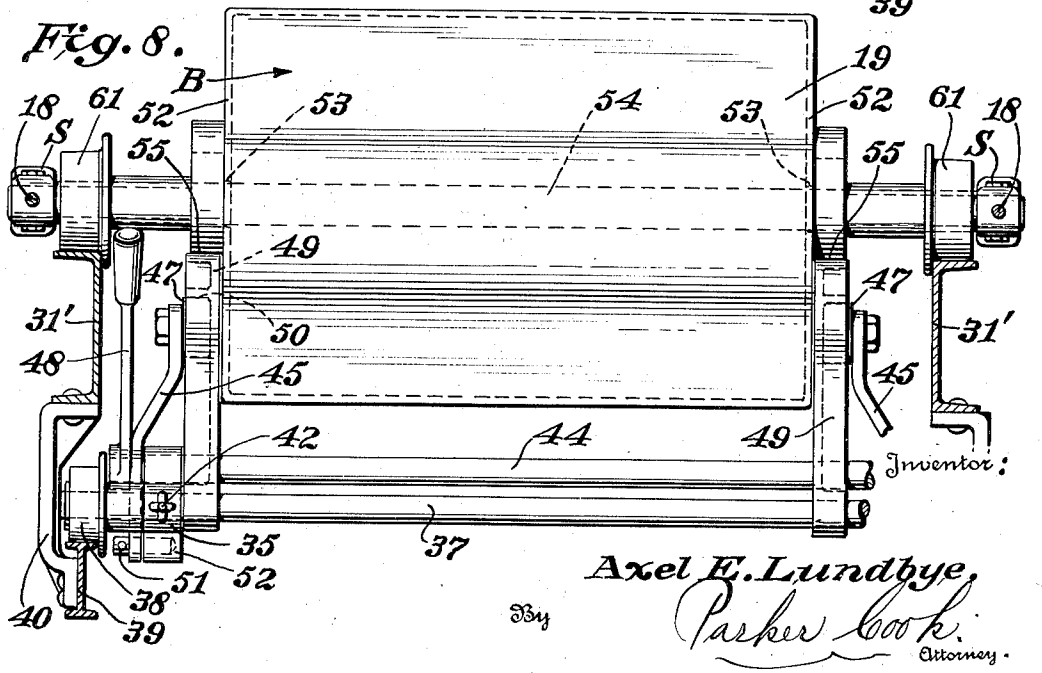


Fig. 8.



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CONCRETE PAVER

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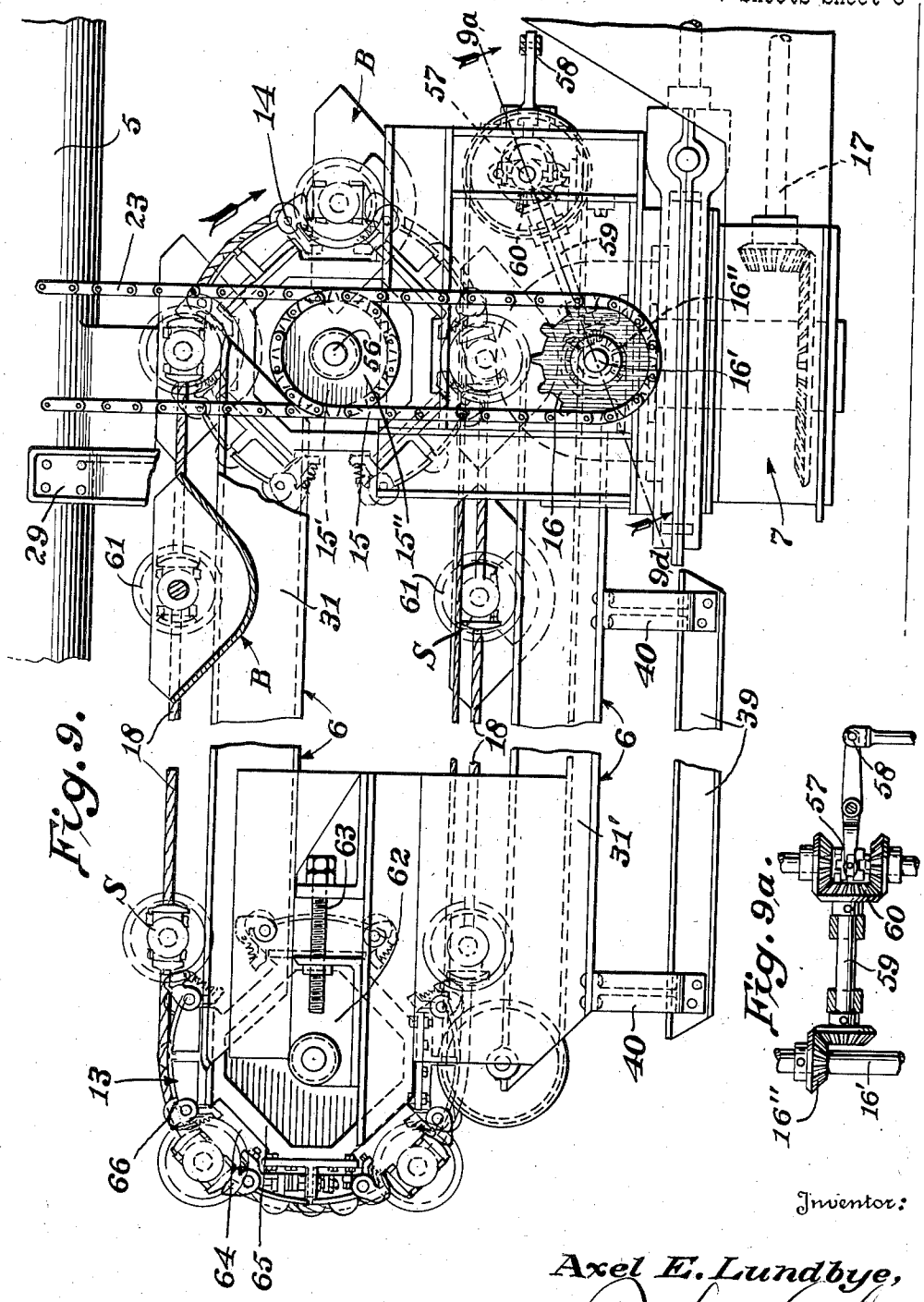


Fig. 9.

Fig. 9a.

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Fig. 10.

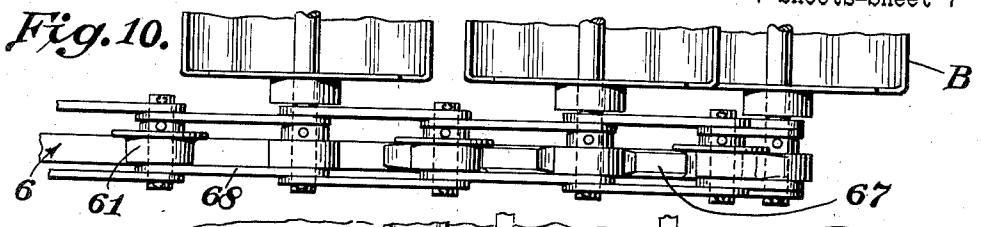


Fig. 11.

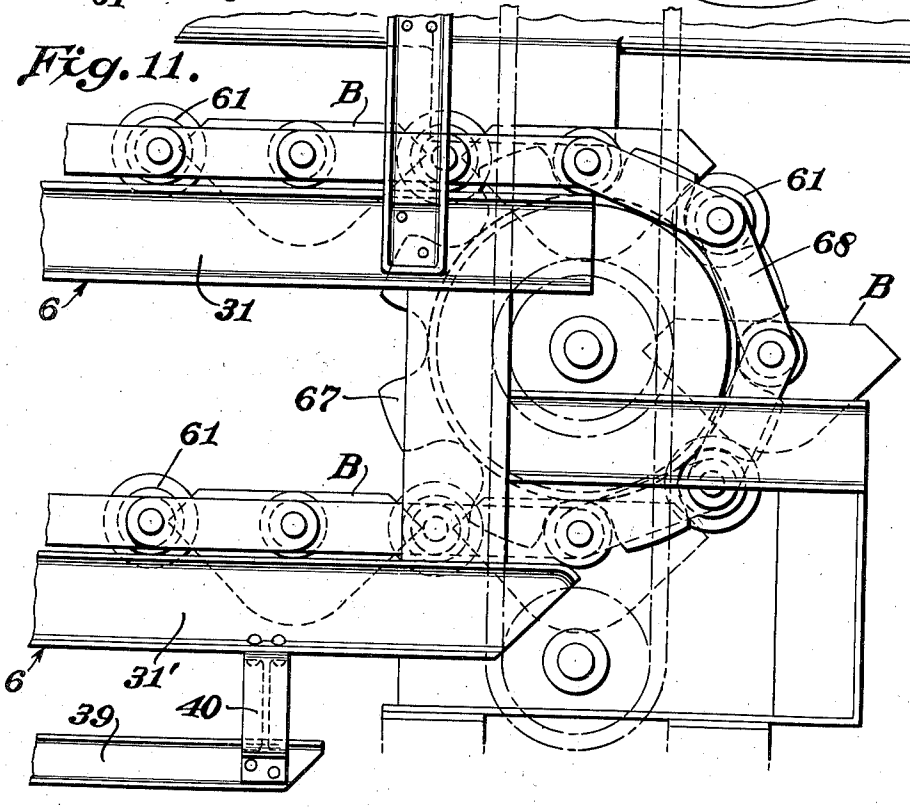
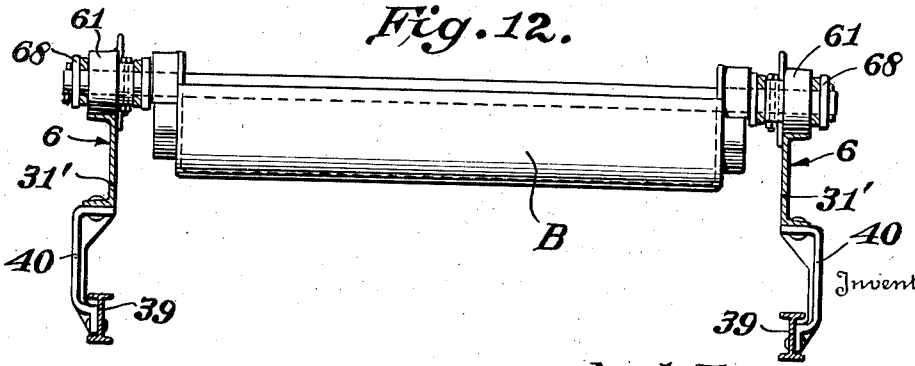


Fig. 12.



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Patented May 10, 1938 2,117,184

UNITED STATES PATENT OFFICE

2,117,184

CONCRETE PAVER

Axel E. Lundbye, Nunda, N. Y., assignor to The Foote Company, Inc., Nunda, N. Y., a corporation of Delaware

Application May 14, 1936, Serial No. 79,818

14 Claims. (Cl. 198—56)

My invention relates to new and useful improvements in concrete pavers, and has for an object to provide a paver having a boom, on which travels an endless conveyor, the endless conveyor, in turn, being made up of a plurality of buckets for conveying the mixed aggregates to the point of discharge.

Concrete pavers are now made of a relatively large size and where the single bucket is used, the length of the boom has to be somewhat restricted, for if the boom is long and the bucket is run out to the end with a full load of aggregates, there is a possibility of tipping the paver or making it at least unstable. On the other hand, if a boom is used on which there is mounted an endless conveyor, the length of the boom can be increased considerably without causing the paver to be overbalanced.

One of the principal objects of the present invention, therefore, is to provide a concrete paver with a relatively long boom, on which there is mounted an endless conveyor made up of a plurality of relatively small buckets, so that the weight is more evenly distributed along the boom.

Still another object of the invention is to provide a boom having an endless conveyor made up of a plurality of dumpable buckets, so that the contents thereof may be discharged at points intermediate the ends of the boom, rather than just out at the far end, to thus provide a flexibility to the boom, which is not possible if the buckets have to be dumped at only the forward end.

Still another object of the invention is to provide a novel means for tripping the buckets in their outward travel at the desired point, which consists generally of a movable carriage, on which there is a trip, so that the cams associated with the buckets may be tripped at any desired point to, in turn, of course, dump the buckets.

Also, as is well known in the concrete paver art, it is desirable to have the machine function as rapidly as possible, that is, to convey the aggregates from the drum after they are properly mixed out to the point desired along the boom and then dumped or spread with as little delay as possible.

Another object, therefore, of the invention is to provide means for delivering the mixed aggregates from the mixing drum to these buckets in as rapid and continuous a manner as possible, which I accomplish by providing two spirals or worms which are mounted beneath a small hopper, which, in turn, is directly under the discharge chute, these spirals extending outwardly over the buckets for a distance equal in length to a space of about seven of the buckets. The spiral conveyors are, in turn, mounted in a trough, which may have five restricted openings in the bottom, so that as the aggregates are forced by the screw action outwardly through the trough and over the several openings, the aggregates will fill the buckets as the latter travel inwardly of the boom in their upper path of travel. Then the buckets may be discharged, in their lower path of travel, when moving in their outward direction at any predetermined point.

Still another object of the invention is to have these points of discharge from the trough to the buckets so arranged and timed that any overflow from a bucket being filled will drop into the buckets in the lower path of travel, rather than slop or fall to the ground.

Still another object of the invention is to provide a concrete paver having a boom and an endless conveyor, which latter is made up of a plurality of dumpable buckets; also to provide screw means for moving the aggregates from the discharge chute in substantially a continuous flow out to the dumpable buckets, which latter may be arranged to discharge at any point desired along the boom.

Still another object of the invention is to provide an endless conveyor for concrete pavers consisting of a plurality of dumpable buckets, each bucket having associated therewith a cam for tripping the bucket by a cam track, these buckets, in turn, being associated either with a cable, as shown in the preferred form, or with a chain, as shown in the modified form.

Still another object of the invention is to provide a power boom, which may be quickly traversed or elevated or lowered, on which there is an endless conveyor, which latter comprises a plurality of buckets which, in turn, may be tripped or dumped as they travel outwardly at any desired point along the boom, and which buckets are being constantly filled by screw means which force the aggregates out along a feed trough to the inwardly moving buckets.

With these and other objects in view, the invention consists in certain new and novel features and combination of parts, as will be hereinafter more fully explained and pointed out in the claims.

Referring now to the drawings showing a preferred embodiment and one modification,

Fig. 1 is a fragmentary side elevation of a paver

and power boom, the boom also being shown in an elevated position in dot and dash lines;

Fig. 2 is a fragmentary enlarged side elevation, showing the hopper and trough with the spiral conveyors for distributing the concrete to the buckets and also showing a fragmentary portion of the inner end of the boom and its transmission;

Fig. 3 is an enlarged top plan view of the spiral conveyors and the associated parts for imparting movement to the conveyors;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmentary top plan view of the boom with the spiral conveyors and other parts removed and omitted for the sake of clearness of illustration;

Fig. 5*a* is a detail plan of the tripper carriage with parts omitted for the sake of clearness of illustration;

Fig. 5*b* is a perspective of one of the buckets;

Fig. 6 is a fragmentary detail of the bucket cable and the tripper carriage and also showing the control cable for the tripper carriage;

Fig. 7 is a fragmentary side elevation of the tripper carriage, showing the cam (track) in its operative and inoperative positions, and also showing two of the buckets, one in its tripped and the other in its non-tripped position;

Fig. 8 is a vertical sectional view showing the arrangement of the bucket, the tripper carriage, and the track therefor, and the manner in which the cam track may be locked in its operative position;

Fig. 9 is an enlarged side elevation showing the transmission for supplying power to the endless conveyor, and also showing the adjustable sprockets at the outer ends of the boom, over which the endless conveyor cables for their buckets travel;

Fig. 9*a* is a section taken on the line 9^a—9^a of Fig. 9;

Fig. 10 is a fragmentary plan view of the endless conveyor wherein a chain is used for actuating the buckets rather than a cable;

Fig. 11 is a fragmentary side elevation of this chain and the rear sprocket which drives the chain; and

Fig. 12 is a transverse sectional view through the lower channels, of the boom, looking toward the outer end, showing a bucket, and the cross shaft having chain links on its ends and rollers thereon for supporting and guiding the buckets upon the boom channels.

Referring now more particularly to the several views, and for the moment to Fig. 1, there is fragmentarily shown a front portion of a paver 1, with the usual mixing drum 2 and the discharge chute 3, beneath which there may be seen a hopper 4 and outwardly extending trough 5, in which are the spiral conveyors 20 and 21. There may also be seen the boom 6, which is mounted at its inner end on the transmission 7, which transmission forms the subject-matter of a separate application filed by me on the 11th day of September, 1935, bearing Serial Number 40,178, for Transmission mechanism for power booms of concrete pavers.

There may also be seen the supporting guy cables 8 and 9, which extend upwardly to the sheaves 10 mounted on the superstructure of the paver 1, the cables, in turn, passing over a drum 11, which is operated by a worm 12 to thus elevate and lower the boom.

The boom 6 may be traversed, pivoting about the transmission 7, and for further detail of this transmission, reference is made to the above-mentioned pending application.

It will be noticed that the trough 5 extends outwardly from the paver and directly over the inner end of the boom, as it is from this trough that the buckets are filled.

Still referring to Fig. 1, and to the invention in general, there will be further noticed, at the outer end of the boom, idler sprockets 13, while at the inner end of the boom, there are the drive sprockets 14, which, in turn, are driven by the chains 15 passing over the small sprockets 15', which chains are driven by the sprockets 16 located on the shaft 16'.

In Fig. 9, there is shown the main power drive 17 leading into the transmission 7, and without further description, it will be understood that operation of this main power shaft 17 drives the sprockets 16, chains 15, and, in turn, drives the cables 18, which pass over the sprockets 13 and 14, to which cables are connected the buckets 19, shortly to be described.

As far as the specification has proceeded, it will be seen that with the operation of the transmission, the cables 18 and the bucket 19 are designed to move outwardly along their lower path of movement and then inwardly in their upper path of movement along the boom.

Description of spiral conveyor

Referring now for the moment to Figs. 3, 4, and 5, there will be seen the hopper 4 with its trough 5, and there will also be seen the worms or spirals 20 and 21. On the outer end of the spiral 20 may be seen the gear 20', which, in turn, meshes with the gear 21' on the end of the spiral 21.

To one side of the trough may be seen the shaft 22 with its pinion 22' on the outer end meshing with the gear 21', so that a rotation of the shaft 22 will cause these two spirals 20 and 21 to rotate in opposite directions and to force the aggregates along the trough where they may drop through the discharge openings 32, 33, etc. into the buckets.

Glancing at Figs. 2 and 3 for the moment, there will be noticed a sprocket 15'' on the same shaft on which the sprocket 15' is mounted. There is also a sprocket chain 23 that operates the sprocket 24 to drive the bevel gear 26 to operate the pinion 27 mounted on the rear end of the shaft 22.

Thus, it will be seen that when the conveyor buckets are set in motion, the shaft 22 is also rotated to, in turn, drive the spiral conveyors or worms 20 and 21.

The trough 5, shown in cross section, Fig. 4, has the downwardly extending sides 28 and the bracket support 29, on both sides, that curve outwardly, as at 30, to clear the upper stretch of the bucket cables 18 traveling on the boom channels 31. It is on these channels that the cross shafts of the buckets are supported in their inward movement, as also may be seen in this Fig. 4.

In Fig. 2, there may be seen the openings 32, 33, 34, etc., which are formed in the bottom of the trough 5, so that the aggregates when being forced outwardly by the spirals 20 and 21 may drop through into the inwardly traveling buckets. Also in Fig. 2, I have diagrammatically shown a gate 33', it being understood that there will be one for each opening, so that the size of the openings in the bottom of the trough in each instance may be regulated.

It will also be understood that the aggregates

will flow continuously from the trough 5 after they are fed thereto from the mixing drum, and although the buckets are set in close proximity, it will be noticed in Fig. 2 that they are staggered or, in other words, so arranged that a bucket in the lower path, for instance, under the discharge 33 will be directly beneath the adjacent edges of two buckets in the upper path, so that any surplus aggregates that might fall between the two upper moving buckets will drop into a bucket directly beneath and be carried out to the point of discharge.

It will thus be seen as far as the specification has proceeded that by providing a trough in which there are two spiral conveyors, the aggregates may be continuously fed outwardly over the buckets and also drop into the traveling buckets to then be discharged at a desired point, thus greatly facilitating the rapidity of discharge from the drum.

Having briefly described the arrangement of the boom and the spiral conveyors, a description will now follow of, first, the tripper carriage, which carriage may be set to trip the buckets as they approach any desired point, said description to be followed by a description of the buckets themselves.

Tripper carriage

The tripper carriage C (Fig. 5*a*) consists of two like side frames 35, having the forward axle 36 and the rear axle 37, on which there are mounted the respective flanged wheels 38, which wheels rest on tracks 39, which latter are supported by hangers 40 from the lower boom channels 31', see Figs. 8 and 12.

It will be understood that the boom 6 is composed of upper and lower boom channels 31 and 31', respectively, together with various cross braces, as is usual construction.

The cross bracing and construction of the boom are not shown in detail, as the boom per se does not form the gist of the present invention.

Again, referring now more specifically to the tripper carriage and its mechanism, reference is made for the moment to Figs. 5, 5*a*, and 6. There will be noticed that the two ends 41 and 42 of the tripper cables are connected, respectively, to the opposite ends of the tripper carriage, and it will also be noticed that there is a like cable on the other side of the carriage and connected in the same manner to its opposite ends.

These cables are operated by respective cable drums 150, as shown in Fig. 5, so that the carriage may be positioned along the boom where desired by the proper operation of these two drums.

As these drums and means of operation are shown in a co-pending application for moving a carriage along the boom, they will be described here but briefly as the specification proceeds.

Returning to the description of the tripper carriage, there will be seen in Figs. 7 and 8, located in a plane above the axle 37, a cross shaft 44, on which the pivotal arms 45 are mounted, which, in turn, have the stub axles with respective cam rollers 47 mounted thereon. The shaft 44 is mounted near its opposite ends in bearings provided on the carriage, and it will be noticed that the arms 45 are pivoted at a short distance from their lower ends, as may be seen. To one end of the shaft 44 and adjacent one arm 45 is a handle 48, which is keyed to the shaft 44, so that when said handle 48 is moved from its position, shown in dotted lines, to its full line position, Fig. 7, the arms 45 will also have moved from the dotted line position to the full line vertical position shown in this figure.

Now the purpose of these pivotal arms is to elevate the two pivotal cam tracks 49 which are mounted on the rear axle 37 of the tripper carriage, and although I have shown only one of these in Fig. 7 in two positions, it will be understood that there is a like one on the opposite side of the carriage (see Fig. 8). The under or lower surface 50 of these cam tracks 49 rests on the rollers 47 mounted on the outer ends of the arms 45 of the carriage, and as the handle 48 is raised, the arms 45 will force these cam tracks 49 upwardly to the full line position, as shown in Fig. 7.

As will be hereinafter mentioned, the traveling buckets of the conveyor have suitable cams that are to engage the elevated cam tracks to tip the buckets to discharge the contents thereof. It will be understood that when the cam tracks 49 are in their lowermost position, the traveling buckets will not be affected.

I have also made provision to lock the cam tracks in their elevated position, and by referring to Figs. 7 and 8, there will be seen a lock pin 51 that will pass through the lower end of one arm 45 when it is in its vertical position to thus retain the cam tracks in their elevated position. When it is desired to lower the cam tracks, this pin will, of course, first have to be removed.

Thus, regardless of the shock that the cam tracks might receive from the cams of the moving carriage, there is no possibility of the cam tracks being lowered, which would cause a failure of the buckets to be tipped.

As far as the specification has proceeded, it will be understood that by providing a tripper carriage, which may be moved by the operation of the drums 150 to any desired point on the boom and by then elevating the cam tracks, means are provided to engage cams of the buckets. These buckets and their cams cooperating with the tripper carriage will now be set forth.

Buckets and tripping means

As the buckets are similar in construction, a description of the one will answer for all. Reference is made to the perspective Fig. 5*b*. It will be seen that the bucket B may be a stamped metal product or a light casting and is substantially U-shaped. The ends 52 are provided with apertures 53, through which passes the shaft 54, which extends outwardly beyond the respective ends of the bucket. It will be understood that, if so desired, instead of having one long shaft 54, there might be a small stub shaft extending from the respective ends of the bucket.

It will also be understood that the bucket is not free to swing with respect to the shaft 54, but is rigidly attached thereto, as it is by the part rotation of this shaft that the bucket is to be tipped. On the opposite ends of the shaft 54 may be seen the two cams 55, which are also fixedly connected with the shaft 54. These cams 55 are substantially as wide as the cam tracks 49 and are seen in their depending position in Fig. 7. The cams may be of cast iron and are of sufficient weight to cause the bucket B to hang in its normal position during its ordinary travel along the boom. The height of the bucket above the tripper carriage is such, as will be shortly mentioned, that when the cam tracks are in their lowermost position (Fig. 7), the cams will not be actuated, but when the cam tracks are raised to

their highest position, they will engage the cams 55 and cause the bucket to tilt, as shown in the forward bucket of Fig. 7, thereby turning the bucket to a substantially vertical position to discharge the contents.

Now having described the buckets in detail, reference may be had to Fig. 9, which shows the buckets as mounted on endless cables, these, of course, extending from the rear end of the boom to the forward end thereof.

It will be remembered that there are two oppositely located sprockets 14 near the inner end of the boom, which are driven through the operation of their shaft 56, which, in turn, is operated through the transmission 7 and its cooperating parts. It might be mentioned at this time that also from this transmission is shown a clutch 57 operated by the slipper rod 58, the clutch being, in turn, operated by a stub shaft 59 and its pinion 60 from a pinion 16'' on the shaft 16'. The operation of this last-mentioned clutch is, in turn, to operate the cable drums 150, heretofore described, to advance or retract the tripper carriage along the boom, so that buckets may be tipped at the desired place.

Referring now to the cables 18, it will be seen that at desired points along these cables, there are provided the sockets S in spaced relationship, the sockets, in turn, receiving the respective ends of the bucket shafts 54, which sockets act as cross bars of a sprocket chain. Spaced inwardly from the respective cables 18 and the sockets are the small flanged rollers 61 which are freely mounted near the respective ends of the shafts 54 of the buckets, so that these rollers, in turn, may be supported on the channel booms 31, 31', as may be especially seen in Figs. 6, 7, and 8.

As far as the specification has proceeded, it will be seen that on the operation of the shaft 56, the drive sprockets 14 through the transmission and the driving mechanism will be operated to, in turn, actuate the cables and their respective buckets. Also, the buckets will be filled when in their upper lane or path of travel and will remain in their upright position until they descend to their lower lane of travel and will still remain in an upright position until the cams of the respective buckets contact with the cam tracks 49 of the tripper carriage. Then, as they continue in their outer movement, the impinging cams retarded by the cam tracks will tilt the buckets to thus dump the contents.

After a dumped bucket clears the forward end of the tracks, the weight of the cam and the center of gravity being as shown will cause the bucket to right itself and be in a receptive position when again passing beneath the trough 5 with its aggregates.

In Fig. 9, there is shown one of the outer sprockets 13, and it will be noticed that it is mounted in a bearing 62, which may be adjusted outwardly on the boom channel by the operation of the bolt 63 to take up the slack in the cables. I furthermore utilize the sprocket wheel 13 made up of a plurality of castings 64, which are mounted on blocks 65, so that the lugs 66 which, in reality, take the place of sprocket teeth may be advanced or retracted slightly around the pitch circle to engage the sockets S, which function like cross bars of a chain. A similar drive sprocket 14 is shown at the inner end of the boom. These forms of sprocket wheels that are used with cables rather than with chains are conventional, and the sprocket wheels per se form no part of the present invention.

It is to be understood, however, that by having these sprocket wheels 13 adjustable on the boom, slack can be taken up in the cable, and by providing movable lugs, the pitch of the sprocket or what substitutes for pitch can be regulated. This is desirable, as otherwise the buckets could not be positioned at points desired along the cable. As heretofore mentioned, it is desirable to have the under buckets staggered with relation to the upper buckets, so that if any spill occurs from the buckets while being filled in their upper path of travel, this spilled material will drop in the buckets in their lower path of travel.

In Figs. 10 and 11, there is shown a slight modification, and in this instance, a regular drive sprocket wheel 67 is used, together with a link chain 68, the buckets B being carried by the link chain rather than with cables with the sprocket stops bolted thereon. In this instance, the outer sprocket will, of course, be of the same pitch and diameter as the inner sprocket and the number of teeth and the pitch will always remain the same.

The buckets will be identical and will travel on the tracks and be dumped in exactly the same manner as in the preferred form. The cable form of drive is, however, less expensive to use than the chain drive.

Having explained the invention in general and also the specific parts, it is thought that only a short reiteration of the operation is necessary.

As may be seen in Fig. 1, the boom may be elevated or traversed to the desired position, after which the power shaft will deliver power to the transmission which, in turn, will drive the spiral conveyors. They, in turn, will force the aggregates toward the outer end of the trough, where the aggregates will drop through the gates in the trough to the buckets located therebeneath. The buckets are driven through the medium of the endless cables or chains to which the buckets are secured, the buckets traveling inwardly in their upper path and outwardly in their lower path.

By the operation of the drums 150 and cables attached to the tripper carriage, the tripper carriage may be positioned inwardly or outwardly of the boom at the desired point, and after once positioned, the handle 48 of the tripper carriage will be moved to throw the cam tracks 49 in their elevated position, where they will be locked by the small locking pin. Then, the outwardly moving buckets B will be tripped as their respective cams ride up the cam tracks and the material dumped to the subgrade. After the buckets have passed the cam tracks, they will right themselves so that by the time they are again returned beneath the spiral conveyors 20 and 21, they will be refilled. If it is desired to move the tripper carriage at any time during the distribution of the concrete, the slipper rod 58 will be operated to operate the cable drums 150 to, in turn, advance the tripper carriage without halting the operation of the buckets.

From the foregoing, it will be seen that I have provided a relatively quick method of distributing the aggregates from the mixing drum to the plurality of buckets. This is an advantage over filling one bucket and then waiting until that bucket is returned. Also, by providing a plurality of buckets that in this manner can be rapidly filled, there is no great weight at any time at the

outer end of the boom, making it practical to build a longer boom than those in use today.

As heretofore mentioned, either a cable drive or a link chain may be used for the operation of the buckets, depending on that desired by the trade. Also the exact construction of the tripper carriage as well as the exact construction of the buckets shown may be varied without departing from the spirit and scope of the invention.

Having thus described my invention, what I desire to claim and secure by Letters Patent is:—

1. In a concrete paver, a boom, an endless conveyor, including tiltable buckets moving inwardly in their upper path of travel and outwardly in their lower path of travel, on said boom, a trough mounted above said endless conveyor, spirals revolving in opposite directions in said trough for forcing the aggregates outwardly over said buckets, gates in the trough for permitting the filling of the buckets from said trough, and means for discharging the buckets at a desired point along said boom.

2. In a concrete paver, a boom, an endless conveyor on said boom, a trough mounted above said endless conveyor, spirals in said trough for forcing the aggregates outwardly of said trough, said trough provided with openings in the bottom thereof, means for running the empty buckets inwardly under said trough to be filled from said trough and the full buckets outwardly, and means for tilting the buckets at any point along the boom during their outward travel to discharge the same.

3. In a concrete paver, a transmission, a boom mounted thereon, an endless conveyor, including tiltable buckets, mounted on said boom, a trough extending outwardly and over the inner end of said boom, means in said trough for forcing the aggregates outwardly of said trough, said trough provided with an opening in the bottom thereof, the buckets traveling inwardly of the boom in their upper path of travel and outwardly in their lower path of travel, means cooperable with the buckets for tilting the buckets at any point in their outward travel, and the propelling means in the trough, the endless conveyor, and the adjustable means for tilting the buckets all being driven from the transmission.

4. In a concrete paver, a transmission, a boom mounted thereon, an endless conveyor, including tiltable cammed buckets, operable on said boom, a trough extending outwardly over a plurality of the buckets and the trough mounted directly above the buckets, means operable in the trough for propelling the aggregates outwardly thereof, said trough provided with openings therein, the buckets traveling inwardly in their upper path of travel beneath the trough and outwardly in their lower path of travel, positionable cam means traveling on the boom and cooperable with the cammed buckets for tilting the buckets at any point in their outward travel, and the propelling means in the trough, the endless conveyor, and the adjustable means for tilting the buckets all being driven from the transmission.

5. In a concrete paver, a boom, an endless conveyor made up of a plurality of tiltable cammed buckets mounted on said boom, a trough mounted directly above the inner end of said endless conveyor, spirals in said trough for forcing the aggregates outwardly over a plurality of the tiltable cammed buckets, a plurality of gates in the trough for permitting the filling of a number of the buckets at the same time, a movable carriage provided with elevating cams, said carriage mounted directly beneath the lower path of travel of the buckets, and means for elevating said cams to contact with the cammed buckets to thereby discharge the buckets during their outward travel on said boom.

6. In a concrete paver, a boom, an endless conveyor including a plurality of rockable buckets, a cam associated with each of said buckets, revolving means extending over the buckets for filling a plurality of the buckets as the same travel inwardly, a carriage positionable inwardly and outwardly of the boom directly beneath the outward path of travel of said buckets, means for driving said carriage inwardly and outwardly, means for driving the buckets, means for filling the buckets, elevating cam tracks on said carriage, and means for raising said cam tracks, said cam tracks cooperable with the cams on said buckets to rock the buckets and discharge the contents thereof.

7. In a concrete paver, a boom, an endless conveyor made up of cables and a plurality of tiltable buckets associated with said cables, cams associated with the buckets, a hopper, a trough extending therefrom, spirals operable in said trough and extending over a plurality of the buckets, means for discharging the aggregates from the trough to the said buckets, a carriage movable on said boom and under the buckets when in their lower path of travel, cam tracks on said carriage, means for elevating the cam tracks, and said cam tracks when elevated cooperating with the cams on said buckets to thereby tilt the buckets and discharge the contents of said buckets.

8. In a concrete paver, a boom, an endless conveyor including a plurality of tiltable buckets, spiral conveyors running in the opposite directions for receiving the aggregates from the drum of the paver, means for discharging the aggregates from the spirals to the buckets, means for driving the buckets and means for driving the spiral conveyors, a carriage provided with relatively short cam tracks for engaging the buckets, means for positioning the carriage inwardly or outwardly of the boom, means for elevating the cam tracks to thereby tilt and discharge the contents of the buckets and the buckets righting themselves after they have moved past the said cam tracks.

9. In a concrete paver, a transmission mounted on the forward end thereof, a boom mounted on said transmission, spiral conveyors mounted on said boom, an endless conveyor made up of a plurality of tiltable buckets also mounted on said boom and beneath said conveyor, a carriage, means on said carriage for cooperating with the buckets to tilt the same during their outward movement along said boom, and means for driving the transmission to operate the spirals, buckets, and carriage.

10. A concrete paver including a boom, an endless conveyor thereon including a plurality of tiltable buckets traveling in an upper and in a lower path, a horizontally arranged spiral extending over said buckets and arranged to fill the buckets as they move inwardly thereunder, the buckets so arranged that adjacent edges of the upper buckets when passing under the spiral will be directly over a bucket beneath the first-mentioned buckets to thus catch any aggregates spilled from the upper buckets.

11. In a concrete paver, a spiral associated with a drum for forcing the aggregates outwardly after delivery from the drum, a boom, an endless conveyor including a plurality of buckets for re-

ceiving the aggregates when moving inwardly under said spiral, means for tilting the buckets when in their lower path of travel, and the buckets so arranged that any material spilled between two buckets in the upper path of travel will fall into a bucket in its lower path of travel.

12. In a concrete paver, a boom, buckets arranged as an endless conveyor on said boom, a trough arranged horizontally over the buckets, spiral means therein, said trough provided with a plurality of adjustable openings in its bottom, means for operating the spiral means and the buckets whereby a number of buckets may be filled at the one time during their inward travel under the said spiral means, and means for discharging the contents of the buckets on their outward travel.

13. In a concrete paver, a relatively long boom, an endless conveyor operable on said boom, a horizontal trough provided with oppositely revolving spirals also mounted on said boom and positioned over the buckets, the buckets arranged in staggered relation when considered from their two paths of travel, the trough provided with openings in its bottom so that a plurality of buckets may be filled during their inward travel in their upper path, and cam means for tripping the buckets on their outward travel in their lower path.

14. In combination with a concrete paver, a boom, an endless conveyor on said boom, a trough having spirals therein, means for operating the spirals when the buckets are traveling, means for simultaneously filling a plurality of buckets as the buckets move inwardly on the boom, the buckets so positioned that any spill from the buckets when being filled will drop into the outwardly moving buckets, and means for discharging the contents of the buckets at any point during the outward movement of the buckets.

AXEL E. LUNDBYE.