Patented Aug. 25, 1925.

UNITED STATES PATENT OFFICE.

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BOOM-AND-BUCKET PAVING MACHINE.

Application filed October 25, 1933. Serial No. 670,738.

To all whom it may concern:

Be it known that I, John F. Robb, a citizen of the United States, residing at Cleveland Heights, in the county of Cuyahoga and State of Ohio, have invented certain new and useful improvements in Boom-and-Bucket Paving Machines, of which the following is a specification.

This invention has to do with machines commonly known today as concrete pavers of the boom and bucket type. Such machines comprise primarily a concrete mixer having an attachment associated therewith in the form of a boom equipped with a bucket for distributing concrete for movement along the boom and discharged at a suitable time in its movement.

Reissue Letters Patent of Koehring No. 13,817 granted September 16, 1913 and Lichtenberg Patent No. 1,411,537 granted March 28, 1922 typify machines such as above broadly described.

The object of the present invention has been to so design a boom and bucket paver as to utilize the movement of the boom carrying the bucket in a direction transversely of the road subgrade, with the coincident discharge of the bucket, to cause a spreading action of the bucket in depositing the concrete aggregates upon the said subgrade. In other words, I utilize largely the structure of the said Koehring reissue patent with a longitudinal bucket, combined with mechanism for moving the boom simultaneously with the discharge of the bucket to accomplish a spreading action quite similar to that of the Lichtenberg patent which utilizes the movement of the bucket along the boom for effecting the spreading operation, however.

The present invention, therefore, resides in those provisions by which the boom of the paver is adapted to be moved in a horizontal plane, or approximately such plane, with a simultaneous discharge action of the bucket so that the spreading of the concrete aggregates may be accomplished in a direction transversely of the road subgrade. The invention further resides in automatic features of the mechanism for moving the boom for the spreading action, enabling the said movement to be initiated when the bucket reaches a certain point in its traverse on the boom, together with means whereby the boom will be restored to its initial position from which it starts to perform the bucket discharging and spreading function hereinbefore set forth.

Still another object of the invention has been to produce a mechanism of the class referred to, which may be readily combined with known boom and bucket attachments for concrete pavers of the Koehring type most commonly in use today, without necessitating any particular reorganization of the machinery embodied in the known type of paver above referred to.

With the foregoing objects in view an understanding of the invention will be had by reference to the following detailed description, in conjunction with the annexed drawings, in which:

Figure 1 is a side view of a concrete paving machine very similar to that of the Lichtenberg patent, previously identified, and showing the general features of the present invention as embodied therein.

Figure 2 is a somewhat enlarged view showing the boom swing trip means intermediate the bucket operating cable and the clutch actuating trip rod.

Figure 3 is a top plan view of certain parts of the mechanism shown in Fig. 1.

Figure 4 is a horizontal sectional view bringing out more clearly the mounting of the clutch operating main sector lever and the adjacent parts at the inner end of the boom for actuating the boom by a swinging movement.

Figure 5 is a sectional view taken about on the line 5—5 of Figure 1.

Figure 6 is a similar view taken about on the line 6—6 of Figure 1.

Figure 7 is a perspective view of the boom swing gearing and the automatic boom swing clutch mechanism at the inner end of the boom, showing clearly the operating arrangement and certain manual actuating means.

Figure 8 is a detail perspective view showing the reversing lever and latch mechanism controlling the actuation of the boom when swung automatically, or through manual control under certain conditions.

Figure 9 is a sectional view more clearly showing the inner member of the main clutch lever controlling the boom swing operation.

Figures 10 to 13 inclusive are simple diagrammatic views indicating more fully the
action of the clutch throwing cams of the inner bar of the main clutch lever for boom
swing control purposes.
It is not believed necessary to describe the
boom and bucket attachment specifically
since the construction illustrated is very
largely that of Lichtenberg Patent No.
1,411,217 heretofore referred to. An un-
derstanding of said patent will enable a
comprehension of the general operation of
the mechanism as shown in Figure 1, which
illustrates the end of the concrete mixing
drum at A as geared by a shaft B to drive
certain clutch means generally designated at
C by which the bucket moving cable 1 is op-
erated. This cable 1 is connected with the
carriage 2 equipped with trolley wheels 3 so
as to operate longitudinally of the boom E
said boom preferably comprising spaced
channels suitably fabricated into a unit.
The carriage 2 moves back and forth on
the boom E and is adapted to strike a knock-out
or shifter arm 3' adjacent to the outer end
of the boom and pivoted to a bracket there-
on. The arm 4 is connected with a pull rod
5 extending longitudinally of the boom be-
tween the channels thereof. When the
knock-out arm is rocked upward a pull is
exerted on the rod 5 and said rod actuated
certain connections at the inner end of the
boom E so as to pull downwards upon a bar
6 and crank lever 7, whereby to operate the
clutch mechanism at C to reverse the pull on
the cable 1, and thereby reverse the direc-
tion of movement of the bucket F and the
carriage 2 supporting the said bucket.
There is provided a suitable hand wheel
mechanism at 8 for operating a boom adjust-
ing cable 9 to raise and lower the boom and
hold it at different inclined adjustments as
required by conditions of service. At its in-
er end, as seen perhaps best by Figures 4
and 7, the boom is equipped with a worm
gear 10 and said worm gear is engaged by
a worm 11 on the worm shaft 12. A hand
wheel 13 is fixed to the shaft 12 to turn the
shafts and its worm 11, and in this way the
boom E may be swung horizontally by man-
nual power.
Thus far described the mechanism or
parts are substantially the same as set forth
in Lichtenberg Patent No. 1,411,217. The
trip mechanism for dumping the bucket is
substantially identical with the mechanism
of the patent just mentioned, and the means
to close the bucket likewise are the same.
The bucket F, however, is disposed so that
its doors are arranged longitudinally sub-
stantially as found in said reissue Patent
No. 13,617, the opening or discharge action
of the bucket, however, being like that of
Patent No. 1,411,217, except that in the lat-
ter the bucket is transverse and in the pres-
cent case the bucket is longitudinal to the
boom.
Referring particularly to Figures 4 and
7 to 13, the improvements of my invention
may be set forth in detail. I use a power
mechanism for operating the worm shaft 12
to swing the boom longitudinally, in addition
to the hand wheel 13, which in the use of
my invention will be very rarely employed.
The power drive mechanism includes a bevel
gear 14 on the end of the shaft opposite the
wheel 13, and adapted to rotate with the
shaft. Adapted to mesh with the gear 14
are the clutch gears 15 and 16 at opposite
sides of the axis constituted by the shaft 12.
The clutch gears 15 and 16 are loosely
mounted upon a drive shaft 17 operated by
gearing 18 from a shaft 19 driven by gearing
20 upon a horizontal shaft 21 equipped with
a spur gear 22 engaging one of the gear
rings on the mixer drum A. Each of the
clutch gears 15 and 16 has a clutch 23 for
connecting it to turn with the shaft 17.
When the gear 15 is clutched to the shaft 17
the intermediate gear 14 of the worm shaft
will be driven to turn the said shaft in one
direction. When the gear 16, however, is
clutched to the shaft 17 and the gear 15 un-
clutched the worm shaft will be driven in
the opposite direction from that just men-
tioned by the reaction of the gears 14 and
15. The gears 14, 15 and 16 and their
clutches 23 may be conventional construc-
tions of such parts well known and in com-
mon use today.
The means for shifting the clutches 23 is
adapted to alternately clutch the gears 15
and 16 to the shaft 17, or maintain the clutch
mechanism in neutral position so that nei-
ther of the said gears will be driven by the
shaft 17. For this purpose I provide shift-
ing yokes 24 on levers 25 suitably pivoted
to any substantial support not shown, the
levers 25 being connected together by a link
bar 26 so that the operation of the clutches
25 may be simultaneously controlled. One
of the levers 24 is a bell crank lever having
the arm 24' attached by a link rod 26 to an-
other bell crank lever 27 equipped with the
selector arms 28. The arms 28 engage in
slots 29 of the selector levers 30 and 31 piv-
oted on a supporting shaft 32 and normally
loose relatively to the shaft. The hubs of
the selector levers 30 and 31 are formed with
spaced lugs 33. Intermediate the levers 30
and 31 is a shifting lever 34 having a fork
35, the purpose of which will be later de-
scribed. However, at the end of the lever
34 mounted on the shaft 32 there is carried
the selector latch 36, movable into either of
two positions, namely, to engage the lugs 33
of the selector arm 31, or the corresponding
lugs of the selector arm 30. When engaged
with either arm it will be observed that the
latch 35 may operatively connect the shift-
ing lever 34 to the hub of either of the arms
30 or 31, and if the lever 34 is moved up or

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down its movement will be transmitted to the clutch levers 24 and the clutches 23 will be operated accordingly as will later be set forth.

5 Thus far, therefore, it will be understood that I have provided a suitable lever mechanism for the operation of the clutches 23, either one first as desired, according to the adjustment of the latch 35, so that the shaft 12 may be caused to be operated by one of the gears 15 and 16 and the boom thereby swung in the particular direction controlled by the particular gear selected to be actuated first. The arrangement of the levers 23 is such furthermore, that when one of the gears 15 and 16 is clutched to the shaft 17 to turn the worm shaft 19 in one direction, the said gear may be unclutched and its opposing gear clutched to the shaft 17 and the worm shaft turned in the opposite direction. It is in this way that I cause a swinging movement of the boom E in opposite directions.

I prefer to control the swinging movement of the boom automatically, for which purpose I provide, pivoted to the boom E to turn therewith, a sort of skeleton main clutch control lever designated at 36. This control lever 36 is seen best in Figures 4 and 7 as having the pivoted trunnions 37 above which extends an arm 38. At its free end portion the control lever 36 is equipped with an inner sector member 36a and an outer sector member 36b. The whole control lever may be made in one casting preferably, and will turn with the boom as the latter is moved horizontally. Referring to Figure 2 there will be seen to be located in a position lengthwise of the boom E an operating rod 39 somewhat similar to the rod 5 and arranged slidable on the boom. The rod 39 carries a pivoted trip member 40. On the lower run of the cable 1 is provided an adjustable trip member 41 secured to the cable in the proper position by a suitable set screw and adapted to engage with the trip member 40 to slide the rod 39 outwardly on the boom. At its inner end the rod 39 is connected with the arm 38 of the control lever 36. The pivoted trip member 40 is so mounted that when engaged by the trip member 41 there will be caused a shifting of the rod 39 outwardly on the boom and a simultaneous lifting of the tail of the member 40, which is virtually a dog, at a certain point near the end of the outward movement of the rod 39 caused by the member 41, the tail of the dog 40 will have lifted by contact with the stationary pin to permit the member 41 to escape so that the parts assume approximately the dotted line positions of Figure 2. By reference to Figures 7 and 9 it will be seen that the inner sector member 36a of the control lever 36 has a centrally located neutralizing clutch shifting cam 42 projecting downward therefrom, and near its ends are located clutch engaging cams 43 and 44. Cooperating with the said inner sector member 36b also is a neutralizing and operating device, seen best in Figures 7 and 9 as comprising a yoke member 45, between the upper and lower arms of which the member 36b is received. The yoke member 45 has a stem 46 extending downwardly therefrom and mounted upon the bracket portion 47 of the bracket 48 on which the boom is pivotally supported. Springs 49 above and below the bracket member 47 engage with small abutments 50 on the stem 46 and also above and below the bracket member 47. By the coaction between the springs 49 and the abutments 50 the yoke member 45 is normally maintained in what may be called a neutral control position, that is a position which tends to cause or maintain the clutches 23 in neutral condition wherefore no drive is transmitted to the worm shaft 12 from the shaft 17.

It may now be stated that the shifting lever 34 has its fork 35 engaged with the outer sector member of the clutch control lever 36 and the operation of the lever 34 is caused by pivotal movement of the lever 36. With the above construction in view I will now describe the cooperation of the parts in a regular cycle of operation of my mechanism. It being assumed that the parts are substantially in the positions of Figure 1, and that the bucket F has been loaded with concrete aggregates in properly mixed condition, and that the said aggregates are ready for distribution, the operator of the machine will actuate the control lever of the clutch mechanism at C and cause outward travel of the bucket F and carriage 2 on the boom E. As the carriage 2 moves outwards on the boom E the cable 1 causes the trip member 41 to move correspondingly toward the outer end of the boom. At a certain point seen in Figure 2, the member 41 engages the dog 40 and slides the clutch operating rod 39 outwards a short distance. Passing now to Figure 7, the said movement of the rod 39 is transmitted to the control lever 36 to raise the latter pivotally and thus elevate the inner and outer sector members 36a and 36b. The raising of the member 36b does not influence the yoke member 45, but the raising of the outer sector member 36b causes an upward movement of the shifting lever 34, assuming that the latch 35 is in the position of Figure 8, the lever 31 will be rocked and the bell crank lever 27 will likewise be rocked in one direction, pushing on the link 26 and rocking the clutch shifting lever 24 which is of bell crank form. Thereby the two levers 24 are actuated so that the right hand clutch 23 of Figure 7 is thrown in rendering the gear 16 active to drive the gear 14 and turn the worm shaft 12. The
turning of the worm shaft 12, of course, turns the boom E in substantially a horizontal direction with what is known as its horizontal swinging movement. It will be borne in mind that the boom E is now swinging toward one side of the subgrade where the pavement is to be laid. It will also be noted that as soon as the clutch 23 aforesaid has been thrown in the trip member 41 will have escaped the dog 40, incident to the progressing outward movement of the bucket F which is traversing the boom E toward its outer end. Just after the swinging movement of the boom E is initiated in the above manner the carriage 2 strikes the rocker arm or lever 3 and reverses the action of the clutch mechanism at C through the cooperation of the rod 5 and parts 6 and 7.

The reversing of the movement of the bucket F in this automatic manner causes a tripping of the dumping mechanism of the bucket in the well known manner set forth in Lichtenberg Patent No. 1,411,217 mentioned above, and in the manner set forth also in Lichtenberg Patent No. 1,414,470 issued June 1, 1915. The mechanism for this purpose is generally illustrated in the drawings and is well known to those versed in the art of paving machines.

Therefore, the stage of the operation of the machine as described is such that the boom E is swinging steadily toward one side of the subgrade and is carrying with it the bucket F in a direction transversely of the pavement being laid. Furthermore, the bucket is discharging simultaneously with the now swinging movement of the boom on account of the reversal of direction of movement of the bucket.

In practical effect as the reverse movement of the bucket takes a moment and the discharge of the bucket takes place very quickly, the inward travel of the bucket on the boom is substantially negligible while it is discharging. In other words, the bucket is practically discharged incident to the swinging movement of the boom before it obtains any headway, practically speaking, in its movement toward the inner end of the boom. In the meanwhile the boom has now reached its limit of sidewise movement for its spreading distributing action of the bucket and the cam 43 on the inner sector member strikes the upper part of the yoke 45 as seen in Figure 11 diagrammatically, and rides under said part of the yoke 45 as seen in Figure 12 diagrammatically. This action of the cam causes a lowering of the control lever 36 below neutral position and correspondingly lowers the shifting lever 34 and reverses the actuation of the clutch parts, so as to throw in the left hand clutch 23 of Figure 7 and disengage the right hand clutch. Thereby the direction of driving of the worm shaft 12 is reversed and the swinging movement of the boom is correspondingly reversed, so that the boom begins to turn back to its normal position from which it started, said position according to this mechanism being a central position longitudinally of the subgrade, although this not being a necessary condition. As the boom is returning to its normal central position the bucket F is returning toward its inner end so as to be ready to receive another batch of aggregates from the drum A. As the boom reaches its original position from which it started to swing, the yoke 45 engages with the central neutralizing cam 42 that projects downwardly from the sector member 39. In this way the yoke 45 compels an upward movement of the central lever 36 just sufficiently to disengage the left hand clutch 23 and maintain the two clutches 23 in neutral positions. The boom is thus brought to a stop at its original position from which it started to swing, and by this time the bucket may or may not have resumed its normal position adjacent to the mixing drum and cause the neutralization of the driving clutch mechanism C coating with the cable 1, which operation is also a known one according to Patent No. 1,411,217.

The control yoke 45 could be rigidly mounted if desired, were its functions restricted to those which I have described. However, I prefer that it be yieldably mounted in accordance with the means previously set forth, in order that I may attach to the lower end of the stem 48 an operating lever 51 adapted to be actuated by a rod 52 and manual power applied there to. By operating the rod 52 I can actuate the control lever 36 independently of its operation from the cable trip 41, and throw either clutch 28 into action to cause a swinging of the boom E by the application of power taken off of the mixing drum or transmitted directly from the engine of the power as desired. I note that I may use a rod 53, see Figure 8, to rock the latch 35 in either direction. When the latch is in the position shown in Figure 8, the boom E will be swung from its central position in one direction toward the side of the subgrade, and when the latch is swung to its other position the boom will be swung from its central position toward the other side of the subgrade. I, therefore, obtain a selective control of the direction of movement of the boom from a central point. I wish to say, however, that within the purview of my invention the normal position of the boom may be extending out with its outer terminal adjacent to a side of the subgrade, and the swinging movement of the boom may take it to the opposite side of the subgrade, instead of the boom working from a central
point. Furthermore, instead of having the cams 43 and 44 integral with the inner sector member 36 they might be adjustable so as to control the degree of swing of the boom, in other words, their adjustability would enable the boom to swing properly to adapt its movement for a spreading action of the bucket on roads of different widths.

Summarizing the features of the present machine in the light of its operation, it may be noted that there are provided in combination for the whole general machine, a mechanism to start the swinging of the boom horizontally before the bucket reaches its outer limit of movement; means for causing a discharge action of the bucket after the movement of the boom has been initiated; an arrangement of doors for the bucket, such that the swinging of the boom will cause the mixed concrete in the bucket to pass therefrom in a stream of suitable thickness, whereby the concrete is laid down on the subgrade in a layer of sufficient thickness to do away with manual spreading as much as possible; means for reversing the swinging movement of the boom to restore it to its normal original position; together with means that reverses the direction of movement of the bucket on the boom at the same time or almost at the same time as the discharging action of the bucket is controlled.

It is to be also noted that my bucket is so carried or mounted upon the boom that its discharge doors will flow the concrete or mixed aggregates to the subgrade in a layer of regulated thickness, so that the concrete is laid down on the subgrade in layer-like form and transversely of the subgrade to materially reduce the manual spreading of the concrete.

In Figure 10 the inner sector 36a of the central lever 36 is shown in its normal position; in Figure 11 said sector is shifting laterally with the boom as depicted by dotted lines; in Figure 12 the sector has reached its limit of lateral movement and has been caused to throw the boom swinging clutch means into reverse action to reverse the direction of the swinging of the boom, and in Figure 13 the sector is shown as it is about to be raised to its neutral position to neutralize the clutch mechanism and discontinue the swinging of the boom as the latter reaches its original position.

I may provide a clutch 14a for the gear 14 to connect and disconnect it in relation to the shaft 12, see Fig. 7. When the shaft is to be turned by hand, the gearing 14, 15 and 16 may be disconnected.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing mechanism associated therewith comprising a bucket with a discharge parallel with the boom, means for moving the bucket outwardly and inwardly on the boom, and for discharging said bucket at a desired moment to stream the concrete therefrom in a layer-like form, together with means for swinging the boom simultaneously with the discharge of the bucket whereby the plastic concrete in the bucket is flowed onto the subgrade with a spreading action.

2. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing attachment therefor, comprising a boom, a bucket adapted to traverse the boom and means for discharging the bucket, and means for swinging the boom operated by said mixer.

3. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing attachment therefor comprising a boom, a bucket adapted to traverse the boom and means for discharging the bucket, means for swinging the boom operated by said mixer, and means to render the operation of swinging the boom and discharging the bucket simultaneous.

4. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing mechanism associated therewith, means for moving the bucket outwardly and inwardly on the boom, and for discharging said bucket at a desired moment, together with means for swinging the boom simultaneously with the discharge of the bucket, whereby the plastic concrete in the bucket is flowed onto the subgrade with a spreading action, the bucket being equipped with discharging means to flow the concrete therefrom on a line substantially parallel with the boom.

5. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing attachment comprising a boom, a bucket to receive concrete from the mixer and adapted to traverse the boom, means for discharging said bucket automatically at a predetermined point in its movement along the boom, and means for causing a swinging movement of the boom to be initiated just prior to the automatic discharging of the bucket.

6. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing attachment comprising a boom, a bucket to receive concrete from the mixer and adapted to traverse the boom, means for discharging said bucket automatically at a predetermined point in its movement along the boom, means for causing a swinging movement of the boom to be initiated just prior to the automatic discharging of the bucket, and means for returning the boom to its normal position from which it was swung.
7. In a concrete distributing machine in combination, a concrete mixer, a boom and bucket distributing attachment comprising a boom, a bucket to receive concrete from the mixer and adapted to traverse the boom, means for discharging said bucket automatically at a predetermined point in its movement along the boom, means for causing a swinging movement of the boom to be initiated just prior to the automatic discharging of the bucket, means for returning the boom to its normal position from which it was swung, and means for reversing the direction of movement of the boom after its discharge operation has been effected.

8. A boom and bucket attachment for concrete mixers comprising a boom, a bucket to traverse the boom, cable driving means for the bucket, swinging means for the boom, and means operated under the control of the cable driving means for initiating the action of the boom swinging means.

9. A boom and bucket attachment for concrete mixers comprising a boom, a bucket to traverse the boom, cable driving means for the bucket, swinging means for the boom, means operated under the control of the cable driving means for initiating the action of the boom swinging means, and automatic means for reversing the operation of the boom swinging means as initiated from the cable means.

10. In a boom and bucket attachment for concrete mixers in combination, a boom, a bucket to traverse the same, cable driving means for moving the bucket on the boom, operating means to swing the boom, a manual controller for said operating means and automatic power actuating means for said operating means controllable manually when said controller is used.

11. In a boom and bucket attachment for concrete mixers in combination, a boom, a bucket to traverse the same, cable driving means for moving the bucket on the boom, operating means to swing the boom, a manual controller for said operating means, power actuating means for said operating means, and an automatic device controlling the action of said last mentioned power means to swing the boom independently of the operation of the controller.

12. In a boom and bucket attachment for concrete mixers in combination, a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, and means controlled by the last mentioned means for automatically causing a swinging movement of the boom at a predetermined time.

13. In a boom and bucket attachment for concrete mixers, in combination a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, means controlled by the last men-
to traverse the boom, cable driving means for the bucket, swinging means for the boom, means operated under the control of the cable driving means for initiating the action of the boom swinging means, automatic means for reversing the operation of the boom swinging means as initiated from the cable means and for discharging the bucket as the boom swings.

20. In a boom and bucket attachment for concrete mixers, in combination a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, means controlled by the last mentioned means for automatically causing a swinging movement of the boom at a predetermined time, and in a horizontal direction, and for also dumping the bucket as the boom swings.

21. In a boom and bucket attachment for concrete mixers, in combination a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, means controlled by the last mentioned means for automatically causing a swinging movement of the boom at a predetermined time, and in a horizontal direction for also dumping the bucket as the boom swings and for restoring the boom to its starting position.

22. In a boom and bucket attachment for concrete mixers, in combination a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, means controlled by the last mentioned means for automatically causing a swinging movement of the boom at a predetermined time, and in a horizontal direction for also dumping the bucket as the boom swings, and for restoring the boom and bucket to normal positions from which they are operated as above mentioned.

23. In a boom and bucket attachment for concrete mixers, in combination a boom, a bucket to traverse the boom, means for moving the bucket inward and outward on the boom, means controlled by the last mentioned means for automatically causing a swinging movement of the boom at a predetermined time, and in a horizontal direction for also dumping the bucket as the boom swings, and for restoring the boom and bucket to normal positions from which they are operated as above mentioned, automatically acting on said parts.

24. In a concrete distributing machine, in combination, a concrete mixer, a boom and bucket distributing machine associated therewith and comprising a discharge for depositing concrete upon the sub-grade, means for moving the bucket inwardly and outwardly on the boom, and means for automatically and simultaneously swinging the boom and discharging the bucket when the latter reaches a certain point in its movement along the boom, to cause spreading of the concrete when it is deposited on the sub-grade below the bucket, as an incident to the said movement of the boom at the same time as the bucket is discharging.

In testimony whereof I affix my signature.

JOHN F. ROBB.