

Sept. 28, 1965

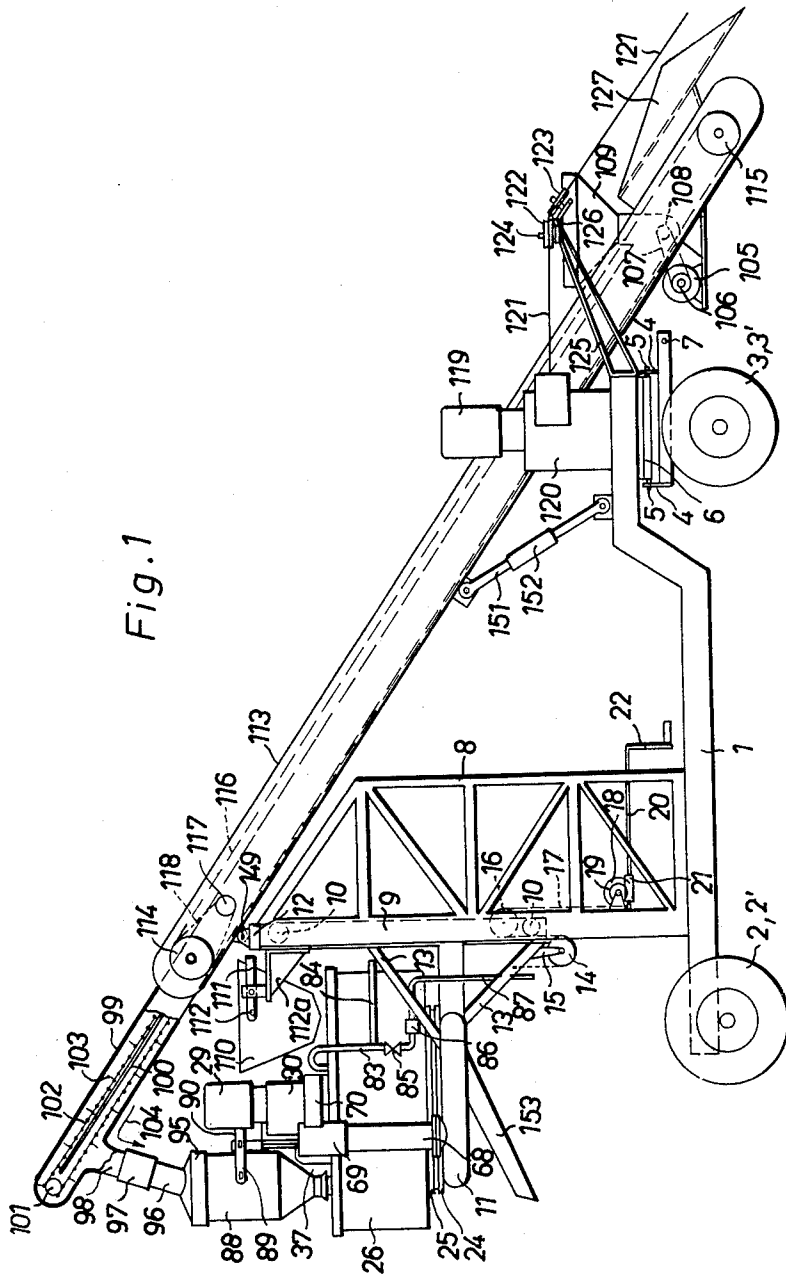
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3,208,735

MOBILE CONCRETE MIXERS

Filed Aug. 16, 1961

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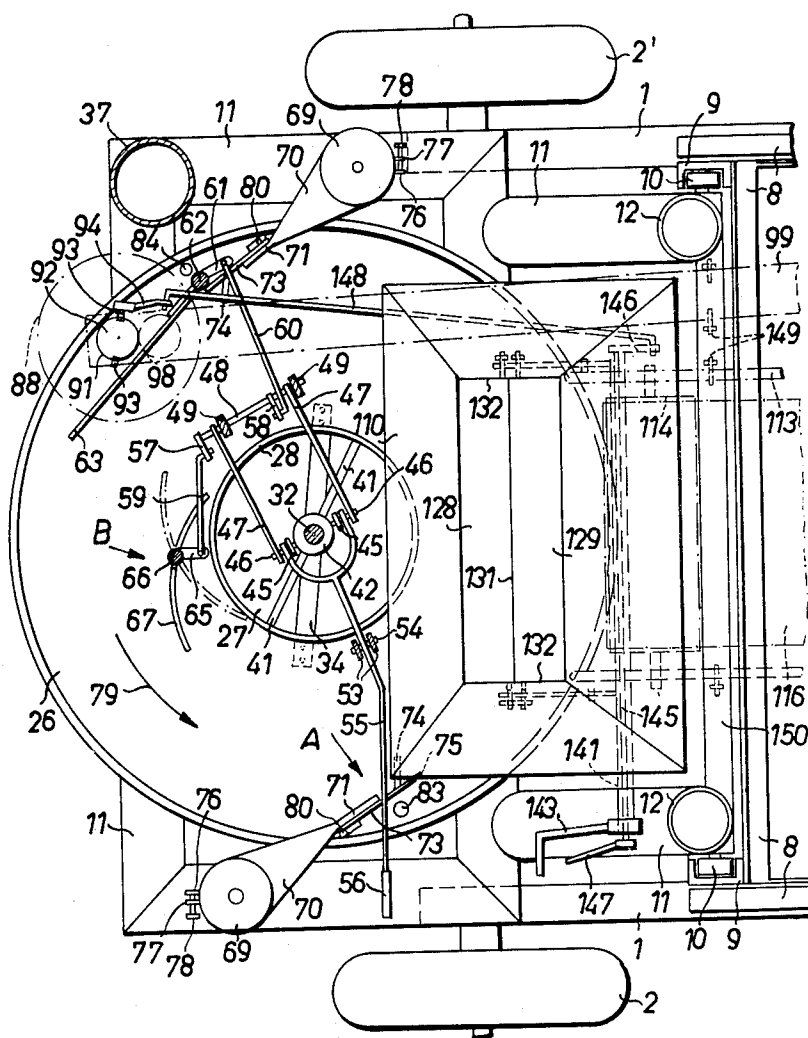
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Fig. 2



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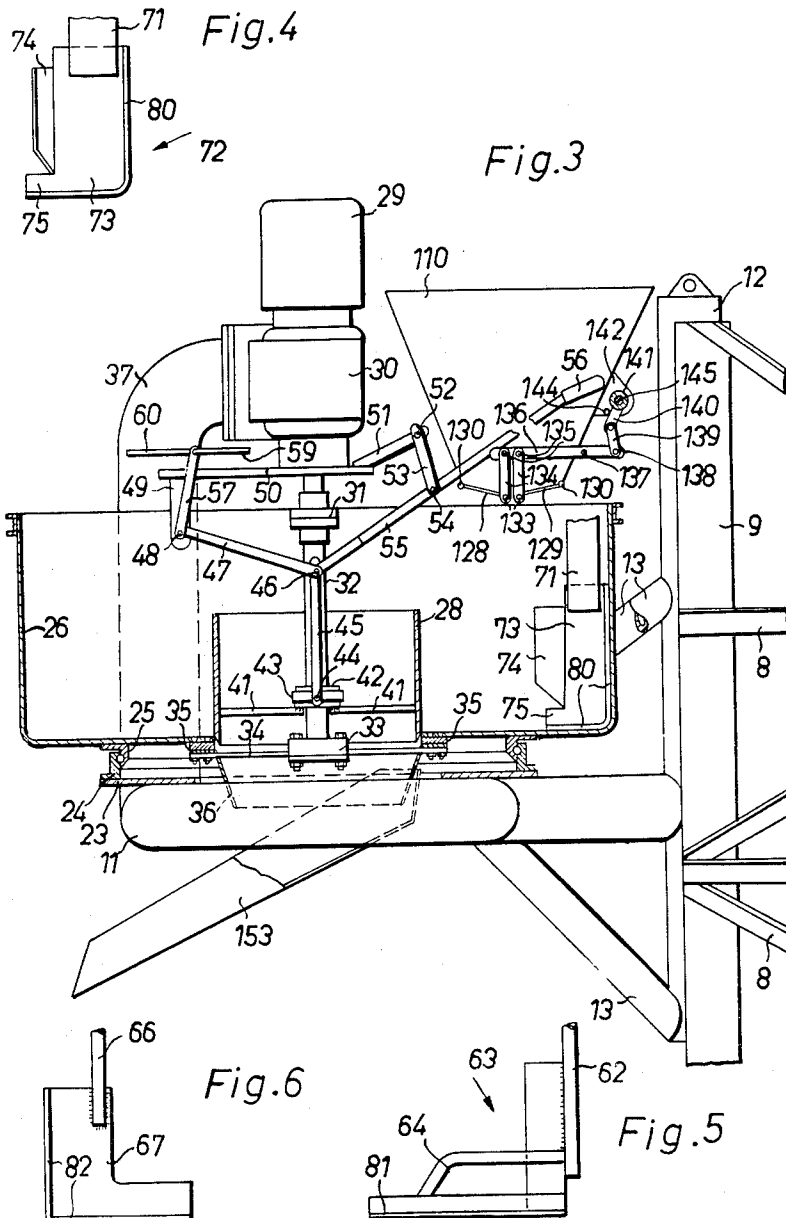
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MOBILE CONCRETE MIXERS
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The invention relates to improvements in mobile concrete mixers.

Mobile concrete mixers are known having tiltable mixing drums which are basically hollow cylindrical in shape and are provided with a tapered constriction, such drums requiring different filling, mixing and discharge positions with regard to their axis. Mixing drums are also known which likewise use the free-fall mixing action but in which the filling and mixing positions are identical, and in this case the mixing drum, with the mixing tools mounted in its interior, rotates substantially about a horizontal axis.

Furthermore, mobile concrete mixtures have already been proposed with a vertical arrangement of the axis of the mixing drum and a concrete installation in the interior of the mixing drum, as a result of which an annular mixing chamber is formed. This known construction uses a stationary drum with blade arrangements rotating about the axis of the mixing drum. The blades are driven by a geared engine, which is in the interior of the concentric installation, and move in the interior of the annular mixing chamber. This concrete mixer therefore uses a non-lift mixing action and in comparison with the ordinary tilting drum mixer, it affords an appreciable reduction in the mixing time and hence a considerably higher hourly output of fresh concrete. In practical operation, however, there is a greater wear of material as a result of the rotating blades in the interior of the mixing chamber and allowance is made for this by the provision of wearing plates. In this case, the whole mixing chamber of the drum is lined with wearing plates which have to be replaced frequently.

According to the present invention a mobile concrete mixer comprises a frame, a circular section mixing drum mounted on the frame and having a substantially vertical axis, a tubular member disposed within the drum concentrically therewith to define an annular mixing space, stationary mixing devices disposed in the annular space and means for rotating the drum about said axis.

With this arrangement, the mix is constantly moved by centrifugal action towards the outer wall of the mixing drum where it is caught by the stationary mixing tools. In this process there is no substantial relative speed between the mixing drum and the mix because the latter is entrained by the mixing drum and rotates. Wearing plates are therefore unnecessary because the natural wear remains within acceptable limits.

Preferably the drum is formed with a centrally disposed outlet in the floor thereof and said tubular member is mounted for displacement from a lower position in which it isolates said annular mixing space from said outlet to a raised position in which said annular mixing space communicates with said outlet.

It is advisable for at least two mixing devices to extend into the annular mixing space which tools are articulated for horizontal pivoting on vertical bearing columns which are mounted outside the mixing drum, the distance between the mixing devices and the cylindrical inner wall of the mixing drum being adjustable. Following the idea of the invention, each mixing tool comprises two vertically orientated blade plates which face in different directions, one of which runs like a chord in the mixing drum while the other has a direction which lies between the radial direction and that of the first blade plate, and the second blade plate ends above the floor of the mixing drum at a distance therefrom while the first blade plate

ends close to the floor of the mixing drum. As a result of this formation of the mixing tools, combined with the centrifugal action exerted on the mix, an excellent and intimate mixture is obtained which not only improves the quality of the concrete but also leads to an optimum mixing time which is considerably shorter than the mixing times of known concrete mixers.

In order to prevent wear on the mixing tools, it is an advantage for the vertical leading edge considered in the direction of rotation of the drum and/or the bottom edge of the first blade plate to be covered with a protective layer of a resilient material, preferably rubber. This prevents the mix contacting the metallic edge of the mixing tool and wear is eliminated at the stressed edges of the mixing tools. Even the protective layer is exposed to only a little wear, because the parts of the mix which impinge on the layer bounce back as a result of the resilience of the latter so that there is substantially no abrasive sliding between the mix and the layer. In addition, the protective layer acquires a protective layer of very fine particles of mix for it has been found that these very fine particles do not bounce back off the resilient material but are applied to the stressed surfaces.

The arrangement of the mixing devices is preferably such that they are equi-angularly disposed about the drum axis. As a result, the forces arising in the mixing drum as a result of the engagement of the mixing devices in the mix, are symmetrical.

Following the idea of the invention, a baffle is arranged substantially in the extension of the first blade plate of a mixing tool and is pivotable about a fixed vertical pivot pin extending into the mixing drum, which baffle extends as far as the floor of the mixing drum and co-operates with a second baffle, which is likewise mounted for pivoting about a fixed vertical pivot pin extending into the mixing drum and situated close to the centrally disposed drum outlet which second baffle likewise extends as far as the floor of the mixing drum, in such manner that, on actuation of an operating lever, both baffles are pivoted in such a manner that the mix is conveyed to the drum outlet and at the same time the length of tube is moved to its raised position and the mix is expelled.

In order to prevent the cement fed into the drum from forming dust it is an advantage for the first baffle to be formed with a slot having a direction of length extending substantially parallel to the floor of the mixing drum. Mix passes through this slot and covers the cement introduced into the drum as a result of which unwanted evolution of cement dust is inhibited. In order to avoid wear, it is advisable to provide the bottom edges of the baffles and the vertical leading edge of the second baffle with a protective layer of resilient material, preferably rubber.

A measured quantity of water is fed into the space between the cylindrical inner wall of the mixing drum and the first blade plate of each mixing tool, with the result that the mixing intensity is favourably influenced because the water is not fed on to the mix but is conveyed into areas which are free of mix and which extend substantially as far as the bottom of the drum, as a result of which the water is drawn under the mix. As a result of this measure, it is unnecessary to stir the water into the mix from the top downwards, a step which can only be carried out with difficulty because of the different specific gravities. Thus a concrete mixer according to the invention avoids one disadvantage of known constructions.

The cement may conveniently be introduced between the cylindrical inner wall of the mixing drum and the first baffle behind the neighbouring water intake, considered in the direction of rotation of the drum. In this case, the supply of cement to the mixing drum is pref-

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erably effected from a closed container which is suspended in a weighing device and the delivery socket of which can be closed by a hinged valve, and to which the cement is supplied through a pipeline with a flexible connection by a completely enclosed continuous conveyor which is automatically stopped on reaching a pre-set weight. As a result there is a considerable saving in time because the container can be re-filled again whilst mixing is being carried out in the drum.

It has been found that the quality of the mix can be improved by adding cement and water which are already mixed together; this may conveniently be effected as a result of the fact that the imaginary extension of the axis of the cement delivery socket and the imaginary extension of the axis of the adjacent water supply pipe converge towards one another in the delivery direction and intersect inside the mixing drum.

Aggregate, for example gravel, is preferably supplied by means of a conveyor belt to a feed hopper which is suspended in a second weighing device, and the delivery end of which can be closed by means of a hinged closing device, the conveyor belt being stopped automatically when the weight of aggregate in the hopper attains a predetermined value. By this means, too, there is the advantage of a saving in time because the feed hopper is refilled with aggregate during the mixing and the correct weight of aggregate is available immediately after the emptying of the drum.

An additional advantage is obtained as a result of the fact that the feed hopper is preferably in the form of a truncated rectangular pyramid, the smaller base of which forms the delivery opening which can be closed by means of a hinged closure which is preferably in two parts and the two halves of which are pivotally mounted on opposite sides of the delivery opening. The free edges of the closure halves, which are actuated by a lever system, come into sliding contact with one another and with the two opposite free walls of the feed hopper respectively. In contrast to all the known closures for gravel bins or hoppers, the hinged closure proposed according to the invention cannot jam and permits particularly easy operation. A lever is preferably articulated to each half of the closure at the outside of the closure device, which lever together with the corresponding lever on the opposite half of the closure, is articulated to one arm of a two-armed lever which is preferably articulated to the feed hopper and the other arm of which is articulately connected to a lever system, one lever of which is articulated to a bearing which is preferably secured to the feed hopper and this lever can be pivotally actuated for the opening and closing of the closure device.

For adaptation to various heights on building sites, it is advisable for the mixing drum to be connected through a rolling-bearing ring mount to a substantially horizontal frame arrangement which also carries the mixing tools, the weighing devices with the associated cement container and feed hopper and the drive unit for the mixing drum, the frame arrangement being guided for lifting movement on a vertical guide structure which is rigidly connected to the chassis. It is further an advantage for the cement conveyor and the conveyor belt for aggregate to be supported for pivoting in the longitudinal direction of the chassis with their delivery ends supported on the guide structure, while variable-length pivoted supports are articulated in the vicinity of their charging ends, the other ends of the supports being pivotally connected to the chassis.

One embodiment of the invention will now be described by way of example, reference being made to the accompanying drawings in which:

FIGURE 1 is a somewhat diagrammatic side elevational view of a mobile concrete mixer according to the invention,

FIGURE 2 is a plan view of the mixing drum,

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FIGURE 3 is a vertical section through the mixing drum of FIGURE 2,

FIGURE 4 is a side view of a mixing tool seen in the direction A of FIGURE 2,

FIGURE 5 is a side view of a baffle, and

FIGURE 6 is a side view of a further baffle seen in the direction B of FIGURE 2.

The mobile concrete mixer of this example comprises a chassis having a torsionally rigid frame 1, a rigid rear axle arrangement with travelling wheels 2, 2' preferably having pneumatic tires, and a jointed cross-shaft front axle arrangement with travelling wheels 3, 3' which are likewise preferably equipped with pneumatic tires. This oscillating axle arrangement may, for example, be pivotally mounted, through bearing members 4 on trunnions 5 which are secured to the under portion of a steering bogie 6. The oscillating axle arrangement has recesses 7 in which a towbar is suspended during the transport of the concrete mixer. In the operating position of the concrete mixer as illustrated in FIGURE 1, the towbar is removed. Moreover, when the concrete mixer is in operation, the chassis 1 must be aligned horizontally both in the longitudinal direction of the chassis and in the transverse direction of the chassis and this may conveniently be effected by means of wooden blocks which are carried with the mixer and which are placed, in the vicinity of the rear axle arrangement, under the chassis 1 which has previously been raised, for example with a winch. Instead of the wooden blocks, however, vertically directed lifting spindle arrangements which are rigidly connected to the chassis 1 may be provided at suitable points on the chassis, each lifting spindle arrangements consisting of the threaded spindle, a threaded nut handwheel or crank fixed to the chassis, and a foot plate. The front axle arrangement which is constructed in the form of an oscillating axle automatically adapts itself to irregularities in the ground and therefore does not have to be aligned.

In the vicinity of the rear axle arrangement, the chassis 1 carries a guide structure 8 which is directed substantially vertically and which is rigidly connected to the chassis. The guide structure 8 may, for example, be of framework construction with alternating bracing and contains two vertical guide rails 9 which are disposed opposite one another in the transverse direction of the chassis. Each guide rail 9 is of U-section, the open side of the U facing the interior of the chassis. Engaging in the guide rails 9 are rollers 10 which are components of a horizontally aligned tubular frame 11. The tubular frame 11 comprises vertically directed tubes 12, each of which is adjacent to a guide rail 9 and on each of which are mounted at least two rollers 10 which are at different heights. The tubes 12 are braced in relation to one another in a suitable manner and in relation to the tubular frame 11, for example by means of tubular stays 13. At the lower end of the frame arrangement 11, 12, 13, preferably in the central longitudinal plane of the chassis, there is mounted a rotatable roller or pulley 14 which is supported on the tubular frame arrangement through bearing members 15. Another roller or pulley 16 is mounted for rotation on the guide structure 8 in the same plane. A cable 17, which is secured to the tubular frame arrangement, is taken over the pulleys 14 and 16 and wound on a cable drum 18 which is mounted for rotation on the guide structure 8. Rigidly connected to the cable drum 18 is a worm wheel 19 which cooperates with a worm 21 on a spindle 20. The spindle 20 is mounted for rotation in the guide structure 8 and has a crank handle 22 at its free end. By means of this crank handle 22, the tubular frame arrangement 11, 12, 13 can be displaced vertically in relation to the guide structure 8. In FIGURE 1, the tubular frame arrangement is shown in its highest position; an ordinary ratchet and pawl or detent device is provided inside the cable drum 18 and prevents the tubular frame arrangement from moving down automatically. The frame arrangement 11, 12, 13 is not limited to the use of tubes as

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components but may be produced by using other suitable sections.

Rigidly connected to the tubular frame 11 is a base plate 23 which carries the lower ring 24 of a rolling-bearing ring mount arrangement. The upper ring 25 of this ring mount arrangement is secured concentrically to the lower face of a cylindrical mixing drum 26. Thus the mixing drum 26 is mounted for rotation about a substantially vertical axis. The mixing drum 26 has a centrally disposed outlet 27 in the floor thereof which is circular and in which a length of tube 28 of suitable outside diameter engages. This tube 28 defines with the drum 26 an annular mixing space. Mounted coaxially with the mixing drum 26 and above the latter is the drive unit which comprises an electric motor 29 with gearing 30 connected in front of it and which is coupled through a flange coupling 31 to the drive shaft 32 of the mixing drum. The drive shaft 32 extends through the outlet 27 and is connected, through a bolted engaging dog arrangement 33 to a driving rod 34. This driving rod 34 extends horizontally and diametrically below the outlet 27 and is bolted or riveted to the mixing drum 26 with the interposition of liners 35 and of a frustoconical discharge funnel 36. The drive unit is flange connected to a pipe 37 which is rigidly connected by welding or flange-mounting to the tubular frame 11.

The drive for the rotation of the mixing drum 26 may alternatively be effected by means of a drive unit (not shown) which is not centrally mounted but drives the mixing drum 26 through a pinion (not shown) and toothed rim (not shown) which is arranged concentrically with the ring mount arrangement 25, 24. This type of drive is preferred for large mixer units.

The length of tube 28 which closes the bottom opening 27 extends over a portion of the height of the mixing drum and is rigidly connected to a guide disc 42 through drive rods 41 which extend diametrically through the length of tube 28. The guide disc 42 is guided for rotation and displacement in height on the drive shaft 32 of the drum and is formed at its circumference with a circular depression or groove in which a guide ring 43 engages. The guide ring 43 is arranged in this groove in such a manner that rotation of the guide disc 42 is possible inside the guide ring 43 which for assembly reasons is preferably in two parts. Lifting rods 45, which each carry a pivot pin 46 at their upper ends, are articulated by means of pivot pins 44 which are secured, diametrically opposite one another, to the guide ring. Transmission rods 47, which are rigidly connected to a pivot pin 48, for example by welding, are articulated to these pivot pins 46. The pivot pin 48 is pivotally held in position by bearing members 49. The bearing members 49 are in turn secured to a bearing plate 50 which is fixed to the gearing 30. This bearing plate 50 carries another bearing member 51 to which pivoted rods 53 are articulated at 52, which rods are articulately connected, through a pin 54 at their other end, to an actuating rod 55. The actuating rod engages in a fork-like manner round the drive shaft 32 and is articulately connected to the pivot pins 46. A handle 56 is provided at the free end of the actuating rod 55.

Rigidly connected to the pivot pin 48, for example by welding, are one-armed actuating levers 57 and 58, to the free ends of which are articulated push-and-pull rods 59 and 60. The linkage described so far is illustrated in plan view in FIGURE 2 and in a side view folded into the plane of the drawing in FIGURE 3.

The push-and-pull rod 60 is articulated to a lever 61 which is rigidly connected, for example by welding, to a pivot pin 62 which projects vertically into the mixing drum 26. This pivot pin is pivotally mounted on the bearing plate 50 and carries a baffle arrangement 63 which is rigidly connected thereto, for example by welding, and which reaches down to the bottom of the mixing drum. The baffle arrangement shown in side elevation in FIGURE 5 is provided with a slot 64 which extends parallel

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to the floor of the mixing drum. The other push-and-pull rod 59 is likewise articulately connected to a one-armed lever 65 which is rigidly mounted, for example by welding, on another pivot pin 66 which is likewise pivotally mounted on the bearing plate 50. The pivot pin 66 is rigidly connected, for example by welding, to a second baffle 67 which is shown in side elevation in FIGURE 6 and in plan view in FIGURE 2, and from the plan view the curvature of this second baffle 67 can be seen. The baffle 67 likewise extends downwards as far as the floor of the mixing drum.

FIGURES 2 and 3 show the position of the linkage and of the baffles when the concrete mixer is in the operating condition and the baffles are in a rest position. When the contents of the mixing drum are to be discharged, the handle 56 is pressed down as a result of which not only is the length of tube 28 raised vertically through the lifting rods and the guide ring 43 but also the one-armed actuating levers 57 and 58 are pivoted in such a manner that the baffles 63 and 67 come into their operative position shown in chain-dotted lines in FIGURE 2, through the agency of the pull-and-push rods 60 and 59. When the baffles are in this operative position, the baffle 63 guides the mix towards the baffle 67 and the latter guides the fully mixed concrete to the outlet 27 where it is discharged. If the handle 56 of the actuating rod 55 is released, the length of tube 28 drops under its own weight closing the outlet 27 and at the same time the baffles 63 and 67 swing back into their rest position.

Vertical bearing columns 68 are secured, for example by flange mounting or welding, to the tubular frame arrangement 11, being substantially diametrically opposite in relation to the mixing drum 26. A head piece 69 is pivotally mounted on each bearing column 68 and carries a cantilever arm 70 which extends substantially horizontally. From each cantilever arm 70, a link 71 extends vertically into the mixing drum and carries a mixing device 72.

The mixing devices 72 extend vertically downwards to the floor of the mixing drum. Each mixing device 72 comprises two blade plates 73 and 74 which extend in different directions as is clear from FIGURE 2. The blade plate 73 represents the rectilinear extension of the link 71 and is formed at its free end with a recess so that a projection 75 is left at the bottom of the blade plate 73. Welded to the vertical edge of the recess in the blade plate 73 is the second blade plate 74 which does not reach down to the floor of the mixing drum. The first blade plate 73 extends in the direction of a chord inside the mixing drum. The second blade plate 74 extends away from the first blade plate 73 in the direction of rotation of the drum and inwardly of the chord. In effect, it extends in a direction which lies between the radial direction and that of the first blade plate. The distance of the mixing tool 72 from the cylindrical inner wall of the mixing drum 26 is adjustable by means of a link 76 welded to each bearing column and disposed opposite to a link 77 welded to the associated head piece 69 and provided with a threaded bore into which is screwed a screw 78 which bears with the end remote from the screw-head against the link 76. As a result of appropriate screwing of the screws 78, the distance between the mixing tool 72 and the cylindrical inner wall of the mixing drum is varied as desired.

The leading vertical edge of the blade plate 73 considered in the direction of rotation of the drum indicated by the arrow 79 and the bottom edge of the blade plate 73 are encased in a protective layer 80 of a resilient material, preferably rubber. It is also possible, however, to provide only one of the said edges with rubber. The rubber casing 80 may, for example, be provided on the blade plate 73 in the manner illustrated in FIGURE 2, that is to say the rubber is applied laterally to the face of the blade plate. It is also possible, however, to use sectional rubber, for example in the shape of a U or L and to cover the working edge of the blade plate with it.

A U-shaped rubber section protects the edge from wear on all sides. An L-shaped rubber section should be provided in such manner that the one arm of the L-section bears against the blade plate and the other arm engages over the working edge of the plate. A protective layer **81** and **82** may also be provided for the baffles **63** and **67** respectively, corresponding to the rubber layer **80** described for the mixing devices. In this case, the rubber layer **81** for the baffle **63** merely engages round the bottom edge of this baffle, while the baffle **67** has its leading vertical edge protected in addition to its lower bottom edge.

In the example illustrated, two mixing devices are provided equi-angularly spaced about the axis of the mixing drum. It is also possible, however, to distribute a larger number of mixing devices about the axis of the mixing drum **26** and this may be advisable with large mixing drums.

The water necessary for the concrete is supplied to the mixing drum through water supply pipes **83** and **84** which are only indicated symbolically in FIGURE 2. As can be seen from the drawing, the water is fed into the compartments or spaces which are present between the cylindrical inner wall of the mixing drum and the blade plate **73** of each mixing device. The water supply pipes **83** and **84** unite, as can be clearly seen for FIGURE 1, behind a common shut-off valve or gate-type shut-off valve **85**, which is represented symbolically in the drawing. This shut-off member **85** is downstream of a water meter **86** which is illustrated diagrammatically and to which the water flows through a pipe **87** which is provided at its outer end with connecting means for a hosepipe in a suitable manner. The water meter **86** permits accurate supervision of the water supplied to the mixing drum and it is possible to set the amount of water supplied in advance in which case the supply of water is automatically shut off through the shut-off member **85** when a measured quantity of water has been provided. For this purpose, the water meter **86** may be provided with an impulse line which actuates an electrical drive to the valve stem of the shut-off member **85** when a measured quantity of water has been provided.

The cement is supplied between the cylindrical inner wall of the mixing drum and the baffle **63**, behind the adjacent water intake **84** considered in the direction of rotation **79** of the drum. A cement container **88** is provided which is suspended by means of pivot pins **89** in a weighing device **90** which is only illustrated symbolically in FIGURE 1. The stationary parts of the weighing device are rigidly connected to the tubular frame **11** through the pipe **37**. Mounted in the delivery socket **91** of the cement container **88** by means of two pivot pins **93** is a hinged valve **92**. An operating lever **94** is secured to the one pivot pin **93**. At its upper end, the cement container **88** is closed by a cover **95** which is secured to the container by means of bayonet catches (not illustrated). Welded into the cover **95** is a connecting pipe **96** over the free end of which is slid a flexible union **97** which connects the connecting pipe **96** to the connecting pipe **98** of a fully enclosed continuous conveyor **99**. The flexible union **97** is provided in order to enable an accurate weighing of the cement content of the container **88** to be carried out. The continuous conveyor **99** is preferably of rectangular cross-section and is centrally divided by a partition wall **100**. This partition wall passes through the whole length of the continuous conveyor **99** and ends in front of the guide rollers **101** for the conveyor chain **102** in each case. Shovel plates **103** are secured, with uniform spacing, to the conveyor chain **102** and supply the cement to the cement container **88** in the conveying direction **104**. The drive of the conveyor chain **102** is effected by means of an electric motor **105**, and its driven pinion **106**, through a belt or chain **107** to the conveyor-chain drive pinion **108**. A feed hopper **109** is mounted at the lower end of the continuous conveyor **99**.

Because of the complete enclosure of the conveyor members, the cement is supplied to the cement container **88** without the formation of any dust. The drive motor **105** is automatically switched off when a predetermined weight of cement is present in the cement container **88** and measured by the weighing device **90**.

The water supply pipe **84** may be directed in such a manner (not shown) that entering water intersects or meets with cement passing through the cement discharge socket inside the compartment between the baffle **63** and the cylindrical inner wall of the mixing drum. As a result, if water and cement are supplied simultaneously, the cement and water meet in the drum and a mixing of these two materials takes place so that in effect, grout is fed into the mixing drum **26**. For the sake of clarity, the cement container **88** with its operating members and the baffles **63** and **67** are not shown in FIGURE 3. The mixing devices **72** are not fully illustrated therein either and one mixing tool is merely folded into the plane of the drawing.

The aggregate for the concrete, for example gravel, is supplied to the mixing drum **26** through a feed hopper **110** which is also suspended in a weighing device **111**, indicated symbolically in FIGURE 1, through pivot pins **112**. The feed hopper **110** and the weighing device **111** may be rigidly connected to the tubular frame arrangement **11**, **12**, **13** for example through bracket **112a**. The supply of aggregate to the feed hopper **110** is effected by means of a conveyor-belt device **113** which comprises an endless conveyor belt **116** guided over guide rollers **114** and **115**. The conveyor belt **116** is driven by a drive pinion **117** of an electric motor which is not illustrated, through a chain or belt drive **118**. The loading of the conveyor belt **116** is effected in known manner through a scraper device of which the drive motor **119** and winch device **120** are secured to the chassis **1**. The cable **121** which is secured to the scraper and which is wound on the drum of the winch device **120**, is guided over pulleys **122** and **123**. The pulley **122** is held, through a pivot **124** by a bracket device **125** secured to the chassis **1**. The pulley **123** is adapted for pivoting in relation to the bracket device **125** through a joint **126**. The pivotal arrangement of the guide pulley **123** makes allowance for the various angular positions of the scraper cable **121**. The aggregate, for example gravel, is supplied to the conveyor belt **116** by the scraper which is introduced inside a guide plate device **127**. The drive of the conveyor belt **116** is automatically switched off as soon as a predetermined weight of aggregate is present in the hopper **110** as measured by the weighing device **111**. Instead of the one conveyor belt **113**, a plurality of conveyor belts, for example three, may be provided to supply the aggregate to the feed hopper **110**.

In order to produce a high-strength concrete, it is known that not only the proportion of the aggregate by weight to the total mix is important but also, particularly with gravel, the composition must correspond, as regards grain size, to a specific grading curve determined by previous calculation. In order to ensure that the course of this grading curve is, in fact, in the favourable range in practice, the gravel is delivered in separate specific grain sizes, for example in the grain sizes 0 to 7, 7 to 15, 15 to 30 mm. These various groups of gravel are then combined in proportions by weight determined according to the grading curve for each concrete mix. In the concrete mixer according to the invention, the combination of the individual groups of gravel in a mix can be effected by means of three conveyor belts. The first belt, for example, conveys only the grade 0 to 7 mm. and after the specific calculated weight of this grade has been conveyed into the feed hopper, this conveyor belt is automatically switched off and the next conveyor belt begins to supply another grade, for example with the grain size 7 to 15 mm. The second conveyor belt is automatically switched off when the required weight

of the grade 7 to 15 mm. plus the weight of the grade 0 to 7 mm. already present has been reached in the feed hopper. At the same time, the third conveyor belt begins to supply the grade 15 to 30 mm. When the total weight of the aggregate with the grain sizes to 0 to 30 mm. has been reached, the third conveyor belt is also switched off again and after the feed hopper has been emptied into the mixing drum, the first conveyor belt again begins automatically to supply the grade 0 to 7 mm. The automatic switching on and off of the conveyor belts is effected by means of known and appropriate electrical circuit elements.

The feed hopper 110 is preferably in the form of a rectangular truncated pyramid, the smaller base of which forms the delivery opening which can be closed by a hinged closure 128, 129 which is preferably in two parts. The halves 128 and 129 of the closure are pivotally connected to opposite longitudinal sides of the delivery opening, for example by means of hinges 130. In the closed position, the longitudinal edges 131 of the two halves 128 and 129 of the closure lie together, and the shorter edges 132 of the two halves of the closure lie against the opposite free side walls of the feed hopper 110. Mounted on each edge 132 of the closure is a pivot pin 133 on which a lever 134 is articulated. Each pair of adjacent levers 134 is articulated through pivot pins 135 to the long arm 136 of a two-armed lever. The two-armed levers are each pivotally mounted on the feed hopper 110 at 137. Articulated to the short arm 138 of the two-armed lever is an intermediate member 139 which is articulately connected to a lever 140 which is rigidly connected to a tube 141, for example by welding. The tube 141 is pivotally guided in brackets 142 on the feed hopper 110. A lever arrangement as described for the halves of the hinged closure is provided on each of the narrow sides of the feed hopper. The tube 141 is provided with an operating lever 143, on rotation of which the levers 140 are pivoted in such a manner that the short arm 138 of the two-armed lever is raised as a result of which the long arm 136 of the two-armed lever moves downwards. In the course of this, the levers 134 swing outwards and open the two halves 128 and 129 of the closure. When the closure is in the closed position, the levers 140 bear against stops 144 which prevent the hinged closure from opening automatically. The connecting members 139 are directed so that the moment of force exerted on the short lever arm 138 of the two-armed lever as a result of the moment of loading urges the levers 140 against the stops 144. When opening the hinged closure only a very slight force is necessary to transfer the levers 140 and the connecting members 139 to the other side so that the halves of the closure open automatically under the action of the load.

Mounted for rotation inside the tube 141 is an actuating shaft 145 which carries a lever 146 at one end and an operating lever 147 at the other end. The lever 146 is articulately connected to a transmission rod 148 which in turn is articulately connected to the lever 94 of the hinged valve 92 in the delivery socket 91 of the cement container 88. On appropriate actuation of the operating lever 147, the hinged valve 92 is opened or closed.

The continuous conveyor 99 and the conveyor belt device 133 are suitably braced together. The two conveyor devices are articulately supported by means of pivot pins 149 on a cross bar 150 connecting the two frame tubes 12. Articulated substantially in the middle of the conveyor belt device 113 are pivoted supports 151, the other ends of which are articulately connected to the chassis 1. These pivoted supports 151 form the second support for the conveyor devices. The pivoted supports may be adapted for variation in length, for example, by means of a screw shackle 152. Thus it is possible to adapt the concrete mixer to the various build-

ing sites as regards the height of the loading ends of the conveyor devices.

The mixing process of the concrete mixer is described below. The water, the cement and the aggregate, for example gravel, are supplied in predetermined quantities by weight, to the mixing drum 26 which rotates at 50 revolutions per minute. It is possible to plan in advance the quantities by weight of the mixture components to be supplied, as a result of which the correct weights of charge are always present automatically. The mix introduced into the mixing drum comes substantially against the cylindrical inner wall of the mixing drum under the action of centrifugal force, and there it is caught by the mixing devices and churned up. In the course of this, various components of motion are superimposed in the mix, being caused by the formation of the mixing devices in conjunction with the action of centrifugal force. Although the components of motion are discussed individually hereinafter, nevertheless it should always be remembered that these components of motion only appear superimposed on one another. The blade plate 73 of each mixing device deflects the mix from the inner wall of the drum against the action of centrifugal force. After passing the blade plate, the mix is again applied against the inner wall. Thus a substantially radial reciprocating movement is imparted to the mix. The proportion of the mix which comes into contact with the blade plate 74 at first piles up, rises up this blade plate and tips over. On the other hand, the mix can pass freely through the space below the blade plate 74 and is merely influenced by the projection 75 on the first blade plate 73. As a result of the arrangement of the blade plate 74, therefore, there is a relative velocity inside the mix which contributes very considerably to the satisfactory intimates of the mixing. The intensity of the mixing of the mixing devices is so great that the mixing time is reduced to a minimum. The supply of the water and of the cement is very important as regards the mixing operation and, as already mentioned, these reach the mixing drum substantially already in the form of grout. The water, as described, is introduced into those areas in which there is no mix, that is to say the water reaches the bottom of the drum from whence it is constantly entrained by the rotating mix. It is therefore unnecessary to convey the water below the mix, a step which is naturally difficult to carry out because there is a considerable difference between the specific gravity of water on the one hand and of the other components of the mix on the other hand. The water which is supplied through the water supply pipe 84 and which becomes mixed with the cement supplied through the cement delivery socket 91, is covered, immediately after entering the space between the baffle 63, the one mixing tool 72 and the cylindrical inner wall of the mixing drum, by mix which passes through the slot 64 in the baffle 63, so that any disturbing dust-formation in the cement which has not yet come into contact with water is prevented. At the same time, however, the cement and the water are constantly drawn into the rotating mix. The passage of the mix through the slot 64 is effected by the action of centrifugal force. It is worth noting that relatively little water is used to mix the concrete and this is a direct consequence of the extremely thorough mixing. In consequence, no segregation occurs after the fully mixed concrete has been laid by the builder, such as can frequently be observed in the form of a layer of water lying on concrete floors, and the concrete structures dry out very quickly. Thus the mixer according to the invention not only affords a reduction in the mixing times but also an improvement in the quality of the mix. In addition, it is worth mentioning that the charging times for the components of the mix are very short because the cement container and the aggregate feed hopper are automatically re-filled during the mixing time which only lasts a few seconds. As a result, it is possible to charge

the drum with fresh components of the mix again immediately after it has been emptied. The finished concrete flows over a guide 153 into a skip which is held in readiness or may be supplied directly to a displacement-type concrete pump.

In the concrete mixer described so far, all the moving devices of the machine are driven by electric motors. It is possible, however, to provide a main drive, instead of these individual drives, and this main drive may be mounted on the chassis 1. This main drive may conveniently consist of an internal combustion engine which drives the machine components to be moved, through conventional transmission means such as shafts, gearwheels and belt or chain drives. When a main drive consisting of an internal combustion engine is used, it is possible to adapt the concrete mixer so that it is self-propelled, thus rendering unnecessary the towing of the concrete mixer to the site by means of a lorry or tractor. For transport, the tubular frame arrangement 11, 12, 13 is lowered inside the guide structure 8 by means of the manually actuated worm drive 19, 21, until the lower surfaces of the tubular frame arrangement rest on the chassis 1 and the conveyor devices 99, 113 are substantially horizontal in the longitudinal direction of the chassis. The conveyor devices then rest on the chassis through the pivot pins 149 and through the pivoted supports 151 and may be secured in position by the provision of additional supports.

What I claim is:

1. A mobile concrete mixer comprising a frame, a circular section mixing drum mounted on said frame and having a substantially vertical axis, an outer wall, and a floor having a centrally positioned outlet, a tubular member concentrically disposed within said drum for defining an annular mixing space, means for moving said tubular member from a lower position, where it isolates said annular mixing space from said outlet, to a raised position, where said annular mixing space communicates with said outlet, a first baffle positioned in said annular mixing space and extending to the floors of said drum, means for mounting said first baffle for pivotal displacement about a substantially vertical axis from a rest position to an operative position in which said first baffle guides the concrete mix in said annular space toward said outlet, a second baffle extending into said annular mixing space to the floor of said drum, means for mounting said second baffle for pivotal displacement about a substantially vertical axis from a rest position to an operative position wherein said second baffle guides the concrete mix in said annular space towards said first baffle, stationary mixing devices disposed within said annular space and being positioned along said outer wall, and means for rotating said drum about said axis at a speed sufficient for moving the concrete mix towards said outer wall under the action of centrifugal force whereby said concrete mix is caught and mixed by said mixing devices.

2. The mobile concrete mixer of claim 1 wherein the lower edges of said first and second baffles and the leading vertical edge of said first baffle are protected by a layer of resilient material.

3. The mobile concrete mixer of claim 1, wherein a cement delivery outlet is provided for delivering cement to said drum at a location between said second baffle and the outer wall of said drum.

4. The mobile concrete mixer of claim 3 wherein said second baffle includes a substantially horizontal slot for permitting the passage of concrete mix therethrough.

5. A mobile concrete mixer comprising a frame, a circular section mixing drum mounted on said frame and having a substantially vertical axis and an outer wall, a tubular member concentrically disposed within said drum for defining an annular mixing space, at least two stationary mixing devices disposed within said annular space and being positioned along the outer wall of said drum, a vertically extending bearing column associated with each of said mixing devices and being disposed externally of said drum, means for connecting each of said mixing devices to its associated bearing column for pivotal displacement about said column, and means for rotating said drum about said axis at a speed sufficient for moving concrete mix toward said outer wall under the action of centrifugal force whereby the concrete mix is caught and mixed by said mixing devices.

6. The mobile concrete mixer of claim 5 wherein means are provided for displacing said mixing device relative to the outer wall of said drum and also wherein said mixing devices are disposed substantially equi-angularly about the axis of said drum.

7. The mobile concrete mixer of claim 5 wherein each of said mixing devices comprises two vertically extending blade plates, the first extending in the direction of a chord of said drum and the second of said plates extending away from said first blade plate in the direction of rotation of said drum and inwardly of said chord.

8. The mobile concrete mixer of claim 5 wherein said first blade plate extends substantially to the floor of said drum and said second blade plate ends short of said floor and wherein the leading vertical edge of said first blade plate is protected by a layer of resilient material.

References Cited by the Examiner

UNITED STATES PATENTS

1,358,045	11/10	Woodhull	259—34
1,750,244	3/30	Robb	259—154
1,767,809	6/30	O'Reilly	259—88 X
2,687,285	8/54	Fisher	259—154
2,727,733	12/55	Carswell	259—154
2,739,797	3/56	Kemper	259—161

FOREIGN PATENTS

746,876	3/56	Great Britain.
853,443	11/60	Great Britain.

OTHER REFERENCES

Engineering News, Dec. 12, 1912, page 1085, A Concrete Mixer of New Type.

WALTER A. SCHEEL, *Primary Examiner*.

LEO QUACKENBUSH, *Examiner*.