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CONCRETE MIXER DRUM

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FIG. 1

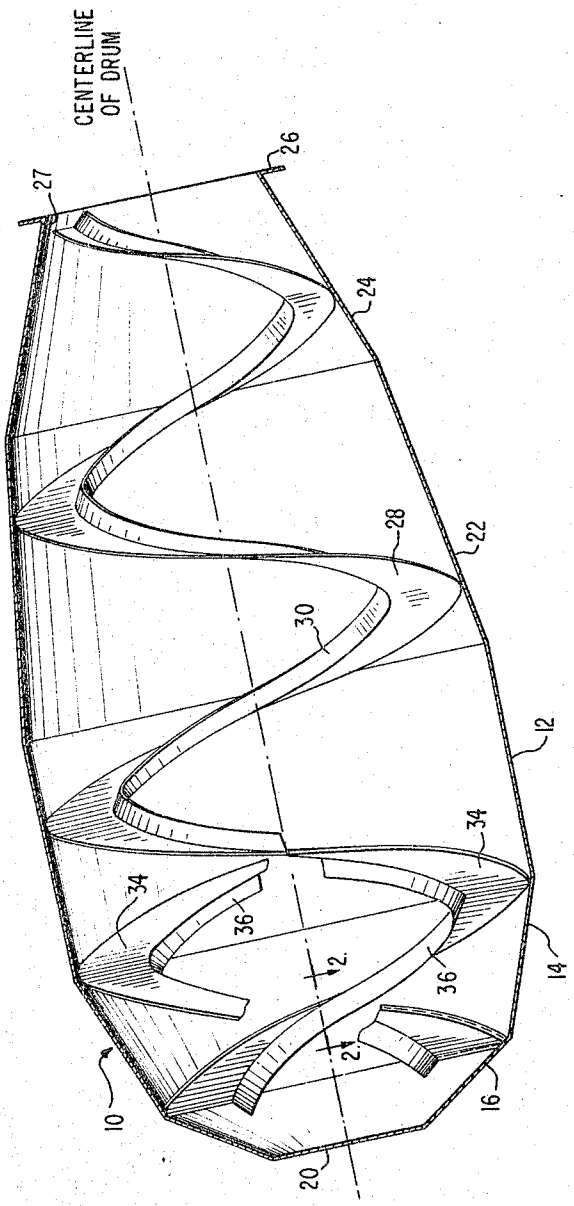
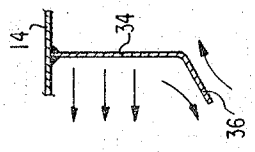


FIG. 2



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CONCRETE MIXER DRUM

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This invention relates to concrete mixers of the type which are truck-mounted such as shown in United States Patent No. 2,687,286. The drum of this type of mixer has a fixed, inclined axis and has an upper end opening through which the drum is filled or charged. The drum is rotated on its axis in opposite directions respectively for mixing and for discharge of the concrete ingredients so that the upper end opening may remain open during mixing and elevated during discharge to provide advantages which are well known in the art.

The inclined drum generally comprises two sections: the head section which is closed and relatively short and the tapered section which is relatively longer and diminishes in diameter toward the elevated open discharge end of the drum. The lowest point of the drum is at or near its largest diameter where the two sections of the drum adjoin. The drum is provided with spiral blades which with drum rotation in one direction elevate the drum contents and discharge the same through the drum opening, For improved discharge, the inner periphery of the blades may be provided with angular flanges such as shown in the patent referred to.

Rotation of the drum in the other direction is required during charging to move the ingredients toward the drum head section and to keep them from blocking the opening. When the drum is filled or charged to capacity the action of the spiral blades causes the ingredients to have a dynamic load line which is higher in the head section. During the first number of revolutions of the drum in the mixing direction the smaller ingredients fill the voids between the larger ingredients and the ingredients shrink to between 75 and 60 percent of their original, apparent volume. With such shrinkage the load line of the drum is similarly lowered but, of course, remains higher in the head section at all times during mixing as the ingredients between the convolutions of the blades continue to be moved toward the drum head section. At the same time the ingredients in the central core of the drum are moved or flow toward the open end of the drum. This axial circulation of the ingredients is essential to complete and fast mixing.

The number of drum revolutions required for mixing is greatly influenced by the method of drum loading. With "one stop loading," the gravel, sand, cement and water are introduced into the drum in parallel streams. With such loading shrinkage of the ingredients may occur almost as fast as the ingredients fill the drum and a minimum total number of mixing revolutions is required. With two-stop loading of the drum, gravel, sand and no water or some water are introduced first. Thereafter, the required water and the cement are added. In such loading the gravel and damp sand initially entering the drum tend to gather and agglomerate in the core of the drum immediate to its closed end so that complete mixing is thereafter unobtainable at least within the time allowable therefor after the addition of the cement and water. That is, the agglomeration occurs at some time during the first half of the charging or well before the drum is completely filled or charged. In the drum shown in the patent referred to this difficulty is overcome by the helical blade at the center of the drum. Other supplementary blades are also shown in U.S. Patent Nos. 2,611,591 and 2,614,819.

Present-day mixers of greater capacity require proportionately more time for shrinking the ingredients but are not allowed any additional time for the total mixing cycle. Due to the height and width limits of vehicles operating on public highways, the larger mixer drum is essentially only longer and consequently has a head section which become completely filled with ingredients when the drum is charged to capacity. Such ingredients tend to rotate as a mass with the drum and the blades which are fully submerged therein and rotate with the drum are largely ineffective under such conditions.

The present invention is based upon the discovery that a spiral blade with an inner peripheral flange extending at an angle only toward the closed end of the drum can be arranged with respect to the closed end of the drum to provide sufficiently fast shrinkage of the ingredients so that mixing of the ingredients in the head section is obtained under the conditions described. While this flange can be very similar to the flange provided for improved discharge, its angularity is considerably more critical or important. Specifically, its angularity must be such that its opposite sides are oppositely functional in that the radially outward side pushes the ingredients toward the lower closed end of the drum whereas the ingredients shifting against the radial inward side are pushed toward the upper open end of the drum. Also according to the invention, the spiral blades terminate near the closed end of the drum to define therebetween an end opening of a cross section which is large enough so that it is not bridged by the ingredients but sufficiently small so that the ingredients initially entering the drum are carried to the top side of the drum and will drop across the closed end of the drum to prevent any agglomeration thereat. The rotational velocity of the drum is an essential factor in effecting this movement as will be described in more detail having reference to the accompanying drawings which illustrate the best mode of carrying out the invention as presently contemplated and set forth hereinafter.

In the drawings:

FIGURE 1 is an axial, vertical section of an inclined axis drum having two blades with one entire blade shown in side elevation and the other blade shown in part; and

FIG. 2 is an enlarged horizontal section taken on line 2—2 of FIGURE 1 with arrows to show principal components of movement of the ingredients being mixed in accordance with the invention.

The drum **10** having an inclined axis as shown in the drawings is typical of an especially large drum for a truck-mixer and as such includes the relatively long cylindrical shell member **12**. The larger end of the frusto-conical shell member **14** is joined to the slightly lower end of member **12**. The smaller end of member **14** is closed by the frusto-conical member **16** and the disc **20** which together with member **14** define the head section of the drum. The smaller and larger ends of the frusto-conical shell members **22** and **24** are joined and the larger end of member **22** is joined to the slightly upper end of cylindrical member **12**. Members **12**, **22** and **24** define the tapered section of the drum. The smaller end of member **24**, which is provided with the external drip ring **26**, defines the upper elevated discharge opening **27** of drum **10**.

As is general, drum **10** is provided for discharge with two spiral blades which are radially opposite or offset one hundred eighty degrees from each other.

In the drawings, blade **28** is shown in full. Its outer periphery adjoins and is secured to the inner sides of the members comprising the discharge section of drum **10**. The inner periphery of the blade is provided with or includes the flange **30** for improved discharge. While flange **30** increases the effective height of the blade so that more mixed concrete is transported upwardly with each convolution of the blade, the angularity of flange **30** is se-

lected to minimize the tendency of such concrete to splash over the lowest part of its radially inner edge and back into the remaining contents of the drum. (As manufactured, the blades comprise a series of cut sheet steel segments which are individually stamped to form the spiral. The blades are uniformly perpendicular to the axis of rotation to avoid geometrical complications and the flanges are added and secured to the blades by welding or may be formed integrally with each blade segment.)

Flange **30** and the blade **28** as shown define an angle of approximately one hundred thirty-five degrees on the side nearer the drum opening. However, flanges with more or less angularity may be provided.

The mixing blades for the head section of the drum of the present invention comprise only the two spiral blades **34** which are provided with the flanges **36**. It has been unexpectedly found that the blades **34** with flanges **36** provide both a fast shrinking action and the complete mixing of the ingredients in the head section of the drum. In particular, the center core of the drum adjacent to disc **20** is unobstructed and is kept clear of any agglomerations.

According to the invention, each blade **34** is provided with the flange **36** so as to have an included angle of approximately one hundred thirty-five degrees on the side nearer the lower closed end of drum **10**. Each blade **34** with flange **36** may be separate of the spiral discharge blades such as blade **28** but are preferably joined thereto. The end of each blade **34** and of flange **36** at the closed end of the drum terminates adjacent to member **16** to define a relatively small opening therebetween. The ingredients first entering the drum are carried by the spiral blades to the head section. With the drum rotating at the full speed in the order of 15 to 20 r.p.m. and if the sand is damp rather than thoroughly wetted, the gravel and sand between the end portion of blades **34** and the head section will be carried up and over the drum axis and then drop therefrom. This action continues, of course, only while the head section is filling with ingredients.

During the latter part of the charging or when the ingredients fill the head section of the drum, the ingredients then tend to rotate with the drum. Under such conditions the discrete particles of the drum contents have only slight shifting motions in opposite directions with each revolution of the drum. These motions are transverse respecting the drum axis and are utilized according to the invention by arranging flanges **36** so that the particles impinge the flanges and are deflected axially of the drum. It is believed that this action is important in bringing about the final, fast shrinking of the ingredients. With such shrinkage the load line of the drum contents is lowered and rotation of the spiral blades **34** and flanges **36** relative to the drum contents again becomes effective to move the ingredients fully to the closed end of the drum. In particular, the ingredients in the center portion of the head section are deflected in the direction of the discharge opening of the drum. Blades **34** and flanges **36** embrace portions of the drum contents to move the same more effectively toward the closed end of the drum. However, the axial distance between member **16** and blades **34** diminishes toward the relatively small opening between the member and the end of each blade. Consequently and because of the restricted size of this opening, some of the ingredients moving axially between blades **34** must be displaced radially inwardly but a major portion passes the end of the blade and is placed in the unobstructed inner core of the drum directly adjacent to disc **20**. Blades **34** and flanges **36** in the head section are thus effective to extend the center-core circulation pattern all the way to the closed end of the drum as is essential to complete mixing.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. In a rotatable drum for mixing concrete, said drum being adapted to be supported for rotation in either direction about its longitudinal axis with said axis inclined and fixed, said drum including a head section which extends from the lower closed end of the drum to the lower-most point and largest diameter of the drum and a discharge section which extends from said point or diameter and diminishes in diameter to the elevated open discharge end of the drum, said discharge section being provided internally with one or more spiral blades providing elevation of the concrete within the drum to the discharge end with rotation of the drum in one direction, mixing blade means for the head section of the drum comprising one or more spiral blades, each such blade having means joining its outer periphery to the head section and a flange extending from its inner periphery and radially inwardly and toward said closed end of the drum, said blade and flange together during rotation of the drum in the other direction being effective to move ingredients towards the said closed end of the drum and terminating adjacent thereto where such ingredients are directed into the central drum portion adjacent to said closed end, said flange and blade defining an angle therebetween of approximately 135 degrees whereby the laterally shifting ingredients in the head section under full conditions are deflected axially of the drum and in particular the ingredients in the central drum portion of the head section are directed toward the open end of the drum and such that axial circulation of the entire contents of the drum is effected.

2. In a rotatable mixing drum having a head section including the closed end of the drum, said drum being adapted to be supported for rotation in either direction about the longitudinal axis thereof with said axis inclined so that the smaller open end of the drum is disposed above said closed end, blade means fixed on and projecting from the inner wall of said drum head section, said blade means being so arranged with relation to the axis of the drum and extending to said closed end of the drum as to move materials in the drum toward said closed end in a charging and mixing action upon rotation of the drum in one direction, flange means secured to the inner periphery of said blade with said flange extending from said blade in one direction only toward the closed end of said drum whereby the ingredients adjacent the inner surface of the drum will be forced toward said drum head during the mixing action with the innermost ingredients being shifted in the opposite direction through the central core of said drum to provide a thorough mixing action with a minimum number of rotations of said drum.

3. In a rotatable mixing drum according to claim **2** wherein said flange projects from the surface of said blade at an angle of approximately 135°.

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