



Industria y Comercio

SUPERINTENDENCIA

Delegatura de Propiedad Industrial

Division de Nuevas Creaciones

PCT

SOLICITUD

PATENTE DE INVENCION

21 EXPEDIENTE No

04-129792

54 TITULO

TAMBOR MEZCLADOR DE CONCRETO MONTADO EN VEHICULO Y METODO

DE FABRICACION DEL MISMO

51 CLASIFICACION INTERNACIONAL

71 SOLICITANTE

Anthony KHOURI

DOMICILIO

Ba kst wn Au t lia

74 APODERADO

EMILIO FERRERO

C C 438 019 d Usaquen

22 BOGOTA D C

()



Industria y Comercio

SUPERINTENDENCIA

PETITORIO

SUPERINDUSTRIA Y COMERCIO

Radicación : 84129792 00000000

Fecha (MRE): 2004-12-29 18:04:00

Folios: 136

Trámite : 011 PCT-PATENT 379 FASE NDCI 411 PRESENTAC

Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

FORMULARIO UNICO DE SOLICITUD DE PATENTE

PCT

ENTRADA EN FASE NACIONAL

1

SOLICITUD DE:

☒ Patente de Invención.

☐ Patente de Modelo de Utilidad.

☐ Capítulo I.

☒ Capítulo II.

2

S LICITANTE

(71)

Nombre: Anthony KHOURI

Dirección: Level 4, Suite 2410,
Chapel Road, Bankstown NSW 2200,
Australia

Domicilio: Bankstown NSW,
Australia

IDENTIFICACIÓN

C.C.

☐

NIT

☐

C.E.

☐

Otro

☐

Cual

Número

3

REPRESENTANTE

APODERADO

Nombre: EMILIO FERRERO

Dirección: Carrera 4ª. No. 72-35

Teléfono: 347 38 11

Fax: 217 92 11

E-mail: clientes@camyp.com.

Domicilio: Bogotá, Colombia.

IDENTIFICACIÓN

C.C.

☒

NIT

☐

C.E.

☐

Otro

☐

Cual

Número

438.019 T.P 31.929

4

INVENTOR (ES)

(72)

1. Anthony KHOURI

Level 4, Suite 2110,
Chapel Road, Bankstown NSW 2200,
Australia.

2- William RODGERS

10-12 Childs Road,
Chipping Norton, NSW 2170,
Australia.

5

PCT (86)

Solicitud Internacional No. PCT/AU03/00664

Fecha: 31 de mayo de 2003

Publicación Internacional No. W0 03/101694 A1

Fecha: 11 de diciembre de 2003

6

Título (54)

TAMBOR MEZCLADOR DE CONCRETO MONTADO EN VEHICULO

Y MÉTODO DE FABRICACIÓN DEL MISMO

7

Clasificación Internacional (51) B28C 5/42

8

Prioridad

SI☒ NO☐

(33) País de Origen

AU.

(32) Fecha

31 de mayo de 2002

(31) Número de Solicitud

PS 2753

9

Comprobante de pago No.: 04 - 95.698

Fecha: 13 de diciembre de 2004

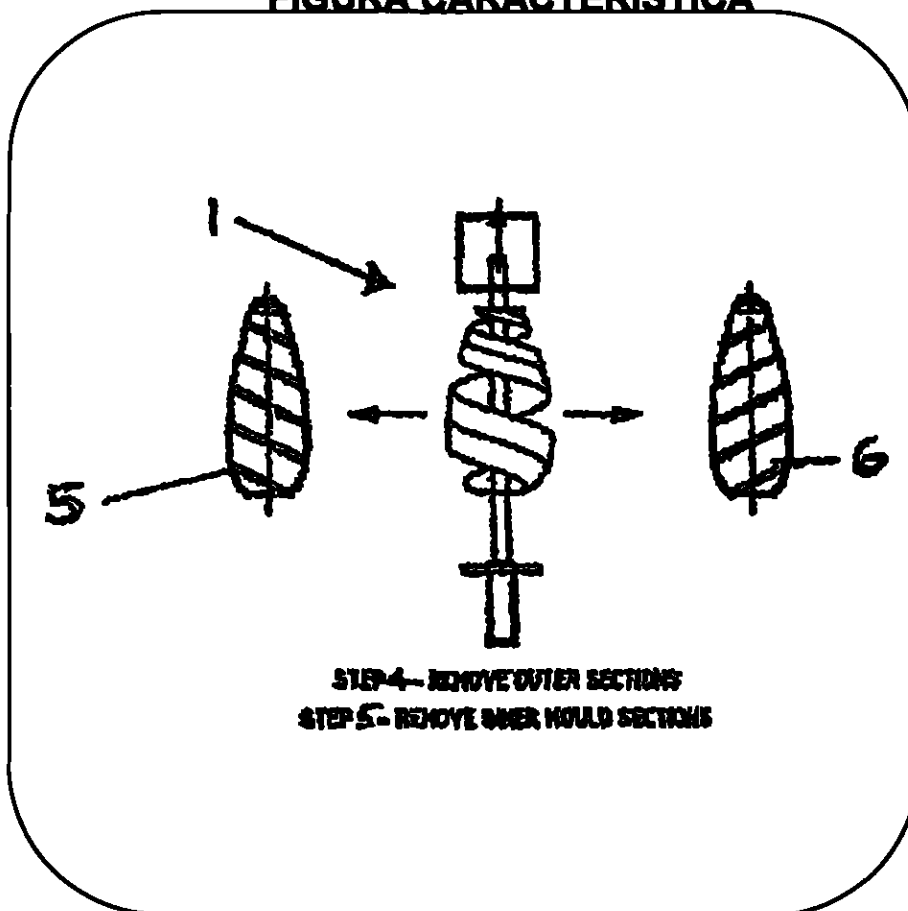
10

Anex s:

- ☒ Comprobante de pago de la tasa de presentación de la solicitud por \$ 422.000.00.
- ☐ Comprobante de pago por reivindicación de prioridad.
- ☐ Documento que acredita la existencia y representación legal cuando el solicitante sea persona jurídica.
- ☐ Poderes, si fuere el caso.
- ☐ Documento de cesión del inventor al solicitante o a su causante.
- ☐ Declaraciones.
- ☒ Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Copia del examen preliminar efectuado por la IPEA.
- ☐ Traducción del examen preliminar efectuado por la IPEA.
- ☐ De ser el caso, copia del contrato de acceso.
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas.
- ☐ De ser el caso, certificado de depósito del material biológico.
- ☒ Arte final 12x12
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas parcial o totalmente con la invención de esta solicitud.
- ☐ Otros

11

FIGURA CARACTERÍSTICA



12

Solicito la concesión de la patente,

NOMBRE:

EMILIO FERRERO

FIRMA:

C.C. 438.019 de Usaquén T.P. 31.929

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
11 December 2003 (11.12.2003)

PCT

(10) International Publication Number
WO 03/101694 A1

(51) International Patent Classification⁷: B28C 5/42, B29C 45/14, B29D 23/00
(21) International Application Number: PCT/AU03/00664
(22) International Filing Date: 31 May 2003 (31.05.2003)
(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data: PS 2753 31 May 2002 (31.05.2002) AU
(71) Applicant and
(72) Inventor: KHOURI, Anthony [AU/AU]; Level 4, Suite 2410, Chapel Road, Bankstown NSW 2200 (AU).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CZ, CU, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GR, GU, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

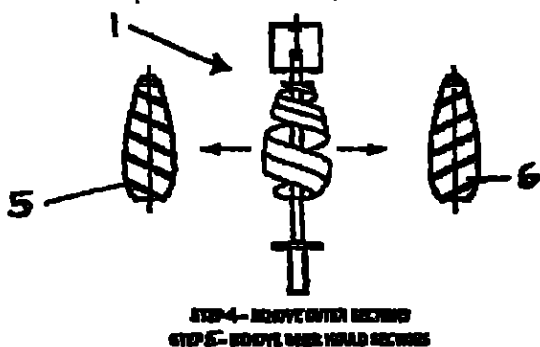
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TO).

(72) Inventor: RODGERS, William; 10-12 Childs Road, Chipping Norton, NSW 2170 (AU).
(74) Agent: WALSH & ASSOCIATES; Patent and Trade Mark Attorneys, Locked Bag 2011, Glebe Post Office, Glebe, NSW 2037 (AU).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: VEHICLE MOUNTED CONCRETE MIXING DRUM AND METHOD OF MANUFACTURE THEREOF



(57) Abstract: A method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete. The drum is manufactured from at least one mould using at least plastics material and further includes integrally attached vanes outstanding from the internal surface of the drum forming an archimedean spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from the drum; wherein, the method comprises the steps of; a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges; b) mounting the first helical inner

mould part on a support c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part; d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly; e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade; f) allowing said polyurethane to cure; g) removing said at least one outer mold parts to expose said inner wall element; h) removing said inner wall element one said inner molds;

WO 03/101694 A1

WO 03/101694

PCT/AU03/00664

VEHICLE MOUNTED CONCRETE MIXING DRUM AND METHOD OF MANUFACTURE THEREOF

BACKGROUND

The present invention relates to concrete mixing apparatuses and more particularly relates to a vehicle mounted plastics drum for mixing concrete and a method manufacture thereof.

PRIOR ART

The building industry makes widespread use of concrete mixing trucks for transportation of ready mixed concrete to sites for concrete pour. These trucks typically comprise a large mixing assembly including a mixer drum mounted to the vehicle and which is connected to a mixer drive for mixing concrete contents during transportation and for discharge of the contents on site. The drive system comprises a gear box which takes power from the vehicle motor and which applies a mixing torque to the drum imparting axial rotation to the drum with the torque being adjustable depending upon the operating requirements. The above general arrangement is described in United States patent 4,583,356 which discloses a concrete mixer truck having a mixer drum adapted to be rotated by the traction motor of the vehicle through an auxiliary transmission of the traction motor transmission.

According to the known vehicle mounted mixing assemblies, the mixing drum is typically of heavy duty steel construction and is disposed at approximately 10 to 15 degrees from horizontal. The drum is fitted with internal vanes or mixing blades defining an archimedian spiral so that as the drum rotates in a first direction the concrete held therein is mixed and as the drum is rotated in the opposite direction, the concrete is discharged from the drum via an elevated discharge orifice under the reverse action of the internal spiral vanes. The drum is disposed such that the drive end is lowest and the discharge end is highest relative to a generally horizontal plane of the vehicle.

5

WO 03/101694

PCT/AU03/00664

While steel drums have been in use for many years, they suffer from a number of attendant disadvantages relating to their cost of manufacture and replacement, working life, wear characteristics, weight and volume.

Steel drums are expensive to manufacture due to their labor intensive construction which involves rolling steel sheets into conical portions and cylinders which once fabricated are then welded to form the finished tank. The archimedian spirals formed from flat sheets are then welded into position inside the drum. As concrete is a highly abrasive material, internal surfaces of steel drums are subject to significant wear abrasion. This occurs particularly on the surfaces which take slump impact, sliding friction and shear load leading to eventual wearing out of the drum.

Typically, a steel drum used every day might last three to five years, thereafter requiring replacement at significant cost. The abrasion of internal surfaces is increased where there are changes of slope in the drum walls usually where the segments of the drum are joined. The mixing blades are welded to the internal surface of the drum causing sharp angled recesses in which concrete can gather and eventually build up degrading the internal surface and providing a catchment for further unwanted build up of concrete. By its nature, a steel surface is relatively smooth and whilst this may be desirable for the purpose of preventing concrete build up on the walls of the drum, the interface between the concrete and steel wall is an area of abrasion rather than concrete mixing.

Ideally, mixing of concrete should take place throughout the whole mix, but in the steel drums, optimum mixing does not take place at the boundary layer and in crevices in which concrete may collect. In fact, due to the nature of the frictional interface between the steel surface and concrete boundary layer, laminar flow occurs resulting in little or no mixing at the boundary layer. The reason for this is that the aggregate in the concrete slides and abrades (with reduced or no mixing) rather than rotates to facilitate mixing.

6

Thus there are 'dead' spots in the mix where no mixing takes place and where there is an increased potential for unwanted collection of concrete. In addition to the above problems associated with the use of steel mixing drums, there are cost and weight factors which add to inherent inefficiencies in use of steel drums. Due to the dead weight of the steel drum, its volume must be restricted so the combination of the dead weight and concrete weight must be maintained within the maximum allowable loading limits for the vehicle to which the drum is attached.

An alternative to the known steel drums was proposed in PCT International patent application PCT/AU00/01226 to Rodgers and Khouri. That application teaches the possibility of using a lightweight material such as plastics for construction of a concrete mixing drum as a substitute for steel whilst recognizing that there were numerous structural and manufacturing difficulties to be overcome in making the transition to plastics not the least of which was the production of a drum which could withstand the high static and dynamic loadings to which truck mounted mixing drums are subject to in normal operation. If the weight of the drum could be reduced without compromising and possibly increasing drum volume, the weight reduction could be taken up with additional concrete thereby increasing the pay load.

There are variety of concrete mixing drum arrangements disclosed in the prior art none of which as far as the inventor is aware anticipate the method of manufacture of a plastic drum to be described herein.

United States patent 4,491,415 discloses a lightweight, pear shaped rotary mixing device open at one end and having an axially elongated socket at the large end. The drum is rotatably supported on a unitary base having a transversely extended forward end and an upwardly and angularly extending rear end providing a bearing portion detachably engageable with the socket to rotatably support the drum at an inclination of about 35

degrees. The drum has a plurality of axially extending radial fins for lifting contents in rotation thereof and is preferably fashioned from molded plastics material either as a unitary body or as a plurality of interfitting parts. The drum described in this patent is for light duty operation and does not have the structural and materials characteristics necessary for heavy duty concrete mixing operations.

United States Patent 5,118,198 discloses a cement mixing apparatus with a cradle support assembly and including a polyethylene cement mixing drum held and supported by a cradle arm assembly formed of cradle base support braces and upright cradle arms which interfit into cradle arm recesses which are preformed with the polyethylene drum. A bull gear drives the polyethylene drum. The drum disclosed in this patent is intended for light duty cement operations and does not address the structural and manufacturing requirements for heavy duty operations. United States patent 5,492,401 discloses a concrete mixer with a mixing drum consisting of high density crosslinked polyethylene material. The drum includes a bottom supported by a conventional rigid metal pan secured to the external surface thereof to rigidify the plastic drum and extend the life expectancy of the plastic drum by enabling the concrete mixer to be used to complete a mixing job at a job site even though movement of the concrete mix within the drum during repetitive mixing cycles may ultimately wear a hole through the bottom of the plastic drum. Paddle assemblies are positioned interiorly of the drum and oriented to maintain minimum splashing during the mixing operation. Not only is the drum disclosed in this patent unsuitable for heavy duty vehicle mounted operation the patent in fact teaches a means to accommodate a wear failure on site whereby a hole could be worn through the wall of the drum.

The prior art teaches use of plastic drums for small cement mixing operations. However
25 there are inherent difficulties in manufacturing plastic drums to an acceptable standard of

8

WO 03/101694

PCT/AU03/00664

strength and reliability. Plastics drums require use of materials which for a drum profile
by use of a mould. As the discharge opening to a drum is narrower than the remainder of
the drum, it is not possible to remove a mould from an inner surface unless the drum is
made in sections which can be joined to form the drum structure. A number of methods
5 of manufacture of plastics heavy duty mixing drums have been proposed in PCT
application PCT/AU00/01226 which discloses a heavy duty rotary concrete mixing drum
for attachment to a vehicle which is characterized in that the drum is manufactured from
at least one mould and from at least one plastics material and wherein the drum includes
an inner surface having a property which promotes mixing of the concrete at the boundary
10 layer between the concrete and said inner surface and reduces wear.
A number of different methods were proposed in that application for the manufacture of a
drum of the type disclosed.

INVENTION

The present invention seeks to provide an alternative method of construction of a
15 heavy duty vehicle mounted rotating cement or concrete mixing drum fabricated from
plastics materials. The drum produced by the method of the invention described herein
overcomes the aforesaid disadvantages of the prior art and maintains efficient concrete
mixing characteristics. According to the invention there is provided a method of
construction of a plastics concrete mixing drum wherein the method includes the use of
20 inner and outer molds each made up from separate mould parts which are divided along
two helical lines mid way between the mixing blades thereby allow formation of a drum
interior from two identical molds.

In one broad form the present invention comprises:
a method of manufacture of a vehicle mounted rotary concrete mixing drum of the type
25 having an opening at one end for receiving and/or discharge of concrete therefrom and at

the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the method comprises the steps of;

- a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
- 10 b) mounting the first helical inner mold part on a support;
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
- d) fitting a second mating inner helical mold part to the first inner mold part to form an inner mold assembly;
- 15 e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts to expose said inner wall element;
- 20 h) removing said inner wall element one of said inner molds;

The method preferably comprises the additional step of placing a reinforcing member in a recess formed in said inner mold part. Steps a) - h) are repeated thereby providing a second helical inner wall element. The first and second helical inner wall elements are complimentary and combine to form an inner wall surface of the molding drum. The first and second helical inner wall elements are then preferably placed into a jig where opposing edges of said elements are held adjacent; the wall elements defining an inner cavity of said drum. Opposing edges of the elements are sealed to complete the inner wall of the drum. The inner wall is removed from the jig and placed the inner wall on a mandrel such that the mandrel is disposed in the inner cavity. The inner wall is placed on the mandrel via an open end of the inner wall whereupon structural layers of glass fibre

WO 03/101694

PCT/AU03/00664

reinforced plastic are applied to the polyurethane inner layer. Preferably, the internal surface of the drum includes an elastomer which will allow mixing of the contents of the concrete at a concrete boundary layer;

The reinforcing member is preferably a continuous rope inserted in a recess in a formation which will form helical blades.

The method includes the use of inner and outer molds each made up from separate mould parts which are divided along two helical lines thereby allowing formation of a drum interior wall from two complementary mould parts.

In another broad form the present invention comprises:

a method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and discharge of concrete therefrom and at the other end means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one inner mould and at least one opposing outer mould; wherein the drum includes integrally attached vanes which extend from the internal surface of the drum forming an archimedean spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; and wherein the internal surface of the drum is formed or lined with an elastomer which causes mixing of the contents of the concrete at the concrete boundary layer; wherein the method comprises the steps of;

- a) preparing a first inner helical mold containing a surface intermediate side edges of the mould;
- b) placing a reinforcing rod in a recess in said inner mold;
- c) enclosing the inner helical mold assembly within at least one outer mold part;
- d) sealing a joint between said inner mold part and said at least one outer mold part;
- e) injecting a polyurethane elastomer into a cavity defined by said inner mold and said at least one outer mold part to form an inner helical wall element comprising one half of an interior of the mixer and one helical blade;
- g) allowing said polyurethane to cure;

- 5 k) repeating steps a) - j) to form a second inner wall element.

According to a preferred embodiment, a mandrel is inserted into an open discharge end of a drum interior following which structural layers of glass fibre reinforced plastics are wound about an outer surface of the inner wall.

a method of construction of a plastics mixing drum comprising the steps of:

- 15 between two helical blades to a mid line mould joint line at an inner edge of said blades;

injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and said at least one outer mold part to form one half of the interior of the mixer and one of the helical blades;

- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold part;
- h) removing one of said inner molds;
- i) removing the interior polyurethane molding from the remainder of the inner mold assembly;
- j) placing said two helical blade and interior moldings in a jig where the jointing surfaces are held adjacent;
- k) inserting a mandrel into an open discharge end of the drum;
- l) applying structural layers of glass fibre reinforced plastic to the polyurethane layer.

Presumably the reinforcing is fitted using spacers which control the reinforcing rod or rope in its recess.

12

WO 03/101694

PCT/AU03/00664

Preferably the first and second inner helical mold elements are jointed with a sealing compound or gaskets along an inner edge. According to one embodiment, the outer mold is formed in three separate mold parts.

- 5 Preferably, a joint between the two inner helical elements forming a helical blade is made with a polyurethane elastomer compound.

In another broad form the present invention comprises:

10 a method of manufacture of a vehicle mounted concrete mixing drum comprising the steps of;

- a) taking a helical inner mould part and mounting the mould on a support;
- b) placing at least one external mould in opposing relationship to said inner mould;
- c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form
- 15 at least part of an inner surface of said drum;
- d) removing the at least one outer mould;
- e) removing the helical element from said inner mould;
- f) repeating steps a) - e) so as to form a second helical element;
- 20 g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

Preferably, the flowable material is polyurethane.

25 In another broad form of an apparatus aspect the present invention comprises

a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics

30 material; wherein the drum further includes integrally attached vanes which extend from the internal surface of the drum forming an archimedean spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the drum is formed by a method comprising the steps of;

- 35 a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;

13

WO 03/101694

PCT/AU03/00664

- b) mounting the first helical inner mould part on a support
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
- d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
- 5 e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- 10 g) removing said at least one outer mold parts to expose said inner wall element;
- h) removing said inner wall element one of said inner molds;

In another broad form of the apparatus aspect, the present invention comprises:

a vehicle mounted concrete mixing drum formed by a method of manufacture comprising the steps of;

- a) taking a helical inner mould part and mounting the mould on a support;
- b) placing at least one external mould in opposing relationship to said inner mould;
- c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;
- 20 d) removing the at least one outer mould;
- e) removing the helical element from said inner mould;
- f) repeating steps a) - e) so as to form a second helical element;
- 25 g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

Preferably the flowable material is polyurethane.

According to one embodiment, the helical blades projecting from an inner surface of said drum have a pitch dimension of between 1- 2 meters and are formed by elastomeric material. Preferably the wall strength of said drum is around 600MPa at a wall thickness of 8mm. Preferably the polyurethane forms an inner layer which is approximately 3mm thick.

14

WO 03/01694

PCT/AU03/00664

Preferably the structural layer comprises filament windings forming a layer of approximately 5mm thickness.

5

10

In another broad form the present invention comprises;

15 a heavy duty rotary concrete mixing drum capable of attachment to a vehicle; the drum comprising a first end which engages a drive assembly which rotates said drum for mixing of said concrete and a second end from which mixed concrete is discharged; wherein said drum is manufactured from at least one layer of plastics material wherein the drum includes a wall having integral internal formations which promote mixing of said
20 concrete and an inner surface which promotes mixing of the concrete at the boundary layer between the concrete and said inner surface; wherein the drum is formed according to the method steps of:

- a) taking a helical inner mould and mounting the mould on a support;
- 25 b) placing at least one external mould in opposing relationship to said inner mould;
- c) injecting polyurethane into a space formed between said inner mould and said outer mould;
- d) removing the at least one outer mould;

15

WO 03/010664

PCT/AU03/00664

- c) removing a helical blade part from said inner mould;
- f) repeating steps a) - e) so as to form a second helical blade part;
- g) mating the first and second helical blade parts with an interior shell;
- g) preparing an exterior of the drum for bonding to a structural layer of glass fibre;
- sh h) winding the structural layer about said exterior.

DETAILED DESCRIPTION

The present invention will now be described according to a preferred but non limiting embodiment and with reference to the accompanying illustrations wherein:

- 10 Figure 1 shows a side elevation of an inner helical mould part;
- Figure 2 shows a side elevation of the mould part of figure 1 including exploded external moulds;
- Figure 3 shows a side view of the inner mould part of figures 1 and 2 fully enclosed by external mould sections
- 15 Figure 3a shows an enlarged view of external moulds exploded from a helical blade part;
- Figure 3b shows an enlarged view of the assembly of figure 3a with outer mould parts moulds assembled.
- Figure 4 shows outer mold sections exploded from the inner mould assembly upon completion of injection of an elastomer.
- 20 Figure 5 shows a helical blade part produced by and removed from the inner mould assembly of figure 4;
- Figure 6 shows a coupling of separate and complementary helical blade parts formed by the arrangements of figures 1-5 and which form an inner wall of the drum;
- Figure 7 shows a housing for assembly in which the inner wall of the drum is placed
- 25 after moulding helical blade parts for preparation of the blade parts to receive an outer structural layer;
- Figure 8 shows an assembly including a mandrel for mounting said inner layer for

16

WO 03/101694

PCT/AU03/00664

applying an outer structural layer of glass fibre;

Figure 9 shows a completed drum with track ring fitted;

The concentrated wear points in the prior art steel drums reduces the working life of the drums necessitating costly repair or replacement. Steel drums are fabricated from rolled flat sheets which form cones and a cylinder which are then joined together by welding. Archimedian spirals are then welded to the inner surface of the drum resulting in a high specific gravity vessel whose self weight reduces the amount of concrete which can be carried by the vehicle to which it is attached. The steel drums suffer from a number of disadvantages including susceptibility to abrasion at the junctions of the cylindrical and conical sections and the tendency for unwanted concrete build up at the sharp corners and crevices formed by the mixing blades. In addition, the smooth internal surface of the steel drum promotes sliding abrasion and inhibits mixing at the boundary layer due to the low coefficient of friction at the concrete/metal interface.

The method to be described below is an alternative to both steel drums and the plastics drums formed by the methods of manufacture described in International Patent application No. PCT/AU00/01226 to Rodgers and Khouli. According to the method, a plastics heavy duty concrete mixing drum is formed using both internal and external moulds. The drum includes an internal archimedian spiral formed by helical blades or vanes which mix concrete during rotation of the drum in one direction and discharge concrete when the drum is rotated in an opposite direction. The drum is generally pear shaped and includes an opening at one end for entry and discharge of concrete.

The first step in the method according to one embodiment, involves the use of an internal

10 mould. A polyurethane drum interior complete with internal helical blades is formed between an interior and an exterior mould set. The exterior moulds are easily removed after the polyurethane is formed, however because the mixer is a closed vessel with the discharge opening smaller than the maximum diameter, and due to the complexity of the blade moulds, it is not possible to form the interior as one complete piece and then remove the mould. Accordingly, the elastomeric drum interior is moulded in sections which can be removed from the moulds, and then joined to form the complete interior. This interior is then reinforced with structural layers to complete the mixer. The joining together of two complementary inner wall sections which are each formed by the same method steps sequentially is a new approach to forming a drum interior not known in the prior art.

Referring to figure 1 there is shown an assembly 1 which comprises a support 2 which receives and retains thereon a helical mould part 3. Mould 3 is shown in profile by line 4. Mould 3 is initially prepared in a separate mould having a helical interior so that mould 3 conforms to the shape of that interior. Once mould 3 is formed, it may be transferred manually or otherwise for mounting on support 2 in preparation for receiving external moulds. Figure 2 shows a side elevation of the mould 3 of figure 1 with exploded opposing external mould parts 5 and 6. Mould parts 5 and 6 encapture mould 3 but leave a generally helical cavity therebetween. Once external mould parts 5 and 6 have been secured and sealed, polyurethane is injected into the aforesaid cavity. It will be appreciated by persons skilled in the art that more than two external moulds may be used to fulfill the same objectives of encapsulating inner mould 3. Figure 3 shows a side view of the inner mould 3 enclosed by external mould sections 5 and 6. Figure 3a shows an enlarged view of external moulds 5, 6 and 7 exploded from inner mould 3 revealing a section view of a part helical blade 8 retrieved from the cavity

WO 03/101694

PCT/AU03/00664

defined by outer moulds 5 and 6 and inner mould 3 following injection of polyurethane.

Figure 3b shows an enlarged section view of the assembly of figure 3a with moulds assembled. Moulds 5, 6 and 7 are shown in figure 3b in abutting relationship with part helical blade 8, which is formed by injection of a polyurethane elastomer into a cavity formed between moulds 5, 6 and 7.

Referring to figure 4 there is shown outer mold sections 5 and 6 exploded from the inner mould assembly 1 upon completion of injection of an elastomer. Upon removal of inner mould section 3 part helical blade (or blade element) 8 which has been formed from the elastomeric material injected into the cavity defined by assembled external moulds 5 and 6 and inner mould 3 as shown in figure 3 may be released. Figure 5 shows

a first helical blade part 8 formed in a first helical (archimedian) spiral. The above described process is repeated once again to form a second helical (archimedian) spiral 9. Helical blade part 8 forms one half of a completed helical blade which is integrally disposed on an inner surface of the drum formed by the processes described herein. A

repeat of steps described with reference to figures 1-5 result in a second helical inner blade element 9 which co operates with and is complementary to helical blade element 8 to form a completed inner wall including integral helical blade. Figure 6 shows a pair of helical blades 8 and 9 formed by the assembly and process as described with reference to figures 1-5. Blades 8 and 9 are in the form of two parallel helical spirals spaced at 180

degree axial phase difference each with a reinforcing rod 10 (see figures 3a and 3b) in the interior edge, which may be a continuous filament and resin rope. As these blades are integral with the interior surface of the drum, it is convenient to join these two structures along two helical lines mid way between the blades. In this way the interior is formed as two identical mouldings which can be removed from the interior mould 3 and exterior mould sections 5, 6 and 7 and which also contain the complete reinforcing rods 10.

19

WO 03/101694

PCT/AU03/00664

The exterior moulds contain a layer of glass reinforced plastic which bonds to the polyurethane which is formed, against it. In this way the two mouldings are formed with two helical jointing lines mid way between the blades and a stiff inner shell ready to receive the structural layers is formed.

According to one embodiment a preferred method of manufacturing the mixer is as follows.

The inner helical mould 3 which includes the surface which extends from a joint line mid-way between two formed helical blades (8 and 9) to a mid-line mould joint line at an inner edge of the blade. This surface faces towards the drive end of the mixer and contains a recess for the reinforcing rod or filament rope 10. The next step is fitting reinforcing rod 10 with polyurethane spacers, which centralizes the rod in a recess in inner mould 3.

A mating inner helical mould is prepared and fitted and is joined with sealing gaskets along its inner edge. The helical inner mould 3 is enclosed within the three external moulds 5, 6 and 7, the surfaces of which are pre coated with glass fibre reinforced plastic, to provide an interior moulding to the polyurethane elastomer. Seals are incorporated into a joint formed between the inner and outer moulds. Following this the polyurethane elastomer is moulded into the cavity formed between the inner and outer moulds. The elastomer polymerizes to form blade 8 which comprises half the interior layer of the mixing drum. The polyurethane is allowed to cure whereupon outer moulds 5, 6 and 7 are removed to expose an inner shell and outer surface of the polyurethane blade part 8. This allows removal of the helical blade part 8 and interior polyurethane moulding. The above process is repeated to provide a second helical blade part 9 and interior moulding. The two helical blades 8 and 9 are then assembled in a jig 11 as shown in figure 7 whereupon they are joined together using a polyurethane elastomer compound. At this stage of the processing a drive ring is applied to the polyurethane layer which will form the inner layer of the mixing drum. The jig is removed and the now formed inner layer of the drum is transferred to a winding station as shown in figure 8.

A steel mandrel 12 is inserted into the open (discharge) end 13 of the mixer so that it reaches the drive ring which is common to heavy duty drums of this type. The drive ring which imparts rotation to the mixer is spigotted and drilled to suit a gear box flange. The glass fibre reinforced plastic exterior of the polyurethane interior is bonded to the drive

5

10

- 19

20

25

30

17

21

WO 03/101694

PCT/AU03/00664

use of the finished drum. Typical loadings on the drum are axial bending under weight of wet concrete, an applied dynamic load at the drive end of the drum, driving torque and support loads at discharge end and trunion rolls. The winding pattern of the filaments aligns the fibres to withstand bending stresses, increasing in angle and in wall thickness towards the discharge end and to accommodate applied roller loads.

The rovings which line the drum may alternatively be drawn through the resin bath and applied to the surface of the drum as a wide ribbon comprising thousands of tensioned fibres. The windings overlap until the required thickness is reached. The surface of the drum may be covered with wet resin and small irregularities which need to be addressed to provide the external finish. As a result of this construction, the spiral mixing blades inside the drum are capable of withstanding high bending and shear resistance during mixing operations. The inner elastomeric surface is highly resistant to abrasion by concrete yet it is softer and lighter than the steel equivalent. The higher resistance to abrasion is facilitated by the natural elastic deformation of the elastomer which absorbs the kinetic energy of the concrete particles without gouging of the surface material. In addition, due to the property of the inner surface which will preferably be polyurethane, the concrete will be mixed rather than slide at the boundary layer ensuring efficient mixing of the concrete throughout the mix and reduction of abrasion due to the smooth curves throughout the interior of the drum.

Furthermore, the blades are strengthened by their molding integrally with the wall of the drum and have a stiffness factor which will sustain all applied normal operating loads.

A further advantage in the use of plastic for the mixing drums lies in the thermal properties of the plastics material. Hot conditions are undesirable for concrete mixing as they accelerate hydration reducing concrete workability which is an essential property required immediately following a concrete pour. In very hot climates, the conventional

WO 03/101694

PCT/AU03/00664

steel vehicle mounted mixing drums conduct high heat loads which increase heat at the concrete boundary layer due to contact with the super heated drum wall causing unwanted accelerated hydration. This phenomenon is difficult to avoid with steel drums as the conductivity of steel leads to high conductive heat transfer from the outer skin of the drum to the inner wall which is normally in contact with the concrete. In some hot climates, ice is placed in the steel drums in an attempt to arrest temperature increase inside the drum. As concrete hydration is an exothermic reaction, it is sensitive to external temperatures. Accordingly it is desirable that the concrete temperature remains acceptably low to ensure a satisfactory level of workability and to retard hydration. Steel drums heat up significantly and conduct heat through their thickness making the concrete vulnerable to the vagaries of temperature variation. Overheating of the concrete mix is a problem to be avoided and has in accordance with one aspect provided a method of manufacture of a plastics drum to take the place of the conventional steel drums thereby reducing the unwanted effects of high thermal conductivity typical of the steel drums.

The plastics drum allows the concrete to remain workable inside the drum for longer periods compared to concrete in steel mixing drums under the same external temperature conditions and transporting concrete.

The method of construction of a plastics concrete mixing drum as described herein provides an alternative yet efficient method of production of plastics drums. The methods described herein allow for mass production with reduction in the number of production steps compared to the known methods.

It will be recognized by persons skilled in the art that numerous variations and modifications may be made to the invention as broadly described herein without departing from the overall spirit and scope of the invention.

25

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

- 5 1 A method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes
10 integrally attached vanes which extend from the internal surface of the drum forming an archimedean spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the method comprises the steps of;
15 a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
b) mounting the first helical inner mold part on a support
c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
d) fitting a second mating inner helical mold part to the first inner mould part to form an
20 inner mold assembly;
e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
f) allowing said polyurethane to cure;
25 g) removing said at least one outer mold parts to expose said inner wall element;
h) removing said inner wall element one of said inner molds;
2 A method according to claim 1 comprising the additional step of placing a reinforcing member in a recess formed in said inner mold part.

3 A method according to claim 2, wherein "steps a) - h) are repeated thereby providing a second helical inner wall element.

4 A method according to claim 3 wherein the first and second helical inner wall
elements are complimentary and combine to form an inner wall surface of the mixing
drum.

5 A method according to claim 4 comprising the further step of placing said first and second helical inner wall elements into a jig where opposing edges of said elements
10 are held adjacent; the wall elements defining an inner cavity of said drum.

6 A method according to claim 5 wherein said opposing edges are sealed to complete said inner wall of said drum.

7 A method according to claim 6 comprising the further step of removing said
inner wall from said jig and placing said inner wall on a mandrel such that the mandrel is
15 disposed in said inner cavity.

8 . A method according to claim 7 wherein the inner wall is placed on said
mandrel via an open end of said inner wall

9 A method according to claim 8 comprising the further step of applying structural layers of glass fibre reinforced plastic to the polyurethane inner layer.

10 A method according to claim 9 wherein the internal surface of the drum
includes an elastomer which allows mixing of the contents of the concrete at a concrete
boundary layer;

11 A method according to claim 10 wherein said reinforcing member is a continuous rope inserted in a recess in said blades.

12 A method of construction of a plastics concrete mixing drum wherein the method includes the use of inner and outer molds each made up from separate mould parts which are divided along two helical lines thereby allowing formation of a drum interior wall from two complementary mould parts.

30 19 A method of manufacture of a vehicle mounted rotary concrete mixing drum

of the type having an opening at one end for receiving and discharge of concrete therefrom and at the other end means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one inner mould and at least one opposing outer mould; wherein the drum includes integrally attached vanes which extend from the internal surface of the drum forming an archimedean spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; and wherein the internal surface of the drum is formed or lined with an elastomer which causes mixing of the contents of the concrete at the concrete boundary layer; wherein the method comprises the steps of;

- a) preparing a first inner helical mold containing a surface intermediate side edges of the mould;
- b) placing a reinforcing rod in a recess in said inner mold;
- 15 c) enclosing the inner helical mold assembly within at least one outer mold part;
- d) sealing a joint between said inner mold part and said at least one outer mold part;
- e) injecting a polyurethane elastomer into a cavity defined by said inner mold and said at least one outer mold part to form an inner helical wall element comprising one half of an interior of the mixer and one helical blade;
- 20 g) allowing said polyurethane to cure;
- h) removing said at least one outer mold parts;
- i) removing one of said inner molds;
- j) removing the interior polyurethane inner helical wall element molding from the remainder of the inner mold assembly;
- 25 k) repeating steps a) - j) to form a second inner wall element.
- 14 A method according to claim 13 comprising the further steps of:
- a) placing a second inner wall element along with said first inner helical wall element in a jig where the jointing surfaces are held adjacent so as to form an inner wall;
- b) sealing the join formed by said jointing surfaces.

90

15 A method according to claim 14 wherein comprising the additional step of

- a) inserting a mandrel into an open discharge end of a drum interior;
- b) winding structural layers of glass fibre reinforced plastic about an outer surface of said inner wall.

16 A method of construction of a plastic mixing drum comprising the steps of:

- 5 a) preparing a first inner mold containing a surface extending from a joint line midway between two helical blades to a mid line should joint line at an inner edge of said blades;
- b) placing a reinforcing rod in a recess in said inner mold;
- c) fitting a second mating inner helical mold to form an inner mold assembly;
- d) enclosing the inner helical mold assembly within at least one outer mold part;
- 10 e) sealing a joint between said inner mold assembly and said at least one outer mold part;
- injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and said at least one outer mold part to form one half of the interior of the mixer and one of the helical blades;
- 15 f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts;
- h) removing one of said inner molds;
- i) removing the interior polyurethane molding from the remainder of the inner mold assembly;
- 20 j) placing said two helical blade and interior moldings in a jig where the jointing surfaces are held adjacent;
- k) inserting a mandrel into an open discharge end of the drum;
- l) applying structural layers of glass fibre reinforced plastic the polyurethane layer.

25 17 A method according to any of the foregoing claims wherein the reinforcing is fitted with spacers which centralize the rod in its recess.

18 A method according to claim 17 wherein, the first and second inner helical mold elements are jointed with a sealing compound or gaskets along an inner edge.

30 19 A method according to claim 17 wherein the outer mold is formed in three separate mold parts.

20 A method according to claim 19 wherein, the joint between said two inner helical elements forming a helical blade is made with a polyurethane elastomer

27

WO 03/101694

PCT/AU03/00664

compound.

- 21 A method of manufacture of a vehicle mounted concrete mixing drum comprising the steps of:
 - a) taking a helical inner mould part and mounting the mould on a support;
 - b) placing at least one external mould in opposing relationship to said inner mould;
 - c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;
 - d) removing the at least one outer mould;
 - e) removing the helical element from said inner mould;
 - f) repeating steps a) - e) so as to form a second helical element;
 - g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.
- 22 A method according to claim 21 wherein the flowable material is polyurethane.
- 23 A method according to claim 22 wherein, said first and second helical elements are joined in a jig to form an inner surface of said drum.
- 24 A method according to claim 23 comprising the further step of preparing an exterior surface of the mixer for bonding to a structural layer of glass fibre.
- 25 A method according to claim 24 comprising the additional step of winding a structural layer of fiberglass about said exterior surface.
- 26 A vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which extend from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are

WO 03/101694

PCT/AU03/00664

mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the drum is formed by a method comprising the steps of;

- a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
- 5 b) mounting the first helical inner mould part on a support
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
- d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
- 10 e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts to expose said inner wall element;
- 15 h) removing said inner wall element one of said inner molds;

27 A vehicle mounted concrete mixing drum formed by a method of manufacture comprising the steps of;

- 20 a) taking a helical inner mould part and mounting the mould on a support;
- b) placing at least one external mould in opposing relationship to said inner mould;
- c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form
- 25 at least part of an inner surface of said drum;
- d) removing the at least one outer mould;
- e) removing the helical element from said inner mould;
- f) repeating steps a) - e) so as to form a second helical element;
- g) preparing an exterior surface of the helical elements for bonding to a structural layer
- 30 of glass fibre.

28 A concrete mixing drum according to claim 27 wherein the flowable material is polyurethane.

29 A concrete mixing drum according to claim 27 wherein helical blades

WO 03/101694

PCT/AU03/00664

projecting from an inner surface of said drum have a pitch dimension of between 1- 2 meters and are formed by elastomeric material.

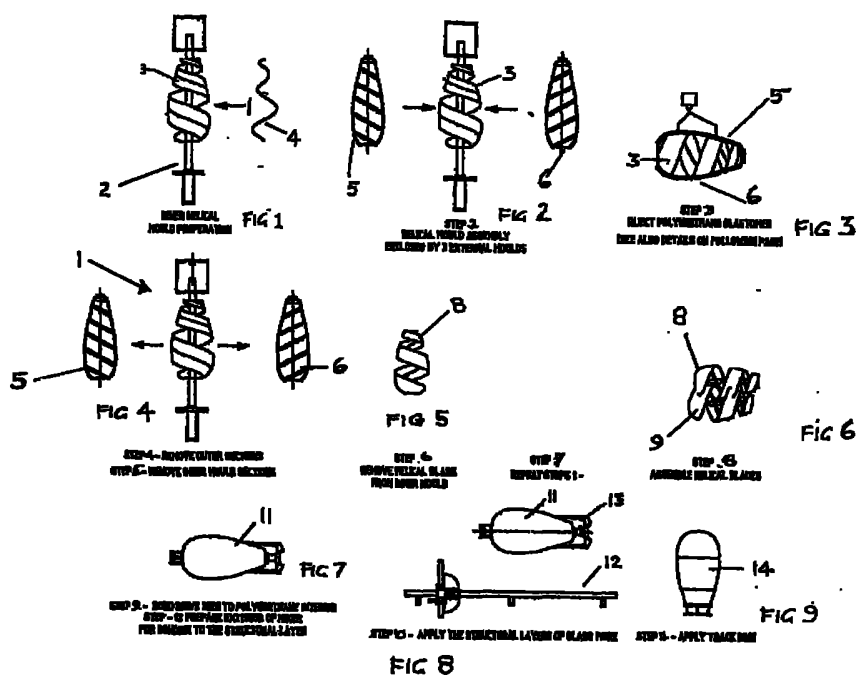
30 A mixing drum according to claim 28 wherein the wall strength of said drum is around 600MPa at a wall thickness of 8mm.

5 31 A mixing drum according to claim 29 wherein the polyurethane forms an inner layer which is approximately 3mm thick.

32 A mixing drum according to claim 31 wherein said structural layer comprises filament windings forming a layer of approximately 5mm thickness.

10

15



2003-10-14
PCT/AU03/00664

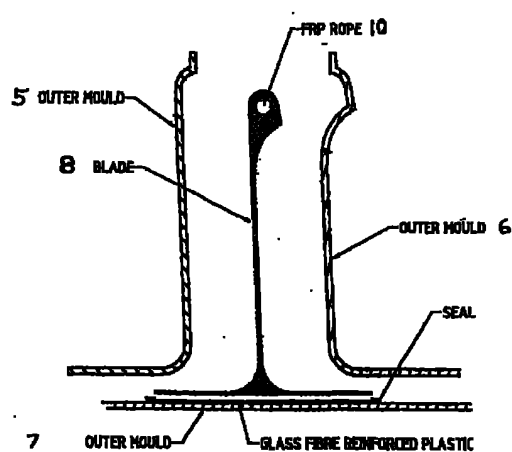
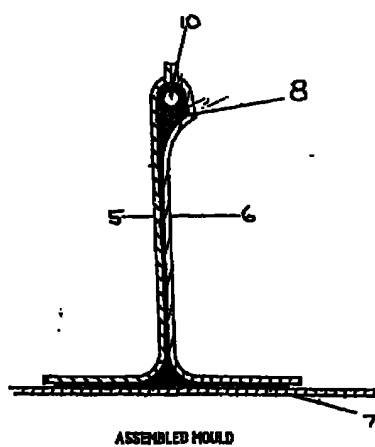


Fig 3a



ASSEMBLED MOULD

Fig 3b

32

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/00664

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl. ⁷ : B28C 5/42, B29C 45/14, B29D 23/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B28C 5/42, B29C 45/14, B29D 23/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI: (CEMENT OR CONCRETE) (S) MIXER+ AND (PLASTIC+ OR POLYURETHANE+)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 0126871 A (KHOURI A) 19 April 2001 See page(s) 6 line 21 to 7 line 2, page 10 lines 3 to 4, and figures 17, 19.	12-15, 21-25, 27-32
A	WO 9732702 A (MINTOAK PTY. LTD.) 12 September 1997	
A	US 5056924 A (Christenson) 15 October 1991	
☐ Further documents are listed in the continuation of Box C ☒ See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "B" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "Z" document member of the same patent family		
Date of the actual completion of the international search 15 August 2003		Date of mailing of the international search report 20 AUG 2003
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WIDEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929		Authorized officer JOHN DEUTS Telephone No : (02) 6283 2146

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU03/00664

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	200126871	AU	200078917	BR	200014121	CA	2382250
		CZ	20021193	EP	1226009	HU	200204016
		NO	20021633				
WO	9732702	AU	20868/97				
US	5056924	AU	52918/90	CA	2013511	EP	438852
		JP	3222702				
END OF ANNEX							

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TNB:FP18993	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/AU2003/000664	International Filing Date (day/month/year) 31 May 2003	Priority Date (day/month/year) 31 May 2002
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ B28C 5/42, B29C 45/14, B29D 23/00		
Applicant KHOURI, Anthony et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheet(s).

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 24 December 2003	Date of completion of the report 23 January 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146

I. Basis of the report**1. With regard to the elements of the international application:***

- ☒ the international application as originally filed.
- ☐ the description, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the drawings, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/AU2003/000664

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-32	YES
	Claims	NO
Inventive step (IS)	Claims 1-32	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-32	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

None of the individual citations disclose all the essential features as claimed. Claims 1-32 are novel and involve an inventive step.

The invention is directed to a method of constructing a plastic fabricated concrete mixing drum wherein, the method includes the use of inner and outer moulds, each made up of separate mould parts which are divided along a helical line, thereby allowing formation of a drum between the two complementary mould parts.

The closest art found was:
WO 0126871 A (KHOURI a) 19 April 2001

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

37

To: Griffith Hack GPO Box 1285K MELBOURNE VIC 3001	GRIFFITH HACK 14 MAY 2004 REC 4M 1..... 2 TNB..... 3.....	PCT WRITTEN OPINION (PCT Rule 66)
Applicant's or agent's file reference TNB:FP18993		Date of mailing (day/month/year) 13 MAY 2004
International Application No. PCT/AU2003/000664		REPLY DUE within TWO MONTHS from the above date of mailing
International Filing Date (day/month/year) 31 May 2003	Priority Date (day/month/year) 31 May 2002	
International Patent Classification (IPC) or both national classification and IPC Int. Cl. ⁷ B28C 5/42, B29C 45/14, B29D 23/00		
Applicant KHOURI, Anthony et al		

1. This written opinion is the **first** drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability, citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application
3. The **FINAL DATE** by which the international preliminary examination report must be established according to Rule 69.2 is:
30 September 2004
4. The applicant is hereby invited to reply to this opinion.

When?	See the Reply Due date indicated above. However, the Australian Patent Office will not establish the Report before the earlier of (i) a response being filed, or (ii) one month before the Final Date by which the international preliminary examination report must be established. The Report will take into account any response (including amendments) filed before the Report is established. If no response is filed by 1 month before the Final Date, the international preliminary examination report will be established on the basis of this opinion. Applicants wishing to have the benefit of a further opinion (if needed) before the report is established should ensure that a response is filed at least 3 months before the Final Date by which the international preliminary examination report must be established.
How?	By submitting a written reply, accompanied; where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.
Also	For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis. For an informal communication with the examiner, see Rule 66.6.

Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146
--	--

I. Basis of the opinion

1. With regard to the elements of the international application:*

- ☒ the international application as originally filed.
- ☐ the description, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the claims, pages , as originally filed,
pages , as amended under Article 19,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the drawings, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-32	YES
	Claims	NO
Inventive step (IS)	Claims 1-32	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-32	YES
	Claims	NO

2. Citations and explanations

None of the individual citations disclose all the essential features as claimed. Claims 1-32 are novel and involve an inventive step.

The invention is directed to a method of constructing a plastic fabricated concrete mixing drum wherein, the method includes the use of inner and outer moulds, each made up of separate mould parts which are divided along a helical line, thereby allowing formation of a drum between the two complementary mould parts.

The closest art found was:
WO 2001026871 A (KHOURI A)

GH
GRIFFITH HACK
PATENT AND TRADE MARK ATTORNEYS

Melbourne Office
509 St Kilda Road Melbourne
VIC 3004 Australia
GPO Box 1285K Melbourne
VIC 3001 Australia

Telephone +61 3 9243 8300
Facsimile +61 3 9243 8333
Facsimile +61 3 9243 8334
ghmelb@griffithhack.com.au
www.griffithhack.com.au

The Commissioner of Patents
Attention: International Preliminary Examining Authority

28 May 2004

COPY

Madam

IN THE MATTER OF International Patent Application No. PCT/AU2003/000664
in the name of ANTHONY KHOURI
Our Ref: TNB:MAF:FP18993

We refer to the written opinion dated 13 May 2004 and we lodge herewith a statement of proposed amendments in which clarifying amendments are made to the specification and claims. The specification has been retyped, and a copy of the specification illustrating the amendments made is enclosed to assist in the amendment.

We look forward to receiving a preliminary examination report on the amended application.

Yours respectfully

MELBOURNE

SYDNEY

PERTH

BRISBANE

Associated with Computer Patent Attorneys Limited Partnership Affiliated with Griffith Hack Lawyers

4/

International Patent Application No. PCT/AU2003/000664
in the name of ANTHONY KHOURI
Our Ref: TNB:MAF:FP18993

FIRST STATEMENT OF PROPOSED AMENDMENTS

- | | |
|-------------------------------|--|
| 1. Pages 1 to 26 | Cancel these pages and substitute therefor replacement pages 1 to 30, lodged herewith. |
| 2. Drawing sheets 1/2 and 2/2 | Cancel these drawing sheets and substitute therefor replacement drawing sheets 1/2 and 2/2, lodged herewith. |

GRIFFITH HACK

✓2

VEHICLE MOUNTED CONCRETE MIXING DRUM AND METHOD OF MANUFACTURE THEREOF

BACKGROUND

- 5 The present invention relates to concrete mixing apparatuses and more particularly relates to a vehicle mounted plastics drum for mixing concrete and a method manufacture thereof.

PRIOR ART

- 10 The building industry makes widespread use of concrete mixing trucks for transportation of ready mixed concrete to sites for concrete pours. These trucks typically comprise a large mixing assembly including a mixer drum mounted to the vehicle and which is connected to a mixer drive for mixing concrete contents during transportation and for discharge of the contents on site. The drive system comprises a gear box which takes power from the vehicle motor and which applies a mixing
- 15 torque to the drum imparting axial rotation to the drum with the torque being adjustable depending upon the operating requirements. The above general arrangement is described in United States patent 4,585,356 which discloses a concrete mixer truck having a mixer drum adapted to be rotated by the traction motor of the vehicle through an auxiliary transmission of the traction motor transmission.
- 20 According to the known vehicle mounted mixing assemblies, the mixing drum is typically of heavy duty steel construction and is disposed at approximately 10 to 15 degrees from horizontal. The drum is fitted with internal vanes or mixing blades defining an archimedian spiral so that as the drum rotates in a first direction the concrete held therein is mixed and as the drum is rotated in the opposite direction, the
- 25 concrete is discharged from the drum via an elevated discharge orifice under the reverse action of the internal spiral vanes. The drum is disposed such that the drive

end is lowest and the discharge end is highest relative to a generally horizontal plane of the vehicle.

While steel drums have been in use for many years, they suffer from a number of attendant disadvantages relating to their cost of manufacture and replacement,
5 working life, wear characteristics, weight and volume.

Steel drums are expensive to manufacture due to their labor intensive construction which involves rolling steel sheets into conical portions and cylinders which once fabricated are then welded to form the finished tank. The archimedian spirals formed from flat sheets are then welded into position inside the drum. As concrete is a highly
10 abrasive material, internal surfaces of steel drums are subject to significant wear abrasion. This occurs particularly on the surfaces which take slump impact, sliding friction and shear load leading to eventual wearing out of the drum.

Typically, a steel drum used every day might last three to five years, thereafter requiring replacement at significant cost. The abrasion of internal surfaces is
15 increased where there are changes of slope in the drum walls usually where the segments of the drum are joined.

The mixing blades are welded to the internal surface of the drum causing sharp angled recesses in which concrete can gather and eventually build up degrading the internal surface and providing a catchment for further unwanted build up of concrete. By its
20 nature, a steel surface is relatively smooth and whilst this may be desirable for the purpose of preventing concrete build up on the walls of the drum, the interface between the concrete and steel wall is an area of abrasion rather than concrete mixing.

Ideally, mixing of concrete should take place throughout the whole mix, but in the steel drums, optimum mixing does not take place at the boundary layer and in
25 crevices in which concrete may collect. In fact, due to the nature of the frictional interface between the steel surface and concrete boundary layer, laminar flow occurs resulting in little or no mixing at the boundary layer. The reason for this is that the aggregate in the concrete slides and abrades (with reduced or no mixing) rather than rotates to facilitate mixing. Thus there are 'dead' spots in the mix where no mixing
30 takes place and where there is an increased potential for unwanted collection of

34

concrete. In addition to the above problems associated with the use of steel mixing drums, there are cost and weight factors which add to inherent inefficiencies in use of steel drums. Due to the dead weight of the steel drum, its volume must be restricted so the combination of the dead weight and concrete weight must be maintained within the maximum allowable loading limits for the vehicle to which the drum is attached.

An alternative to the known steel drums was proposed in PCT International patent application PCT/AU00/01226 to Rodgers and Khouri. That application teaches the possibility of using a lightweight material such as plastics for construction of a concrete mixing drum as a substitute for steel whilst recognizing that there were numerous structural and manufacturing difficulties to be overcome in making the transition to plastics not the least of which was the production of a drum which could withstand the high static and dynamic loadings to which truck mounted mixing drums are subject to in normal operation. If the weight of the drum could be reduced without compromising and possibly increasing drum volume, the weight reduction could be taken up with additional concrete thereby increasing the pay load.

There are variety of concrete mixing drum arrangements disclosed in the prior art none of which as far as the inventor is aware anticipate the method of manufacture of a plastics drum to be described herein.

United States patent 4,491,415 discloses a lightweight, pear shaped rotary mixing device open at one end and having an axially elongated socket at the large end. The drum is rotatably supported on a unitary base having a transversely extended forward end and an upwardly and angularly extending rear end providing a bearing portion detachably engagable with the socket to rotatably support the drum at an inclination of about 35 degrees. The drum has a plurality of axially extending radial fins for lifting contents in rotation thereof and is preferably fashioned from molded plastics material either as a unitary body or as a plurality of interfitting parts. The drum described in this patent is for light duty operation and does not have the structural and materials characteristics necessary for heavy duty concrete mixing operations.

United States Patent 5,118,198 discloses a cement mixing apparatus with a cradle support assembly and including a polyethylene cement mixing drum held and

45

supported by a cradle arm assembly formed of cradle base support braces and upright cradle arms which interfit into cradle arm recesses which are preformed with the polyethylene drum. A bull gear drives the polyethylene drum. The drum disclosed in this patent is intended for light duty cement operations and does not address the

5 structural and manufacturing requirements for heavy duty operations. United States patent 5,492,401 discloses a concrete mixer with a mixing drum consisting of high density crosslinked polyethylene material. The drum includes a bottom supported by a conventional rigid metal pan secured to the external surface thereof to rigidify the plastic drum and extend the life expectancy of the plastic drum by enabling the

10 concrete mixer to be used to complete a mixing job at a job site even though movement of the concrete mix within the drum during repetitive mixing cycles may ultimately wear a hole through the bottom of the plastic drum. Paddle assemblies are positioned interiorly of the drum and oriented to maintain minimum splashing during the mixing operation. Not only is the drum disclosed in this patent unsuitable for

15 heavy duty vehicle mounted operation the patent in fact teaches a means to accommodate a wear failure on site whereby a hole could be worn through the wall of the drum.

The prior art teaches use of plastics drums for small cement mixing operations. However there are inherent difficulties in manufacturing plastic drums to an

20 acceptable standard of strength and reliability. Plastics drums require use of materials which for a drum profile by use of a mould. As the discharge opening to a drum is narrower than the remainder of the drum, it is not possible to remove a mould from an inner surface unless the drum is made in sections which can be joined to form the drum structure. A number of methods of manufacture of plastics heavy duty mixing

25 drums have been proposed in PCT application PCT/AU00/01226 which discloses a heavy duty rotary concrete mixing drum for attachment to a vehicle which is characterized in that the drum is manufactured from at least one mould and from at least one plastics material and wherein the drum includes an inner surface having a property which promotes mixing of the concrete at the boundary layer between the

30 concrete and said inner surface and reduces wear.

A number of different methods were proposed in that application for the manufacture of a drum of the type disclosed.

INVENTION

The present invention seeks to provide an alternative method of construction of a heavy duty vehicle mounted rotating cement or concrete mixing drum fabricated from plastics materials. The drum produced by the method of the invention described herein overcomes the aforesaid disadvantages of the prior art and maintains efficient concrete mixing characteristics. According to the invention there is provided a method of construction of a plastics concrete mixing drum wherein the method includes the use of inner and outer molds each made up from separate mould parts which are divided along two helical lines mid way between the mixing blades thereby allow formation of a drum interior from two identical molds.

In one broad form the present invention comprises:

a method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the method comprises the steps of;

- a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
- b) mounting the first helical inner mould part on a support
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;

47

- d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
- e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one
5 half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts to expose said inner wall element;
- h) removing said inner wall element one of said inner molds;

The method preferably comprises the additional step of placing a reinforcing member
10 in a recess formed in said inner mold part. Steps a) – h) are repeated thereby providing a second helical inner wall element. The first and second helical inner wall elements are complimentary and combine to form an inner wall surface of the mixing drum. The first and second helical inner wall elements are then preferably placed into
15 a jig where opposing edges of said elements are held adjacent; the wall elements defining an inner cavity of said drum. Opposing edges of the elements are sealed to complete the inner wall of the drum. The inner wall is removed from the jig and placed the inner wall on a mandrel such that the mandrel is disposed in the inner cavity. The inner wall is placed on the mandrel via an open end of the inner wall whereupon structural layers of glass fibre reinforced plastic are applied to the
20 polyurethane inner layer. Preferably, the internal surface of the drum includes an elastomer which will allow mixing of the contents of the concrete at a concrete boundary layer;

The reinforcing member is preferably a continuous rope inserted in a recess in a formation which will form helical blades.

25 The method includes the use of inner and outer molds each made up from separate mould parts which are divided along two helical lines thereby allowing formation of a drum interior wall from two complementary mould parts.

In another broad form the present invention comprises:

48

- a method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and discharge of concrete therefrom and at the other end means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one
- 5 inner mould and at least one opposing outer mould; wherein the drum includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharges from said drum; and wherein the internal surface
- 10 of the drum is formed or lined with an elastomer which causes mixing of the contents of the concrete at the concrete boundary layer; wherein the method comprises the steps of ;
- a) preparing a first inner helical mold containing a surface intermediate side edges of the mould;
- 15 b) placing a reinforcing rod in a recess in said inner mold;
- c) enclosing the inner helical mold assembly within at least one outer mold part;
- d) sealing a joint between said inner mold part and said at least one outer mold part;
- e) injecting a polyurethane elastomer into a cavity defined by said inner mold
- 20 and said at least one outer mold part to form an inner helical wall element comprising one half of an interior of the mixer and one helical blade;
- g) allowing said polyurethane to cure;
- h) removing said at least one outer mold parts;
- i) removing one of said inner molds;
- 25 j) removing the interior polyurethane inner helical wall element molding from the remainder of the inner mold assembly;
- k) repeating steps a) – j) to form a second inner wall element.

44

Preferably when a first and a second inner wall element are placed in a jig jointing surfaces are held adjacent to enable sealing the join formed by the jointing surfaces.

According to a preferred embodiment, a mandrel is inserted into an open discharge end of a drum interior following which structural layers of glass fibre reinforced plastics are wound about an outer surface of the inner wall.

In another broad form the present invention comprises:

a method of construction of a plastics mixing drum comprising the steps of:

- a) preparing a first inner mold containing a surface extending from a joint line midway between two helical blades to a mid line mould joint line at an inner edge of said blades;
- b) placing a reinforcing rod in a recess in said inner mold;
- c) fitting a second mating inner helical mold to form an inner mold assembly;
- d) enclosing the inner helical mold assembly within at least one outer mold part;
- e) sealing a joint between said inner mold assembly and said at least one outer mold part;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts;
- h) removing one of said inner molds;
- i) removing the interior polyurethane molding from the remainder of the inner mold assembly;
- j) placing said two helical blade and interior moldings in a jig where the jointing surfaces are held adjacent;
- k) inserting a mandrel into an open discharge end of the drum;

- l) applying structural layers of glass fibre reinforced plastic the polyurethane layer.

Preferably the reinforcing is fitted using spacers which centralize the reinforcing rod or rope in its recess. Preferably the first and second inner helical mold elements are
 5 jointed with a sealing compound or gaskets along an inner edge. According to one embodiment, the outer mold is formed in three separate mold parts.

Preferably, a joint between the two inner helical elements forming a helical blade is made with a polyurethane elastomer compound.

In another broad form the present invention comprises:

- 10 a method of manufacture of a vehicle mounted concrete mixing drum comprising the steps of;
 - a) taking a helical inner mould part and mounting the mould on a support;
 - b) placing at least one external mould in opposing relationship to said inner mould;
 - 15 c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;
 - d) removing the at least one outer mould;
 - e) removing the helical element from said inner mould;
 - 20 f) repeating steps a) - e) so as to form a second helical element;
 - g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

Preferably, the flowable material is polyurethane.

In another broad form of an apparatus aspect the present invention comprises

- 25 a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging

concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction. the concrete contents
 5 are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the drum is formed by a method comprising the steps of ;

- a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
- 10 b) mounting the first helical inner mould part on a support
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
- d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
- 15 e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts to expose said inner wall element;
- 20 h) removing said inner wall element one of said inner molds;

In another broad form of the apparatus aspect, the present invention comprises:

a vehicle mounted concrete mixing drum formed by a method of manufacture comprising the steps of;

- a) taking a helical inner mould part and mounting the mould on a support;
- 25 b) placing at least one external mould in opposing relationship to said inner mould;

- c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;
- d) removing the at least one outer mould;
- 5 e) removing the helical element from said inner mould;
- f) repeating steps a) - e) so as to form a second helical element;
- g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

Preferably the flowable material is polyurethane.

- 10 According to one embodiment, the helical blades projecting from an inner surface of said drum have a pitch dimension of between 1- 2 meters and are formed by elastomeric material. Preferably the wall strength of said drum is around 600MPa at a wall thickness of 8mm. Preferably the polyurethane forms an inner layer which is approximately 3mm thick.
- 15 Preferably the structural layer comprises filament windings forming a layer of approximately 5mm thickness.

In another broad form the present invention comprises;

- a heavy duty rotary concrete mixing drum capable of attachment to a vehicle; the drum comprising a first end which engages a drive assembly which rotates said drum
- 20 for mixing of said concrete and a second end from which mixed concrete is discharged; wherein said drum is manufactured from at least one layer of plastics material wherein the drum includes a wall having integral internal formations which promote mixing of said concrete and an inner surface which promotes mixing of the concrete at the boundary layer between the concrete and said inner surface; wherein
- 25 the drum is formed according to the method steps of:
 - a) taking a helical inner mould and mounting the mould on a support;
 - b) placing at least one external mould in opposing relationship to said inner mould;

- c) injecting polyurethane into a space formed between said inner mould and said outer mould;
- d) removing the at least one outer mould;
- e) removing a helical blade part from said inner mould;
- 5 f) repeating steps a) - e) so as to form a second helical blade part;
- g) mating the first and second helical blade parts with an interior shell;
- g) preparing an exterior of the drum for bonding to a structural layer of glass fibre;
- h) winding the structural layer about said exterior.

10

DETAILED DESCRIPTION

The present invention will now be described according to a preferred but non limiting embodiment and with reference to the accompanying illustrations wherein:

Figure 1 shows a side elevation of an inner helical mould part;

15 Figure 2 shows a side elevation of the mould part of figure 1 including exploded external moulds;

Figure 3 shows a side view of the inner mould part of figures 1 and 2 fully enclosed by external mould sections

Figure 3a shows an enlarged view of external moulds exploded from a helical blade part;

20 Figure 3b shows an enlarged view of the assembly of figure 3a with outer mould parts moulds assembled.

Figure 4 shows outer mold sections exploded from the inner mould assembly upon completion of injection of an elastomer.

25 Figure 5 shows a helical blade part produced by and removed from the inner mould assembly of figure 4;

52

- Figure 6 shows a coupling of separate and complementary helical blade parts formed by the arrangements of figures 1-5 and which form an inner wall of the drum;
- Figure 7 shows a housing for assembly in which the inner wall of the drum is placed after moulding helical blade parts for preparation of the blade parts to receive an outer structural layer;
- Figure 8 shows an assembly including a mandrel for mounting said inner payer for applying an outer structural layer of glass fibre;
- Figure 9 shows a completed drum with track ring fitted.;

The concentrated wear points in the prior art steel drums reduces the working life of the drums necessitating costly repair or replacement. Steel drums are fabricated from rolled flat sheets which form cones and a cylinder which are then joined together by welding. Archimedian spirals are then welded to the inner surface of the drum resulting in a high specific gravity vessel whose self weight reduces the amount of concrete which can be carried by the vehicle to which it is attached. The steel drums suffer from a number of disadvantages including susceptibility to abrasion at the junctions of the cylindrical and conical sections and the tendency for unwanted concrete build up at the sharp corners and crevices formed by the mixing blades. In addition, the smooth internal surface of the steel drum promotes sliding abrasion and inhibits mixing at the boundary layer due to the low coefficient of friction at the concrete/metal interface.

The method to be described below is an alternative to both steel drums and the plastics drums formed by the methods of manufacture described in International Patent application No. PCT/AU00/01226 to Rodgers and Khouri. According to the method, a plastics heavy duty concrete mixing drum is formed using both internal and external moulds. The drum includes an internal archimedian spiral formed by helical blades or vanes which mix concrete during rotation of the drum in one direction and discharge concrete when the drum is rotated in an opposite direction. The drum is generally pear shaped and includes an opening at one end for entry and discharge of concrete.

The first step in the method according to one embodiment, involves the use of an internal mould. A polyurethane drum interior complete with internal helical blades is formed between an interior and an exterior mould set. The exterior moulds are easily removed after the polyurethane is formed, however because the mixer is a closed vessel with the discharge opening smaller than the maximum diameter, and due to the complexity of the blade moulds, it is not possible to form the interior as one complete piece and then remove the mould. Accordingly, the elastomeric drum interior is moulded in sections which can be removed from the moulds, and then joined to form the complete interior. This interior is then reinforced with structural layers to complete the mixer. The joining together of two complementary inner wall sections which are each formed by the same method steps sequentially is a new approach to forming a drum interior not known in the prior art.

Referring to figure 1 there is shown an assembly 10 which comprises a support 12 which receives and retains thereon a helical inner mould assembly 14. Mould assembly 14 is shown in profile by line [4] 14A. Mould assembly 14 is initially prepared in a separate mould having a helical interior so that mould 14 conforms to the shape of that interior. Once mould assembly 14 is formed, it may be transferred manually or otherwise for mounting on support 12 in preparation for receiving external mould[s] parts 16, 18 (shown in figure 2). Figure 2 shows a side elevation of the mould assembly 14 of figure 1 with exploded opposing external mould parts 16 and 18.

As shown by figure 3, mould parts 16 and 18 encapture mould assembly 14 but leave a generally helical cavity therebetween. Once external mould parts 16 and 18 have been secured and sealed, polyurethane is injected into the aforesaid cavity 19. It will be appreciated by persons skilled in the art that more than two external moulds 16, 18 may be used to fulfill the same objectives of encapsulating inner mould 3. Figure 3 shows a side view of the inner mould 3 assembly 14 enclosed by external mould sections or parts 16 and 18.

Figure 3a shows an enlarged view of inner mould[s] assembly parts 14A and 14B exploded from inner mould assembly 14 and outer mould 16 revealing a section view

of a part helical spiral or element 20 retrieved from the cavity 19 defined by inner mould[s] parts 14A and 14B and outer mould 16 following injection of polyurethane.

Figure 3b shows an enlarged section view of the assembly of figure 3a with moulds 14 and 16 assembled. Mould parts 14A, 14B and mould 16 are shown in figure 3b in
5 abutting relationship with molded part, which is formed by injection of a polyurethane elastomer into a cavity 19 formed between moulds 14, 16 and 18.

Referring to figure 4 there is shown outer mold sections 16 and 18 exploded from the inner mould assembly + 14 upon completion of injection of an elastomer. Upon removal of inner mould sections or parts 14A, 14B, helical (or element) [8] 20 which
10 has been formed from the elastomeric material injected into the cavity defined by assembled external mould[s] parts 16, 18 and mould 14 as shown in figure 3 may be released. Figure 5 shows a first helical element 20 formed in a first helical (archimedian) spiral. The above described process is repeated once again to form a second helical (archimedian) helical element 24. Helical element 22 forms one half
15 of a completed shell having blades 28 which are integrally disposed on an inner surface 32 of the drum 72 formed by the processes described herein. A repeat of steps described with reference to figures 1-5 result in a second helical inner element [9] 24 which co operates with and is complementary to helical element [8] 22 to form a completed inner wall 26 including integral helical blade 28. Figure 6 shows a pair of
20 helical sections 22 and [9] 24 formed by the assembly and process as described with reference to figures 1-5. Sections 22 and [9] 24 are in the form of two parallel helical spirals spaced at 180 degree axial phase difference each with a reinforcing rod 30 (see figures 3a and 3b) in the interior edge, which may be a continuous filament and resin rope. As these blades 28 are integral with the interior surface 32 of the mixer, it is
25 convenient to join these two structures along two helical lines 34 mid way between the blades 28. In this way the interior is formed as two identical mouldings or sections 22, 24 which can be removed from the interior mould 14 and exterior mould sections 16, 18 and which also contain the complete reinforcing rods 30.

As shown by figures 3a and 3b, the moulds 16, 18 contain a layer 38 of glass
30 reinforced plastic which bonds to the polyurethane of elements 22, 24 which is are

formed, against it. In this way the two mouldings or sections 20, 24 are formed with two helical jointing lines 34 mid way between the blades 28 and a stiff inner shell 40 ready to receive the structural layers 42 is formed.

According to one embodiment, a preferred method of manufacturing the mixer is as follows.

As shown by figures 3a and 3b, inner helical mould 14B includes surfaces 42, 44 which extend[s] from a joint line 46 mid way between two formed helical blade (28) to a mid-line mould joint line 48 at an inner edge of the blade 28. Surface 44 faces towards the drive end of the mixer and contains a recess 50 for the reinforcing rod or filament rope 30. The next step is fitting reinforcing rod 30 with polyurethane spacers (not shown), which centralize the rod 30 in a recess 50 between inner mould 14A, 14B.

A mating helical mould 14A is prepared, fitted and is joined with sealing' gaskets (not shown) to mould 14b along their inner edge 48. The helical mould 52 is formed by moulds 14A, 14B and mould 16, the surfaces of which are pre coated with a layer 58 of glass fibre reinforced plastic, to provide an interior moulding 58 to the polyurethane elastomer. Seals 60 are incorporated into a joint formed between the mould 16 and moulds 14A, 14B. Following this the polyurethane elastomer is moulded into the cavity 62 formed between the moulds 14, 16. The elastomer polymerizes to form section 20 which comprises half the interior layer of the mixing drum 64. The polyurethane is allowed to cure whereupon moulds 14A, 14B and 16 are removed to expose an inner shell and outer surface of the polyurethane section 20. This allows removal of the helical section 20, the interior polyurethane moulding. The above process is repeated to provide a second helical section 24, having blade 28 and interior wall moulding 26.

The two helical section 22 and [9] 24 are then assembled in a jig 62 as shown in figure 7 whereupon they are joined together using a polyurethane elastomer compound. An inflation pressure is applied to the interior of the mixer to ensure it conforms to the interior of the jointing jig 62. The top half of the jig 62 is removed and the external surface of the polyethylene joints is covered with glass fibre

reinforced plastics. Following that, the external surface of the moulded polyurethane interior of the mixer is prepared for bonding to the structural layer. At this stage of the processing a drive ring is applied to the polyurethane layer which will form the inner layer or wall 26 of the mixing drum. The jig 62 is removed and the now formed
 5 inner layer 26 of the drum is transferred to a winding station 64 as shown in figure 8.

A steel mandrel 66 is inserted into the open (discharge) end 68 of the mixer so that it reaches the drive ring (not shown) which is common to heavy duty drums of this type. The drive ring which imparts rotation to the mixer is spigotted and drilled to suit a gear box flange (not shown). The glass fibre reinforced plastic exterior of the
 10 polyurethane interior 26 is bonded to the drive ring and allowed to cure. The glass fibre reinforced plastic exterior 70 is extended over the discharge end support flange which then forms an enclosed vessel against the mandrel.

Structural layers of glass fibre reinforced plastic are applied by one of the known methods standard to the industry such as :

- 15 a) Contact moulding of random and/or directional glass fibres and resin.
- b) Filament winding.
- c) Surface finishing by filling and grinding or/ Moulding a gel coat finish using vacuum or pressure.

The winding step is conducted by winding device 64 after drum inner layer is mounted on mandrel 66. (see figure 8). As represented by figure 9, the final step in
 20 the construction of the drum involves the installation of the track ring 80.

These are known in conventional heavy duty drums and comprise a cylindrical rail attached to the mixer adjacent to the discharge end and which is supported by two rollers to allow the mixer to be rotated by the gearbox at the drive end. The ring is
 25 held in position with rubber gaskets (not shown) which seal to the mixer and this space between the ring and the mixer is filled with a liquid polyurethane which bonds to both as it gels and cures.

In operation this elastomer transmits the loads from the mixer shell to the steel track ring and hence to the steel support rollers. In this way the concentrated loads are spread and only low stresses are transmitted via the elastomer to the mixer shell.

5 According to one embodiment, a computer may be employed to program and control the delivery of the polymer to the mold surface and the application of the structural layer.

The winding of a fibre reinforced structural layer may involve computer controlled unwinding of resin wetted fibre rovings from around a rotating former. The tensile strength of the windings may be in the order of 600 MPa. To obtain the optimum
10 physical properties of the filament wound structure the fibres are aligned to the loads imposed in use of the finished drum. Typical loadings on the drum are axial bending under weight of wet concrete, an applied dynamic load at the drive end of the drum, driving torque and support loads at discharge end trunion rolls. The winding pattern of the filaments 70 aligns the fibres to withstand bending stresses, increasing in angle
15 and in wall thickness towards the discharge end to accommodate applied roller loads.

The rovings 70 which line the drum may alternatively be drawn through the resin bath and applied to the surface of the drum as a wide ribbon comprising thousands of tensioned fibres. The windings 70 overlap until the required thickness is reached. The surface of the drum may be covered with wet resin and small irregularities which
20 need to be addressed to provide the external finish. As a result of this construction, the spiral mixing blades 28 inside the drum are capable of withstanding high bending and shear resistance during mixing operations. The inner elastomeric surface 32 is highly resistant to abrasion by concrete yet it is softer and lighter than the steel equivalent. The higher resistance to abrasion is facilitated by the natural elastic
25 deformation of the elastomer which absorbs the kinetic energy of the concrete particles without gouging of the surface material. In addition, due to the property of the inner surface which will preferably be polyurethane, the concrete will be mixed rather than slide at the boundary layer ensuring efficient mixing of the concrete throughout the mix and reduction of abrasion due to the smooth curves throughout the
30 interior of the drum.

Furthermore, the blades 28 are strengthened by their molding integrally with the wall 26 of the drum and have a stiffness factor which will sustain all applied normal operating loads.

5 A further advantage in the use of plastics for the mixing drums lies in the thermal properties of the plastics material. Hot conditions are undesirable for concrete mixing as they accelerate hydration reducing concrete workability which is an essential property required immediately following a concrete pour. In very hot climates, the conventional steel vehicle mounted mixing drums conduct high heat loads which increase heat at the concrete boundary layer due to contact with the super heated drum
10 wall causing unwanted accelerated hydration. This phenomenon is difficult to avoid with steel drums as the conductivity of steel leads to high conductive heat transfer from the outer skin of the drum to the inner wall which is normally in contact with the concrete. In some hot climates, ice is placed in the steel drums in an attempt to arrest temperature increase inside the drum. As concrete hydration is an exothermic
15 reaction, it is sensitive to external temperatures. Accordingly it is desirable that the concrete temperature remains acceptably low to ensure a satisfactory level of workability and to retard hydration. Steel drums heat up significantly and conduct heat through their thickness making the concrete vulnerable to the vagaries of temperature variation. Overheating of the concrete mix is a problem to be avoided
20 and has in accordance with one aspect provided a method of manufacture of a plastics drum to take the place of the conventional steel drums thereby reducing the unwanted effects of high thermal conductivity typical of the steel drums. The plastics drum allows the concrete to remain workable inside the drum for longer periods compared to concrete in steel mixing drums under the same external temperature conditions and
25 transporting concrete.

The method of construction of a plastics concrete mixing drum as described herein provides an alternative yet efficient method of production of plastics drums. The methods described herein allow for mass production with reduction in the number of production steps compared to the known methods.

It will be recognized by persons skilled in the art that numerous variations and modifications may be made to the invention as broadly described herein without departing from the overall spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from said drum; wherein, the method comprises the steps of ;
 - a) preparing a first generally helical inner mold part;
 - b) mounting the first helical inner mould part on a support
 - c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
 - d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
 - e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
 - f) allowing said polyurethane to cure;
 - g) removing said at least one outer mold parts to expose said inner wall element;
 - h) removing said inner wall element one of said inner molds;
2. A method according to claim 1 comprising the additional step of placing a reinforcing member in a recess formed in said inner mold part.
3. A method according to claim 2, wherein steps a) – h) are repeated thereby providing a second helical inner wall element.

4. A method according to claim 3 wherein the first and second helical inner wall elements are complimentary and combine to form an inner wall surface of the mixing drum.
5. A method according to claim 4 comprising the further step of placing said first and second helical inner wall elements into a jig where opposing edges of said elements are held adjacent; the wall elements defining an inner cavity of said drum.
6. A method according to claim 5 wherein said opposing edges are sealed to complete said inner wall of said drum.
7. A method according to claim 6 comprising the further step of removing said inner wall from said jig and placing said inner wall on a mandrel such that the mandrel is disposed in said inner cavity.
8. A method according to claim 7 wherein the inner wall is placed on said mandrel via an open end of said inner wall
9. A method according to claim 8 comprising the further step of applying structural layers of glass fibre reinforced plastic to the polyurethane inner layer.
10. A method according to claim 9 wherein the internal surface of the drum includes an elastomer which allows mixing of the contents of the concrete at a concrete boundary layer;
11. A method according to claim 10 wherein said reinforcing member is a continuous rope inserted in a recess in said blades.
12. A method of construction of a plastics concrete mixing drum wherein the method includes the use of inner and outer molds each made up from separate mould parts which are divided along two helical lines thereby allowing formation of a drum interior wall from two complementary mould parts.

13. A method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and discharge of concrete therefrom and at the other end means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete; wherein, the drum is manufactured from at least one inner mould and at least one opposing outer mould; wherein the drum includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharges from said drum; and wherein the internal surface of the drum is formed or lined with an elastomer which causes mixing of the contents of the concrete at the concrete boundary layer; wherein the method comprises the steps of;
- a) preparing a first inner helical mold containing a surface intermediate side edges of the mould;
 - b) placing a reinforcing rod in a recess in said inner mold;
 - c) enclosing the inner helical mold assembly within at least one outer mold part;
 - d) sealing a joint between said inner mold part and said at least one outer mold part;
 - e) injecting a polyurethane elastomer into a cavity defined by said inner mold and said at least one outer mold part to form an inner helical wall element comprising one half of an interior of the mixer and one helical blade;
 - g) allowing said polyurethane to cure;
 - h) removing said at least one outer mold parts;
 - i) removing one of said inner molds;
 - j) removing the interior polyurethane inner helical wall element molding from the remainder of the inner mold assembly;
 - k) repeating steps a) – j) to form a second inner wall element.

14. A method according to claim 13 comprising the further steps of :

a) placing a second inner wall element along with said first inner helical wall element in a jig where the jointing surfaces are held adjacent so as to form an inner wall;

b) sealing the join formed by said jointing surfaces.

5 15. A method according to claim 14 wherein comprising the additional step of

a) inserting a mandrel into an open discharge end of a drum interior ;

10 b) winding structural layers of glass fibre reinforced plastic about an outer surface of said inner wall.

16. A method of construction of a plastics mixing drum comprising the steps of:

15 a) preparing a first inner mold containing a surface extending from a joint line midway between two helical blades to a mid line mould joint line at an inner edge of said blades;

b) placing a reinforcing rod in a recess in said inner mold;

c) fitting a second mating inner helical mold to form an inner mold assembly;

20 d) enclosing the inner helical mold assembly within at least one outer mold part;

e) scaling a joint between said inner mold assembly and said at least one outer mold part;

25 injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and said at least one outer mold part to form one half of the interior of the mixer and one of the helical blades;

f) allowing said polyurethane to cure;

g) removing said at least one outer mold parts;

h) removing one of said inner molds;

30 i) removing the interior polyurethane molding from the remainder of the inner mold assembly;

- j) placing said two helical blade and interior moldings in a jig where the jointing surfaces are held adjacent;
 - k) inserting a mandrel into an open discharge end of the drum;
 - l) applying structural layers of glass fibre reinforced plastic the
- 5 polyurethane layer.

17. A method according to any of the foregoing claims wherein the reinforcing is fitted with spacers which centralize the rod in its recess.

18. A method according to claim 17 wherein, the first and second inner helical mold elements are jointed with a sealing compound or gaskets along an inner

10 edge.

19. A method according to claim 17 wherein the outer mold is formed in three separate mold parts.

20. A method according to claim 19 wherein, the joint between said two inner helical elements forming a helical blade is made with a polyurethane elastomer

15 compound.

21. A method of manufacture of a vehicle mounted concrete mixing drum comprising the steps of;

- a) taking a helical inner mould part and mounting the mould on a support;
- 20 b) placing at least one external mould in opposing relationship to said inner mould;
- c) injecting a flowable material into a space formed between said inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;
- 25 d) removing the at least one outer mould;
- e) removing the helical element from said inner mould;
- f) repeating steps a) - e) so as to form a second helical element;

g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

22. A method according to claim 21 wherein the flowable material is polyurethane.

5 23. A method according to claim 22 wherein, said first and second helical elements are joined in a jig to form an inner surface of said drum.

24. A method according to claim 23 comprising the further step of preparing an exterior surface of the mixer for bonding to a structural layer of glass fibre.

10 25. A method according to claim 24 comprising the additional step of winding a structural layer of fiberglass about said exterior surface.

26. A vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or
15 discharging concrete; wherein, the drum is manufactured from at least one mould using at least one plastics material; wherein the drum further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction the concrete contents are mixed and when the drum is rotated in a second direction the
20 contents are discharged from said drum; wherein, the drum is formed by a method comprising the steps of ;

a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;

b) mounting the first helical inner mould part on a support

25 c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;

d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;

- e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- 5 g) removing said at least one outer mold parts to expose said inner wall element;
- h) removing said inner wall element one of said inner molds;

27. A vehicle mounted concrete mixing drum formed by a method of manufacture comprising the steps of;

10 a) taking a helical inner mould part and mounting the mould on a support;

b) placing at least one external mould in opposing relationship to said inner mould;

c) injecting a flowable material into a space formed between said

15 inner mould and said outer mould such that the flowable material forms a helical element which will form at least part of an inner surface of said drum;

d) removing the at least one outer mould;

e) removing the helical element from said inner mould;

f) repeating steps a) - e) so as to form a second helical element;

20 g) preparing an exterior surface of the helical elements for bonding to a structural layer of glass fibre.

28. A concrete mixing drum according to claim 27 wherein the flowable material is polyurethane.

29. A concrete mixing drum according to claim 27 wherein helical blades

25 projecting from an inner surface of said drum have a pitch dimension of between 1- 2 meters and are formed by elastomeric material.

30. A mixing drum according to claim 28 wherein the wall strength of said drum is around 600MPa at a wall thickness of 8mm.

31. A mixing drum according to claim 29 wherein the polyurethane forms an inner layer which is approximately 3mm thick.
32. A mixing drum according to claim 31 wherein said structural layer comprises filament windings forming a layer of approximately 5mm thickness.
- 5 33. A method for making a concrete mixing drum, the method comprising: combining a first helical section and a second helical section.
34. A method for making a concrete mixing drum, the method comprising: providing a mould having a recess configured to form a drum blade; locating a reinforcing member in the recess; and
10 inserting polymeric fluid in the recess such that the fluid flows about and substantially surrounds the reinforcing member.
35. A concrete mixing drum comprising:
a first helical element; and
a second helical element joined to the first helical element, wherein the
15 first helical element and the second helical element form a substantially continuous layer circumferentially extending about a longitudinal axis of the drum.
36. The drum of claim 35 wherein the first helical element and the second helical element are polymeric.
37. The drum of claim 35 wherein the first helical element includes a
20 blade.
38. The drum of claim 37 wherein the second helical element includes a blade.
39. The drum of claim 37 wherein the blade is helical.
40. The drum of claim 37 including a reinforcing member within a tip of
25 the blade.

70

41. The drum of claim 35 including a second substantially continuous layer extending across a junction of the first element and the second element.

42. The drum of claim 41 wherein the second continuous layer is a fibre reinforced elastomer.

5 43. The drum of claim 35 wherein the first helical element and the second helical element form an interior of the drum.

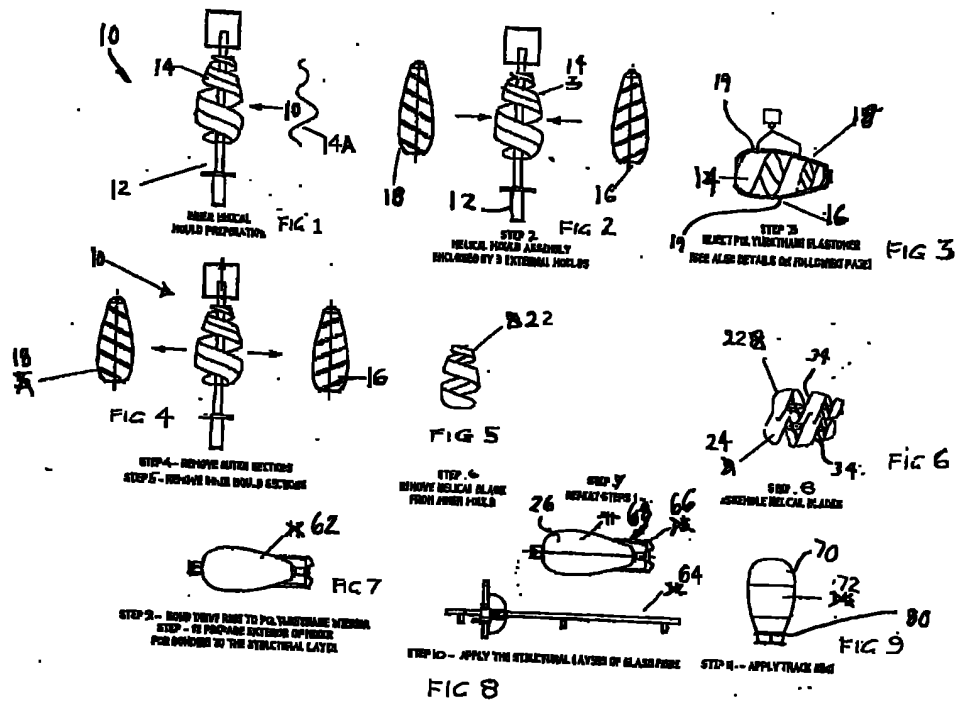
44. An element comprising:
a helical polymeric shell; and
a polymeric blade integrally formed with and extending from the shell.

71

ABSTRACT

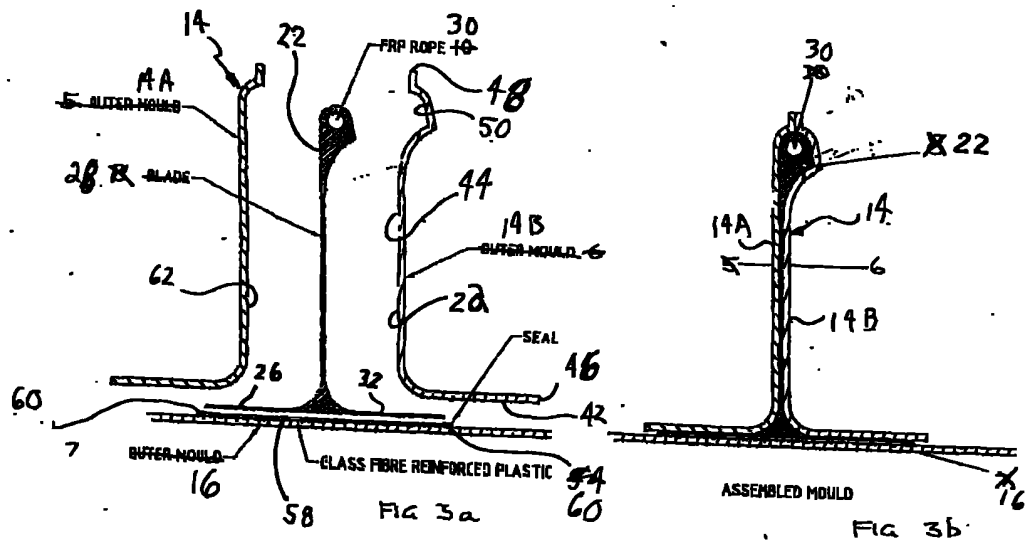
A method of manufacture of a vehicle mounted rotary concrete mixing drum of the type having an opening at one end for receiving and/or discharge of concrete therefrom and at the other end, means for engaging a drive assembly so as to rotate the drum for mixing or discharging concrete. The drum is manufactured from at least one mould using at least one plastics material and further includes integrally attached vanes which outstand from the internal surface of the drum forming an archimedian spiral disposed such that when the drum is rotated in a first direction, the concrete contents are mixed and when the drum is rotated in a second direction the contents are discharged from the drum; wherein, the method comprises the steps of;

- a) preparing a first generally helical inner mold part containing a surface extending between first and second helical edges;
- b) mounting the first helical inner mould part on a support
- c) enclosing the inner helical mold assembly within an outer mould formed by at least one outer mold part;
- d) fitting a second mating inner helical mold part to the first inner mould part to form an inner mold assembly;
- e) injecting a polyurethane elastomer into a cavity defined by said inner mold assembly and the outer mould assembly to form an inner wall element comprising one half of an interior wall of the mixer and one helical blade;
- f) allowing said polyurethane to cure;
- g) removing said at least one outer mold parts to expose said inner wall element;
- h) removing said inner wall element one of said inner molds;



1/2

72



2/2

23

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Griffith Hack
GPO Box 1285K
MELBOURNE VIC 3001

PCT
WRITTEN OPINION
(PCT Rule 66)



Date of mailing (day/month/year) 10 JUN 2004	
Applicant's or agent's file reference TNB:FP18993	REPLY DUE within ONE MONTH from the above date of mailing
International Application No. PCT/AU2003/000664	International Filing Date (day/month/year) 31 May 2003
Priority Date (day/month/year) 31 May 2002	
International Patent Classification (IPC) or both national classification and IPC Int. CL ⁷ B28C 5/42, B29C 45/14, B29D 23/00	
Applicant KHOURI, Anthony et al	

DIARIED
ID. 309388

1. This written opinion is the **second** drawn by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☒	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application
3. The **FINAL DATE** by which the international preliminary examination report must be established according to Rule 69.2 is:
30 September 2004
4. The applicant is hereby invited to reply to this opinion.

When?	See the Reply Due date indicated above. However, the Australian Patent Office will not establish the Report before the earlier of (i) a response being filed, or (ii) one month before the Final Date by which the international preliminary examination report must be established. The Report will take into account any response (including amendments) filed before the Report is established. If no response is filed by 1 month before the Final Date, the international preliminary examination report will be established on the basis of this opinion. Applicants wishing to have the benefit of a further opinion (if needed) before the report is established should ensure that a response is filed at least 3 months before the Final Date by which the international preliminary examination report must be established.
How?	By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.
Also	For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis. For an informal communication with the examiner, see Rule 66.6.

Name and mailing address of the IPRA/AU
AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaaustralia.gov.au
Facsimile No. (02) 6285 3929

Authorized Officer

JOHN DEUIS
Telephone No. (02) 6283 2146

WRITTEN OPINION

International application No.
PCT/AU2003/000664

I. Basis of the opinion

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description, pages , as originally filed,
pages , filed with the demand,
pages 1-20 received on 28 May 2004 with the letter of 28 May 2004
- ☒ the claims, pages , as originally filed,
pages 21-29 as amended under Article 19 of 28 May 2004,
pages , filed with the demand,
pages , received on with the letter of
- ☒ the drawings, pages , as originally filed,
pages , filed with the demand,
pages 1/2-2/2 received on 28 May 2004 with the letter of 28 May 2004
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☒ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"

WRITTEN OPINION

International application No.

PCT/AU2003/000664

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos: 34, 44.

because:

☒ the said international application, or the said claim Nos. 34, 44 relate to the following subject matter which does not require an international preliminary examination (*specify*):

Claim 34 relates to a method of making a concrete drum comprising a mould having a recess to form a blade; locating a reinforcing member in the recess; and flowing polymeric fluid in the recess and surrounding the reinforcing member.

Claim 44 relates to an element comprising a helical polymeric shell and a polymeric blade integrally formed with and extending from the shell.

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claim Nos. 34, 44

2. A written opinion cannot be drawn due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Rule 66.2(a)(II) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-33, 35-43	YES
	Claims	NO
Inventive step (IS)	Claims 1-33, 35-43	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-33, 35-43	YES
	Claims	NO

2. Citations and explanations

None of the individual citations disclose all the essential features as claimed. Claims 1-33, 35-43 are novel and involve an inventive step.

The invention is directed to a method of constructing a plastic fabricated concrete mixing drum wherein, the method includes the use of inner and outer moulds, each made up of separate mould parts which are divided along a helical line, thereby allowing formation of a drum between the two complementary mould parts.

The closest art found was:
WO 2001026871 A (KHOURI A)

WRITTEN OPINION

International application No.

PCT/AU2003/000664

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of Box 1 Item 5

The amendment submitted with the letter of the 28 May 2004 causes the subject matter of the application to be extended beyond the content of the application as originally filed. Therefore, it is contrary to the PCT Articles. The amendment in question relates specifically to claims 34, 44.

The subject matter of the invention is assessed as being related to a method of manufacture of a vehicle mounted rotary concrete mixing drum comprising the steps of fitting an inner and outer moulds each made up from separate mould parts which are divided along two helical lines thereby to form a drum wall from the complementary mould parts.

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

99

Applicant's or agent's file reference TNB:FP18993	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International Application No. PCT/AU2003/000664	International Filing Date (day/month/year) 31 May 2003	Priority Date (day/month/year) 31 May 2002
International Patent Classification (IPC) or national classification and IPC Int. Cl. 7 B28C 5/42, B29C 45/14, B29D 23/00		
Applicant KHOURI, Anthony et al		

1. ☐ This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 32 sheet(s).

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 24 December 2003	Date of completion of the report 7 September 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed.
- ☒ the description, pages , as originally filed,
pages , filed with the demand,
pages 1-20 received on 28 May 2004 with the letter of 28 May 2004
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 21-29 received on 28 May 2004 with the letter of 28 May 2004
- ☒ the drawings, pages , as originally filed,
pages , filed with the demand,
pages 1/2-2/2 received on 28 May 2004 with the letter of 28 May 2004
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under Item I and annexed to this report

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be nonobvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos: 34, 44.

because:

☒ the said international application, or the said claims Nos. 34, 44 relate to the following subject matter which does not require an international preliminary examination (*specify*):

Claim 34 relates to a method of making a concrete drum comprising a mould having a recess to form a blade; locating a reinforcing member in the recess; and flowing polymeric fluid in the recess and surrounding the reinforcing member.

Claim 44 relates to an element comprising a helical polymeric shell and a polymeric blade integrally formed with and extending from the shell.

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claim Nos. 34, 44

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-33, 35-43	YES
	Claims	NO
Inventive step (IS)	Claims 1-33, 35-43	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-33, 35-43	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

None of the individual citations disclose all the essential features as claimed. Claims 1-33, 35-43 are novel and involve an inventive step.

The invention is directed to a method of constructing a plastic fabricated concrete mixing drum wherein, the method includes the use of inner and outer moulds, each made up of separate mould parts which are divided along a helical line, thereby allowing formation of a drum between the two complementary mould parts.

The closest art found was:
WO 2001026871 A (KHOURI A)

Supplemental Box**(To be used when the space in any of the preceding boxes is not sufficient)****Continuation of Box 1 Item 5**

The amendment submitted with the letter of the 28 May 2004 causes the subject matter of the application to be extended beyond the content of the application as originally filed. Therefore, it is contrary to the PCT Articles. The amendment in question relates specifically to claims 34, 44.

The subject matter of the invention is assessed as being related to a method of manufacture of a vehicle mounted rotary concrete mixing drum comprising the steps of fitting an inner and outer moulds each made up from separate mould parts which are divided along two helical lines thereby to form a drum wall from the complementary mould parts.

TAMBOR MEZCLADOR DE CONCRETO MONTADO EN VEHÍCULO Y MÉTODO DE
FABRICACIÓN DEL MISMO

5 ANTECEDENTES

La presente invención se relaciona con aparatos mezcladores de concreto y más particularmente se relaciona con un tambor de plástico montado en vehículo para mezclar concreto y un método de fabricación del mismo.

10 TÉCNICA ANTERIOR

La industria de la construcción hace uso amplio de camiones mezcladores de concreto para transporte de concreto mezclado listos a sitios para vertederos de concreto. Estos camiones típicamente comprenden un conjunto mezclador grande que incluye un tambor mezclador montado al vehículo y que
15 está conectado a una impulsión de mezclador para mezclar los contenidos de concreto durante el transporte y para descarga de los contenidos en el sitio. El sistema de impulsión comprende un a caja de engranajes que toma energía del motor del vehículo y que aplica un par de torsión mezclador al
20 tambor impartiendo rotación axial al tambor con el par de torsión siendo ajustable dependiendo de los requerimientos de operación. La disposición general anterior se describe en la patente de Estados Unidos 4,585,356 que describe un camión mezclador de concreto que tiene un tambor mezclador adaptado
25 para hacerse girar por el motor de tracción del vehículo a través de una transmisión auxiliar de la transmisión del

motor de tracción.

De conformidad con los conjuntos conocidos
5 mezcladores montados en vehículo, el tambor mezclador es
típicamente de construcción de acero de servicio pesado y
está dispuesto a aproximadamente 10 a 15 grados de la
horizontal. El tambor está equipado con paletas internas o
paletas mezcladoras que definen una espiral arquimedia de
10 manera que a medida que el tambor gira en una primera
dirección, el concreto retenido en el mismo se mezcla y a
medida que el tambor gira en la dirección opuesta, el
concreto se descarga del tambor a través de un orificio de
descarga elevado bajo la acción de reversa de las paletas
15 espirales internas. El tambor está dispuesto de manera que
el extremo de impulsión sea el más bajo y el extremo de
descarga sea más alto con relación al plano generalmente
horizontal del vehículo.

Mientras que los tambores de acero han estado en
20 uso durante muchos años, adolecen de un número de desventajas
inherentes relacionadas con su costo de fabricación y
reposición, vida de trabajo, características de desgaste,
peso y volumen.

Los tambores de acero son costosos de fabricar
25 debido a su construcción de trabajo intenso que involucra
laminar hojas de acero hacia porciones cónicas y cilindros
que una vez fabricados luego se sueldan para formar el

tanque terminado. Las espirales arquimedianas formadas de las
hojas planas luego se sueldan hacia posición dentro del
5 tambor. Como el concreto es un material altamente abrasivo,
las superficies internas de los tambores de acero se someten
a una abrasión de desgaste significativa. Esto ocurre
particularmente en las superficies que toman el impacto de
asentamiento, fricción deslizante y carga de esfuerzo
10 cortante que conducen a desgaste eventual del tambor.

Típicamente, un tambor de acero usado cada día
podría durar tres a cinco años, a continuación requiriendo
reposición a costo significativo. La abrasión de las
superficies internas se aumenta cuando hay cambios de
15 inclinación en las paredes de tambor usualmente en donde
están unidos los segmentos del tambor.

Las paletas mezcladoras están soldadas a la
superficie interna del tambor ocasionando rebajos angulados
agudos en los que el concreto se puede reunir y acumular
eventualmente degradando la superficie interna y
20 proporcionando un atrapamiento para acumulación adicional no
deseada de concreto. Por su naturaleza, una superficie de
acero es relativamente tersa y mientras que esto puede ser
deseable para el propósito de prevenir la acumulación de
concreto sobre las paredes del tambor, la interfaz entre el
25 concreto y la pared de acero es una área de abrasión más bien
que de mezclado de concreto.

Idealmente, el mezclado de concreto debe ocurrir a través de la mezcla completa, pero en los tambores de acero, el mezclado óptimo no ocurre en la capa de límite y en huecos en los que el concreto se puede recoger. De hecho, debido a la naturaleza de la interfaz de fricción entre la superficie de acero y la capa de límite de concreto, el flujo laminar ocurre resultando en poco o ningún mezclado en la capa de límite. La razón de esto es que el agregado en el concreto se desliza y somete a abrasión (con mezclado reducido o sin mezclado) en lugar de giros para facilitar el mezclado. De esta manera, existen puntos "muertos" en la mezcla en donde no ocurre mezclado y en donde hay un potencial aumentado de recolección no deseada de concreto. Además de los problemas anteriores asociados con el uso de tambores mezcladores de acero, se encuentran factores de costo y peso que se añaden a las ineficiencias inherentes en uso de tambores de acero. Debido al peso muerto del tambor de acero, su volumen se debe restringir de manera que la combinación del peso muerto y el peso de concreto se debe mantener dentro de los límites de carga máximos permisibles para el vehículo al que está fijado el tambor.

Una alternativa a los tambores de acero conocidos se propuso en la solicitud de patente Internacional de PCT, PCT/AU00/01226 a Rodgers y Khouri. Esa solicitud enseña la posibilidad de utilizar un material de peso ligero tal como

plástico para construcción de un tambor mezclador de concreto como un sustituto por el acero mientras que se reconoce que
5 había numerosas dificultades estructurales y de fabricación a superior al hacer la transición a plástico no siendo la menor de las cuales la producción de un tambor que pudiera soportar las cargas elevadas estática y dinámica a las que se someten los tambores mezcladores montados en camión en operación
10 normal. Si el peso del tambor se pudiera reducir sin comprometer y posiblemente aumentar el volumen de tambor, la reducción de peso podría ser tomada con concreto adicional, aumentando de esta manera la carga útil.

Existe una variedad de disposiciones de tambor
15 mezclador de concreto descritas en el ramo anterior, ninguna de las cuales, en tanto conoce el inventor, anticipa el método de fabricación de un tambor de plástico que se describirá en la presente.

La patente de Estados Unidos 4,491,415 describe un
20 dispositivo mezclador giratorio de peso ligero, en forma de pera, abierto en un extremo y que tiene un casquillo axialmente alargado en el extremo grande. El tambor está sustentado giratoriamente sobre una base unitaria que tiene un extremo delantero transversalmente extendido y un extremo
25 posterior que se extiende hacia arriba y angularmente proporcionando una porción de apoyo separablemente acoplable con el casquillo para sustentar giratoriamente el tambor a

una inclinación de aproximadamente 35 grados. El tambor tiene una pluralidad de aletas radiales que se extienden axialmente para levantar el contenido en rotación del mismo y de preferencia está formado de material de plástico moldeado ya sea como un cuerpo unitario o como una pluralidad de partes que se interajustan. El tambor descrito en esta patente es para operación de servicio ligero y no tiene las características estructurales y materiales necesarias para operaciones de mezclado de concreto de servicio pesado.

La patente de Estados Unidos 5,118,198 describe un aparato mezclador de cemento con un conjunto de soporte de caballete y que incluye un tambor mezclador de cemento de polietileno retenido y soportado por un conjunto de brazo de caballete formado de tirantes de soporte de base de caballete y brazos de caballete verticales que se interajustan hacia rebajos de brazo de caballete que están previamente formados con el tambor de polietileno. Un engranaje de giro impulsa el tambor de polietileno. El tambor descrito en esta patente se pretende para operaciones de cemento de servicio ligero y no se dirige a los requerimientos estructurales y de fabricación para operaciones de servicio pesado. La patente de Estados Unidos 5,492,401 describe una mezcladora de concreto con un tambor mezclador que consiste de material de polietileno reticulado de alta densidad. El tambor incluye un fondo soportado por una bandeja de metal rígido

convencional asegurada a la superficie externa del mismo para dar rigidez al tambor de plástico y prolongar la esperanza de vida del tambor de plástico permitiendo que la mezcladora de concreto se utiliza para completar un trabajo de mezclado en un sitio de trabajo aún cuando el movimiento de la mezcla de concreto dentro del tambor durante ciclos de mezclado repetitivos pueda desgastar finalmente un agujero a través del fondo del tambor de plástico. Conjuntos de paleta se colocan interiormente del tambor y se orientan para mantener salpicadura mínima durante la operación de mezclado. No solamente el tambor descrito en esta patente es inapropiado para operación montada en vehículo de servicio pesado, la patente de hecho enseña un medio para acomodar una falla de desgaste en el sitio mediante lo cual un agujero se podría desgastar a través de la pared del tambor.

La técnica anterior enseña el uso de tambores de plástico para operaciones pequeñas de mezclado de cemento. Sin embargo, hay dificultades inherentes en la fabricación de tambores de plástico a una norma aceptable de resistencia y confiabilidad. Los tambores de plástico requieren el uso de materiales que para un perfil de tambor mediante uso de un molde. Ya que la abertura de descarga de un tambor es más angosta que el resto del tambor, no se posible remover un molde de una superficie interna a menos que el tambor esté hecho en secciones que se pueden unir para formar la

estructura de tambor. Un número de métodos de fabricación de tambores mezcladores de plástico de servicio pesado se ha
5 propuesto en la solicitud de PCT, PCT/AU00/01226 que describe un tambor mezclador de concreto giratorio de servicio pesado para fijación a un vehículo que se caracteriza en que el tambor se fabrica de cuando menos un molde y de por lo menos un material de plástico, y en donde el tambor incluye una
10 superficie interna que tiene una propiedad que promueve el mezclado del concreto en la capa de límite entre el concreto y la superficie interna y reduce el desgaste.

Un número de métodos diferentes se propusieron en esa solicitud para la fabricación de un tambor del tipo
15 descrito.

INVENCION

La presente invención busca proporcionar un método alternativo de construcción de un tambor mezclador de cemento o concreto giratorio, montado en vehículo de servicio pesado,
20 fabricado de materiales de plástico. El tambor producido mediante el método de la invención descrita en la presente supera las desventajas antes mencionadas del ramo anterior y mantiene características mezcladoras de concreto eficientes. De conformidad con la invención se proporciona un método de
25 construcción de un tambor mezclador de concreto de plástico en donde el método incluye el uso de moldes internos y externos cada uno hecho de partes de molde separadas que

están divididas en dos líneas helicoidales a la mitad entre las paletas mezcladoras, permitiendo de esta manera la formación de un interior de tambor a partir de dos moldes idénticos.

En una forma amplia, la presente invención comprende:

un método para fabricación de un tambor mezclador de concreto giratorio montado en vehículo del tipo que tiene una abertura en un extremo para recibir y/o descargar el concreto del mismo y en el otro extremo, medios para acoplar un conjunto de impulsión de manera de hacer girar el tambor para mezclado o descarga del concreto; en donde, el tambor se fabrica de cuando menos un molde que utiliza por lo menos un material de plástico; en donde el tambor incluye además paletas integralmente fijadas que sobresalen de la superficie interna del tambor formando una espiral arquimedia dispuesta de manera que cuando se hace girar el tambor en una primera dirección, el contenido de concreto se mezcla y cuando el tambor se hace girar en una segunda dirección, los contenidos se descargan del tambor; en donde el método comprende los pasos de:

(a) preparar una parte de molde interna generalmente helicoidal que contiene una superficie que se extiende entre primero y segundo bordes helicoidales;

(b) montar la primera parte de molde helicoidal en

un soporte;

5 (c) encerar el conjunto de molde helicoidal interno dentro de un molde externo formado por cuando menos una parte de molde externa;

 (d) ajustar una segunda parte de molde helicoidal interna coincidente a la primera parte de molde interno para formar un conjunto de molde interno;

10 (e) inyectar un elastómero de poliuretano hacia una cavidad definida por el conjunto de molde interno y el conjunto de molde externo para formar un elemento de pared interna que comprende una mitad de una pared interior de la mezcladora y una paleta helicoidal;

15 (f) permitir que el poliuretano se cure;

 (g) remover las cuando menos partes de molde externas para exponer el elemento de pared interna;

 (h) remover el elemento de pared interna de los moldes internos.

20 El método de preferencia comprende el paso adicional de colocar un miembro de refuerzo en un rebajo formado en la parte de molde interno. Los pasos (a) - (h) se repiten proporcionando de esta manera un segundo elemento de pared interna helicoidal. El primero y segundo elementos de
25 pared interna helicoidal son complementarios y se combinan para formar una superficie de pared interna del tambor mezclador. El primero y segundo elementos de pared interna

helicoidal luego de preferencia se colocan hacia una
plantilla en donde bordes opuestos de los elementos se
5 mantienen adyacentes; los elementos de pared definiendo una
cavidad interna del tambor. Los bordes opuestos de los
elementos se sellan para completar la pared interna del
tambor. La pared interna se separa de la plantilla y se
coloca la pared interna en un mandril de manera que el
10 mandril esté dispuesto en la cavidad interna. La pared
interna se coloca en el mandril a través de un extremo
abierto de la pared interna después de lo cual las capas
estructurales de plástico reforzado con fibra de vidrio se
aplican a la capa interna de poliuretano. De preferencia, la
15 superficie interna del tambor incluye un elastómero que
permitirá el mezclado de los contenidos del concreto en una
capa de límite de concreto;

El miembro de refuerzo es de preferencia una cuerda
continua insertada en un rebajo en una formación que formará
20 paletas helicoidales.

El método incluye el uso de moldes interno y
externo cada uno hecho de partes de molde separadas que están
divididas a lo largo de dos líneas helicoidales, permitiendo
de esta manera la formación de una pared interior de tambor
25 de dos partes de molde complementarias.

En otra forma amplia, la presente invención
comprende:

un método para fabricación de un tambor mezclador de concreto giratorio montado en vehículo del tipo que tiene una abertura en un extremo para recibir y descargar el concreto del mismo y en el otro extremo medios para acoplar un conjunto de impulsión de manera de hacer girar el tambor para mezclado o descarga de concreto; en donde, el tambor se fabrica de cuando menos un molde interno y por lo menos un molde externo opuesto; en donde el tambor incluye paletas integralmente fijadas que sobresalen de la superficie interna del tambor formando una espiral de Arquímedes dispuesta de manera que cuando el tambor se hace girar en una primera dirección, los contenidos de concreto se mezclan y cuando el tambor se hace girar en una segunda dirección, los contenidos se descargan del tambor; y en donde la superficie interna del tambor se forma o recubre con un elastómero que ocasiona el mezclado de los contenidos del concreto en la capa de límite de concreto; en donde el método comprende los pasos de:

- (a) preparar un primer molde helicoidal interno que contiene una superficie intermedia a los bordes laterales del molde;
- (b) colocar una varilla de refuerzo en un rebajo en el molde interno;
- (c) encerrar el conjunto de molde helicoidal interno dentro de cuando menos una parte de molde externo;

(d) sellar una junta entre la parte de molde interno y la cuando menos una parte de molde externa;

5 (e) inyectar un elastómero de poliuretano hacia una cavidad definida por el molde interno en la cuando menos una parte de molde externa para formar un elemento de pared helicoidal interno que comprende la mitad de un interior de la mezcladora y una paleta helicoidal;

10 (g) permitir que el poliuretano se cure,

(h) remover la cuando menos una parte de molde externo;

(i) remover uno de los moldes internos;

(j) remover el molde de elemento de pared
15 helicoidal interno de poliuretano interior del resto del conjunto de molde interno,

(k) repetir los pasos (a) - (j) para formar un segundo elemento de pared interna.

De preferencia, cuando un primer y un segundo
20 elemento de pared interna se colocan en una plantilla las superficies de junta se mantienen adyacentes para permitir el sellado de la junta formada por las superficies de unión.

De conformidad con una modalidad preferida, un mandril se inserta hacia un extremo de descarga abierto de un
25 interior de tambor después de lo cual las capas estructurales de plástico reforzado con fibra de vidrio se enrollan alrededor de una superficie externa de la pared interna.

En otra forma amplia, la presente invención comprende:

5 un método de construcción de un tambor mezclador de plástico que comprende los pasos de:

(a) preparar un primer molde interno que contiene una superficie que se extiende desde una línea de junta a la mitad entre dos paletas helicoidales a una línea de junta de molde de línea media en un borde interno de las paletas;

10 (b) colocar una varilla de refuerzo en un rebajo en el molde interno;

(c) ajustar un segundo molde helicoidal interno coincidente para formar un conjunto de molde interno;

15 (d) encerrar el conjunto de molde helicoidal interno dentro de cuando menos una parte de molde externo;

(e) sellar una junta entre el conjunto de molde interno y la cuando menos una parte de molde externo;

20 inyectar un elastómero de poliuretano hacia una cavidad definida por el conjunto de molde interno y la cuando menos una parte de molde externa para formar una mitad del interior del mezclador y una de las paletas helicoidales;

(f) permitir que el poliuretano se cure;

25 (g) remover la cuando menos una parte de molde externo,

(h) remover uno de los moldes internos;

(i) remover el moldeado de poliuretano interior

del resto del conjunto de molde interno;

(j) colocar las dos molduras de cuchilla
5 helicoidal e interior en una plantilla en donde las
superficies de junta se retienen adyacentes;

(k) insertar un mandril hacia un extremo de
descarga abierta del tambor;

(l) aplicar capas estructurales de la capa de
10 poliuretano de plástico reforzado con fibra de vidrio.

De preferencia, el refuerzo se ajusta utilizando
espaciadores que centralizan la varilla de refuerzo o cuerda
en su rebajo. De preferencia, el primero y segundo elementos
de molde helicoidal internos se juntan con un compuesto de
15 sello o empaques a lo largo de un borde interno. De
conformidad con una modalidad, el molde externo se forma en
tres partes de molde separadas.

De preferencia, una junta entre los dos elementos
helicoidales internos que forman una paleta helicoidal se
20 hace con un compuesto de elastómero de poliuretano.

En otra forma amplia, la presente invención
comprende:

un método de fabricación de un tambor mezclador de
concreto montado en vehículo que comprende los pasos de:

(a) tomar una parte de molde interno helicoidal y
25 montar el molde en un soporte,

(b) colocar cuando menos un molde externo en

relación opuesta al molde interno;

5 (c) inyectar un material fluido hacia un espacio formado entre el molde interno y el molde externo de manera que el material fluido forme un elemento helicoidal que formará cuando menos parte de una superficie interna del tambor;

(d) remover el cuando menos un molde externo,

10 (e) remover el elemento helicoidal del molde interno;

(f) repetir los pasos (a) - (e) de manera de formar un segundo elemento helicoidal;

15 (g) preparar una superficie exterior de los elementos helicoidales para ligarse a una capa estructural de fibra de vidrio.

De preferencia, el material fluido es poliuretano.

En otra forma amplia de un aspecto de aparato, la presente invención comprende

20 un tambor mezclador de concreto giratorio montado en vehículo del tipo que tiene una abertura en un extremo para recibir y/o descargar concreto del mismo y en el otro extremo, medios para acoplar un conjunto de impulsión de manera de hacer girar el tambor para mezclado o descarga de
25 concreto; en donde, el tambor se fabrica de cuando menos un molde que utiliza por lo menos un material plástico; en donde el tambor incluye además paletas integralmente fijadas

que sobresalen de la superficie interna del tambor formando una espiral de Arquímedes dispuesta de manera que cuando el tambor se hace girar en una primera dirección, los contenidos de concreto se mezclan y cuando el tambor se hace girar en una segunda dirección, los contenidos se descargan del tambor; en donde el tambor se forma mediante un método que comprende los pasos de:

10 (a) preparar una primera parte de molde interno generalmente helicoidal que contiene una superficie que se extiende entre primero y segundo bordes helicoidales;

 (b) montar la primera parte de molde interno helicoidal sobre un soporte

15 (c) encerrar el conjunto de molde helicoidal interno dentro de un molde externo formado por cuando menos una parte de molde externo;

 (d) ajustar una segunda parte de molde helicoidal interno coincidente a la primera parte de molde interno para
20 formar un conjunto de molde interno;

 (e) inyectar un elastómero de poliuretano hacia una cavidad definida por el conjunto de molde interno y el conjunto de molde externo para formar un elemento de pared interno que comprende una mitad de una pared interior de la mezcladora y una paleta helicoidal;
25

 (f) permitir que el poliuretano se cure;

 (g) remover la cuando menos una parte de molde

J.D.

externo para exponer el elemento de pared interna;

5 (h) remover el elemento de pared interno de uno de los moldes internos.

En otra forma amplia del aspecto de aparato, la presente invención comprende:

10 un tambor mezclador de concreto montado en vehículo formado mediante un método de fabricación que comprende los pasos de:

 (a) tomar una parte de molde interno helicoidal y montar el molde en un soporte,

 (b) colocar cuando menos un molde externo en relación opuesta al molde interno;

15 (c) inyectar un material fluido hacia un espacio formado entre el molde interno y el molde externo de manera que el material fluido forme un elemento helicoidal que formará cuando menos parte de una superficie interna del tambor;

20 (d) remover el cuando menos un molde externo;

 (e) remover el elemento helicoidal del molde interno;

 (f) repetir los pasos (a) - (e) de manera de formar un segundo elemento helicoidal;

25 (g) preparar una superficie exterior de los elementos helicoidales para ligarse a una capa estructural de fibra de vidrio.

De preferencia, el material fluido es poliuretano.

De conformidad con una modalidad, las paletas
5 helicoidales que se proyectan desde una superficie interna
del tambor tienen una dimensión de paso de entre 1 - 2 metros
y se forman mediante material elastomérico. De preferencia
la resistencia de pared del tambor es alrededor de 600 MPa a
un espesor de pared de 8 mm. De preferencia el poliuretano
10 forma una capa interna que es de aproximadamente 3 mm de
grueso.

De preferencia, la capa estructural comprende
arrollamientos de filamento que forman una capa de
aproximadamente 5 mm de espesor.

15 En otra forma amplia, la presente invención
comprende:

un tambor mezclador de concreto giratorio de
servicio pesado capaz de fijación a un vehículo; el tambor
comprendiendo un primer extremo que acopla un conjunto de
20 impulsión que hace girar el tambor para mezclado del concreto
y un segundo extremo desde el que el concreto mezclado se
descarga; en donde el tambor se fabrica de cuando menos una
capa de material plástico, en donde el tambor incluye una
pared que tiene formaciones internas integrales que promueven
25 el mezclado del concreto y una superficie interna que
promueve el mezclado del concreto en la capa de límite entre
el concreto y la superficie interna; en donde el tambor se

forma de conformidad con los pasos de método de:

- 5 (a) tomar un molde interno helicoidal y montar el
molde sobre un soporte;
- (b) colocar cuando menos un molde externo en
relación opuesta al molde interno;
- (c) inyectar poliuretano hacia un espacio formado
entre el molde interno y el molde externo,
- 10 (d) remover el cuando menos un molde externo;
- (e) remover una parte de cuchilla helicoidal del
molde interno,
- (f) repetir los pasos (a) - (e) de manera de
formar una segunda parte de cuchilla helicoidal;
- 15 (g) hacer coincidir la primera y segunda partes de
cuchilla helicoidal con una coraza interior;
- (g) preparar un exterior del tambor para ligarse a
una capa estructural de fibra de vidrio;
- (h) arrollar la capa estructural alrededor del
- 20 exterior.

DESCRIPCIÓN DETALLADA

La presente invención se describirá ahora de conformidad con una modalidad preferida pero no limitativa y con referencia a las ilustraciones que se acompañan, en

25 donde:

La Figura 1 muestra una elevación lateral de una parte de molde helicoidal interna;

La Figura 2 muestra una elevación lateral de la parte de molde de la figura 1 que incluye moldes externos detallados;

La Figura 3 muestra una vista lateral de la parte de molde interno de las figuras 1 y 2 totalmente encerrada por secciones de molde externas;

La Figura 3a muestra una vista amplificada de moldes externos detallados desde una parte de cuchilla helicoidal;

La Figura 3b muestra una vista amplificada del conjunto de la figura 3a con las partes de molde externas ensambladas.

La Figura 4 muestra secciones de molde externas detalladas desde el conjunto de molde interno a la terminación de la inyección de un elastómero.

La Figura 5 muestra una parte de cuchilla helicoidal producida por y separada del conjunto de molde interno de la figura 4;

La Figura 6 muestra un acoplamiento de partes de cuchilla helicoidal separadas y complementarias formadas por las disposiciones de las figuras 1-5 y que forman una pared interna del tambor;

La Figura 7 muestra un alojamiento para ensamblado en el que la pared interna del tambor se coloca después del moldeo de partes de cuchilla helicoidal para preparación de

las partes de cuchilla para recibir una capa estructural externa.

5 La Figura 8 muestra un conjunto que incluye un mandril para montar la parte interna para aplicar una capa estructural externa de fibra de vidrio;

La Figura 9 muestra un tambor completado con anillo de rodamiento ajustado.

10 Los puntos de desgaste concentrado en los tambores de acero del ramo anterior reducen la vida de trabajo de los tambores necesitando reparación o reposición costosa. Los tambores de acero se fabrican de láminas planas laminadas que forman conos y un cilindro que luego se unen juntos mediante
15 soldadura. Las espirales de Arquímedes luego se sueldan a la superficie interna del tambor resultado en un recipiente de elevada gravedad específica cuyo propio peso reduce la cantidad de concreto que puede ser llevada por el vehículo al que está fijado. Los tambores de acero adolecen de un número
20 de desventajas incluyendo susceptibilidad a la abrasión en las juntas de las secciones cilíndrica y cónica y la tendencia de acumulación de concreto no deseada en las esquinas agudas y hendiduras formadas por las cuchillas mezcladoras. Además, la superficie interna uniforme del
25 tambor de acero promueve la abrasión de deslizamiento e inhibe el mezclado en la capa de límite debido al bajo coeficiente de fricción en la interfaz de concreto/metal.

El método que se describirá ahora es una alternativa a ambos, tambores de acero y los tambores de plástico formados por los métodos de fabricación descritos en la solicitud de Patente Internacional No. PCT/AU00/01226 a Rodgers y Khouri. De conformidad con el método, se forma un tambor mezclador de concreto de plástico de servicio pesado usando moldes tanto internos como externos. El tambor incluye una espiral de Arquímedes interna formada por cuchillas o paletas helicoidales que mezclan el concreto durante la rotación del tambor en una dirección y descargan concreto cuando el tambor se hace girar en una dirección opuesta. El tambor es generalmente de forma de pera e incluye una abertura en un extremo para entrada y descarga de concreto.

El primer paso en el método de conformidad con una modalidad, involucra el uso de un molde interno. Un interior de tambor de poliuretano completo con cuchillas helicoidales internas se forma entre un juego de molde interior y uno exterior. Los moldes exteriores se separan fácilmente después de que el poliuretano se forma, sin embargo, debido a que la mezcladora es un recipiente cerrado con la abertura de descarga menor que el diámetro máximo, y debido a la complejidad de los moldes de paleta, no es posible formar el interior como una pieza completa y luego separar el molde. Consecuentemente, el interior de tambor elastomérico se

Haciendo referencia a la figura 1, se muestra un conjunto 10 que comprende un soporte 12 que recibe y retiene sobre el mismo un conjunto 14 de molde interno helicoidal. El conjunto 14 de molde se muestra en perfil mediante la línea moldea en secciones que se pueden separar de los moldes, y luego unirse para formar el interior completo. Este interior luego se refuerza con capas estructurales para completar la mezcladora. La unión junta de las dos secciones de pared interna complementarias que se forman cada una mediante los mismos pasos de método en secuencia es un nuevo acercamiento a formar un interior de tambor no conocido en el ramo anterior.

Haciendo referencia a la figura 1 se muestra un conjunto 10 que comprende un soporte 12 que recibe y retiene en el mismo un conjunto 14 de molde interno helicoidal. El conjunto 14 de molde se muestra en perfil mediante la línea (4) 14A. El conjunto 14 3 de molde se prepara inicialmente en un molde separado que tiene un interior helicoidal de manera que el molde 3 14 se conforma a la forma de ese interior. Una vez que el conjunto 14 de molde se forma, se puede transferir manualmente o de otra manera para montaje sobre el soporte 12 en preparación para recibir las partes 16, 18 de molde(s) externas (mostradas en la figura 2). La Figura 2 muestra una elevación lateral del conjunto 14 de molde de la figura 1 con partes 16 y 18 de molde externas

108

opuestas detalladas.

5 Como se muestra en la figura 3, las partes 16 y 18 de molde capturan el conjunto 14 de molde pero dejan una cavidad generalmente helicoidal entre las mismas. Una vez que las partes 16 y 18 de molde externo se han asegurado y sellado, se inyecta poliuretano hacia la cavidad 19 antes mencionada. Se observará por las personas expertas en el
10 ramo que más de dos moldes 16, 18 externos se pueden utilizar para llenar los mismos objetivos de encapsular el molde 3 interno. La figura 3 muestra una vista lateral del conjunto 14 de molde 3 interno encerrado por las secciones o partes 16 y 18 de molde externo.

15 La figura 3a muestra una vista amplificada de las partes 14A y 14B de conjunto de molde(s) interno detallada desde el conjunto 14 de molde interno y molde 16 externo que revela una vista en sección de una espiral o elemento 20 helicoidal parcial retraído de la cavidad 19 definida por las partes 14A y 14B de molde(s) internos y molde 16 externo
20 después de la inyección de poliuretano.

La figura 3b muestra una vista en sección amplificada del conjunto de la figura 3a con moldes 14 y 16 ensamblados. Las partes 14A, 14B de molde y el molde 16 se
25 muestran en la figura 3b en relación de tope con la parte moldeada, que se forma mediante inyección de un elastómero de poliuretano hacia una cavidad 19 formada entre los moldes 14,

16 y 18.

Haciendo referencia a la figura 4, se muestran las secciones 16 y 18 de molde externas detalladas desde el conjunto 14 1 de molde interno después de la terminación de inyección de un elastómero. Durante la remoción de las secciones o partes 14A, 14B de molde interno, el helicoidal (o elemento (8) 2 que se ha formado del material elastomérico inyectado hacia la cavidad definida por las partes 16, 18 de molde(s) externos ensamblados y el molde 14 como se muestra en la figura 3 se pueden liberar. La Figura 5 muestra un primer elemento 20 helicoidal formado en una primera espiral helicoidal (de Arquímedes). El proceso arriba descrito se repite nuevamente para formar un segundo elemento 24 helicoidal (de Arquímedes). El elemento 22 helicoidal forma la mitad de una coraza terminada que tiene cuchillas 28 que están integralmente dispuestas en una superficie 32 interna del tambor 72 formado por los procesos descritos en la presente. Una repetición de los pasos descritos con referencia a las figuras 1-5 resulta en un segundo elemento (9) 24 interno helicoidal que coopera con y es complementario con el elemento (8) 22 helicoidal para formar una pared 26 interna terminada que incluye la cuchilla 28 helicoidal integral. La figura 6 muestra un par de secciones 22 y (9) 24 helicoidales formadas por el conjunto y proceso como se describe con referencia a las figuras 1-5. Las secciones 22

y (9) 24 están en la forma de dos espirales helicoidales paralelas separadas a diferencia de fase axial de 180 grados cada una con una varilla 30 de refuerzo (ver las figuras 3a y 3b) en el borde interior, que puede ser un filamento continuo y cuerda de resina. Ya que estas paletas 28 son integrales con la superficie 32 interior de la mezcladora, es conveniente unir estas dos estructuras a lo largo de dos líneas 34 helicoidales a la mitad entre las paletas 28. De esta manera, se forma el interior como dos moldeos o secciones 22, 24 idénticas que se pueden separar del molde 14 interior y secciones 16, 18 de molde exterior y que también contienen las varillas 30 de refuerzo completas.

Como se muestra en las figuras 3a y 3b, los moldes 16, 18 contienen una capa 38 de plástico reforzado con vidrio que se liga al poliuretano de los elementos 22, 24 que se forman contra el mismo. De esta manera las dos piezas moldeadas o secciones 20, 24 se forman con dos líneas 34 de junta helicoidales a la mitad entre las paletas 28 y una coraza 40 interna rígida lista para recibir las capas 42 estructurales se forma.

De conformidad con una modalidad, un método preferido para fabricar la mezcladora es como sigue.

Como se muestra por las figuras 3a y 3b, el molde 14B helicoidal interno incluye superficies 42, 44 que se extienden desde una línea 46 de junta a la mitad entre dos

paletas (28) helicoidales formadas a una línea 48 de junta de molde de línea media en un borde interno de la cuchilla 24.

5 La superficie 44 está orientada hacia el extremo de impulsión de la mezcladora y contiene un rebajo 50 para la varilla de refuerzo o cuerda 30 de filamento. El siguiente paso es ajustar la varilla 30 de refuerzo con espaciadores de poliuretano (no mostrados), que centralizan la varilla 30 en

10 un rebajo 50 entre el molde 14A, 14B interno.

Se prepara un molde 14A helicoidal coincidente, ajustado y unido con empaques de sello (no mostrados) al molde 14b a lo largo de su borde 48 interno. El molde 52 helicoidal se forma mediante los moldes 14A, 14B y el molde

15 16, las superficies de los cuales están revestidas previamente con una capa 58 de plástico reforzado con fibra de vidrio, para proporcionar una pieza 58 moldeada interior al elastómero de poliuretano. Los sellos 60 se incorporan hacia una junta formada entre el molde 16 y los moldes 14A,

20 14B. Después de esto, el elastómero de poliuretano se moldea hacia la cavidad 62 formada entre los moldes 14, 16. El elastómero se polimeriza para formar la sección 20 que comprende media capa interior del tambor 64 de mezclado. El poliuretano se deja curar después de lo cual los moldes 14A,

25 14B y 16 se separan para exponer una coraza interna y la superficie externa de la sección 20 de poliuretano. El proceso anterior se repite para proporcionar una segunda

1/2

sección 24 helicoidal, que tiene la paleta 28 y pieza moldeada 26 de pared interior.

5 Las dos secciones 22 y (9) 24 helicoidales luego se ensamblan en una plantilla 62 como se muestra en la figura 7, después de lo cual se unen juntas utilizando un compuesto de elastómero de poliuretano. Se aplica una presión de inflado al interior de la mezcladora para asegurar que se conforme al interior de la plantilla 62 de junta. La mitad superior de la plantilla 62 se separa y la superficie externa de las juntas de polietileno se cubre con plástico reforzado con fibra de vidrio. Después de eso, la superficie externa del interior de poliuretano moldeado de la mezcladora se prepara para ligarse a la capa estructural. En esta etapa del procesado, se aplica un anillo de impulsión a la capa de poliuretano que formará la capa interna o pared 26 del tambor mezclador. La plantilla 62 se separa y la capa 26 interna ahora formada del tambor se transfiere a una estación 64 de arrollamiento como se muestra en la figura 8.

20 Un mandril 66 de acero se inserta hacia el extremo 68 abierto (descarga) de la mezcladora de manera que alcance el anillo de impulsión (no mostrado) que es común a tambores de servicio pesado de este tipo. El anillo de impulsión que imparte rotación a la mezcladora se resalta y perfora para ser apropiado a una pestaña de caja de engranaje (no mostrada). El exterior de plástico reforzado con fibra de

13

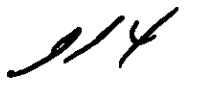
vidrio del interior 26 de poliuretano se liga al anillo de impulsión y se deja curar. El exterior 70 de plástico reforzado con fibra de vidrio se extiende sobre la pestaña de soporte de extremo de descarga que luego forma un recipiente encerrado contra el mandril.

Las capas estructurales de plástico reforzado con fibra de vidrio aplicado por uno de los métodos conocidos convencionales a la industria tales como:

- (a) Moldeo por contacto de fibras de vidrio aleatorias y/o direccionales y resina.
- (b) Arrollamiento de filamento.
- (c) Acabado superficial llenado y rectificando o/ moldeando un acabado de revestimiento de gel utilizando vacío o presión.

El paso de arrollamiento se conduce mediante el dispositivo 64 de arrollamiento después de que la capa interna de tambor se monta sobre el mandril 66 (ver la figura 8). Como se representa por la figura 9, el paso final en la construcción del tambor involucra la instalación del anillo 80 de pista.

Estos son conocidos en tambores de servicio pesado convencionales y comprenden un riel cilíndrico fijado a la mezcladora adyacente al extremo de descarga y que está sustentado por dos rodillos para permitir que la mezcladora se haga girar por la caja de engranajes en el extremo de



impulsión. El anillo se retiene en posición con empaques de caucho (no mostrados) que se sellan a la mezcladora y este espacio entre el anillo y la mezcladora se llena con un poliuretano líquido que se liga a ambos a medida que se gelifica y cura.

En operación este elastómero transmite las cargas de la coraza de mezcladora al anillo de pista de acero y de ahí a los rodillos de soporte de acero. De esta forma, las cargas concentradas se dispersan y solamente esfuerzos bajos se transmiten a través del elastómero a la coraza mezcladora.

De conformidad con una modalidad, una computadora se puede emplear para programar y controlar la entrega del polímero a la superficie de molde y la aplicación de la capa estructural.

El arrollamiento de la capa estructural reforzada con fibra puede involucrar desenrollado controlado por computadora de mechas de fibra humedecidas con resina de alrededor de un formador giratorio. La resistencia a la tensión de los arrollamientos puede ser del orden de 600 MPa. Para obtener las propiedades físicas óptimas de la estructura enrollada de filamento, las fibras se alinean a las cargas impuestas en uso del tambor terminado. Las cargas típicas en el tambor son doblez axial bajo el peso del concreto húmedo, una carga dinámica aplicada en el extremo de impulsión del tambor, par de torsión de impulsión y cargas de soporte en

/ / J

los rodillos de muñón de extremo de descarga. El patrón de arrollamiento de los filamentos 70 alinea las fibras para soportar los esfuerzos de doblez, aumentando en ángulo y en espesor de pared hacia el extremo de descarga para acomodar las cargas de rodillo aplicadas.

Las mechas 70 que recubren el tambor se pueden estirar alternativamente a través del baño de resina y aplicarse a la superficie del tambor como un listón ancho que comprende miles de fibras tensadas. Los arrollamientos 70 se traslapan hasta que se alcanza el espesor requerido. La superficie del tambor se puede cubrir con resina húmeda y las irregularidades pequeñas que necesitan dirigirse para proporcionar el acabado externo. Como resultado de esta construcción, las paletas 28 mezcladoras espirales dentro del tambor son capaces de soportar doblez elevado y resistencia al esfuerzo cortante durante las operaciones de mezclado. La superficie 32 elastomérica interna es altamente resistente a la abrasión por concreto, sin embargo es más suave y más ligera que el equivalente de acero. La resistencia a la abrasión superior se facilita por la deformación elástica natural del elastómero que absorbe la energía cinética de las partículas de concreto sin ensanchado del material de superficie. Además, debido a la propiedad de la superficie interna que de preferencia será poliuretano, el concreto se mezclará en lugar de deslizarse en la capa de límite

116

asegurando el mezclado eficiente del concreto a través de la
mezcla y reducción de abrasión debida a las curvas uniformes
5 a través del interior del tambor.

Adicionalmente, las cuchillas 28 están reforzadas
por el moldeo integralmente con la pared 26 del tambor y
tienen un factor de rigidez que sostendrá todas las cargas de
operación normales aplicadas.

10 Una ventaja adicional en el uso de plástico para
los tambores mezcladores reside en las propiedades térmicas
del material de plástico. Las condiciones calientes son
indeseables para mezclado de concreto ya que aceleran la
hidratación reduciendo la capacidad de trabajo del concreto
15 que es una propiedad esencial requerida inmediatamente
después de un vertido de concreto. En climas muy calientes,
los tambores mezcladores montados en vehículo, de acero,
convencionales, conducen a cargas de calor elevadas que
aumentan el calor en la capa de límite de concreto debido al
20 contacto con la pared de tambor sobre calentada ocasionando
hidratación acelerada no deseada. Este fenómeno es difícil
de evitar con tambores de acero ya que la conductividad del
acero conduce a transferencia de calor conductor elevada
desde la piel externa del tambor a la pared interna que
25 normalmente está en contacto con el concreto. En algunos
climas calientes, se coloca hielo en los tambores de acero en
un esfuerzo para contrarrestar el aumento de temperatura

/ /

dentro del tambor. Ya que la hidratación de concreto es una reacción exotérmica, es sensible a las temperaturas externas. Consecuentemente, es deseable que la temperatura del concreto permanezca aceptablemente baja para asegurar un nivel satisfactorio de capacidad de trabajo y para retardar la hidratación. Los tambores de acero se calientan significativamente y conducen calor a través de su espesor haciendo al concreto vulnerable a los cambios de variación de temperatura. El sobrecalentamiento de la mezcla de concreto es un problema que se debe evitar y tiene, de conformidad con un aspecto provisto por el método de fabricación de un tambor de plástico que ocurrir en los tambores de acero convencionales, reduciendo de esta manera los efectos no deseados de alta conductividad térmica típica de los tambores de acero. El tambor de plástico permite que el concreto permanezca trabajable dentro del tambor durante períodos más prolongados en comparación con el concreto en tambores mezcladores de acero bajo las mismas condiciones externas de temperatura y transporte de concreto.

El método de construcción de un tambor mezclador de concreto de plástico como se describe en la presente proporciona un método alternativo, sin embargo eficiente, de producción de tambores de plástico. Los métodos descritos en la presente permiten la producción en masa con reducción en el número de pasos de producción comparados con los

18

métodos conocidos.

Se reconocerá por las personas expertas en el ramo
5 que se pueden hacer numerosas variaciones y modificaciones a
la invención como se describe ampliamente en la presente sin
abandonar el espíritu y alcance general de la invención.

.
.
10 .
.
.
.
.
.
15 .
.
.
.
.
20 .
.
.
.
.
25 .
.
.

219

REIVINDICACIONES

1.- Un método de fabricación de un tambor
5 mezclador de concreto giratorio montado en vehículo del tipo
que tiene una abertura en un extremo para recibir y/o
descargar concreto del mismo y en el otro extremo, medios
para acoplar un conjunto de impulsión de manera de hacer
girar el tambor para mezcla o descarga de concreto; en
10 donde, el tambor se fabrica de cuando menos un molde
utilizando por lo menos un material plástico; en donde el
tambor incluye además paletas integralmente fijadas que
sobresalen de la superficie interna del tambor formando una
espiral de Arquímedes dispuesta de manera que cuando el
15 tambor se hace girar en una primera dirección, los contenidos
de concreto se mezclan y cuando el tambor se hace girar en
una segunda dirección, los contenidos se descargan del
tambor; en donde el método comprende los pasos de:

(a) preparar una primera parte de molde interna
20 generalmente helicoidal;

(b) montar la primera parte de molde interno
helicoidal sobre un soporte

(c) encerrar el conjunto de molde helicoidal
interno dentro de un molde externo formado por cuando menos
25 una parte de molde externo,

(d) ajustar una segunda parte de molde helicoidal
interna coincidente con la primera parte de molde interno

120

para formar un conjunto de molde interno;

5 (e) inyectar un elastómero de poliuretano hacia una cavidad definida por el conjunto de molde interno y el conjunto de molde externo para formar un elemento de pared interna que comprende la mitad de una pared interior de la mezcladora y una paleta helicoidal;

(f) permitir que el poliuretano se cure;

10 (g) remover la cuando menos una parte de molde externo para exponer el elemento de pared interno,

(h) remover el elemento de pared interno uno de los moldes internos.

2.- Un método de conformidad con la reivindicación 15 1, que comprende el paso adicional de colocar un miembro de refuerzo en un rebajo formado en la parte de molde interno.

3.- Un método de conformidad con la reivindicación 2, en donde los pasos (a) - (h) se repiten, proporcionando de esta manera un segundo elemento de pared interna helicoidal.

20 4.- Un método de conformidad con la reivindicación 3, en donde el primero y segundo elementos de pared interna helicoidal son complementarios y se combinan para formar una superficie de pared interna del tambor mezclador.

5.- Un método de conformidad con la reivindicación 25 4, que comprende el paso adicional de colocar el primero y segundo elementos de pared interna helicoidal hacia una plantilla en donde los bordes opuestos de los elementos se

121

mantienen adyacentes; los elementos de pared definiendo una cavidad interna del tambor.

5 6.- Un método de conformidad con la reivindicación 5, en donde los bordes opuestos se sellan para completar la pared interna del tambor.

 7.- Un método de conformidad con la reivindicación 6, que comprende el paso adicional de remover la pared
10 interna de la plantilla y colocar la pared interna en un mandril de manera que el mandril esté dispuesto en la cavidad interna.

 8.- Un método de conformidad con la reivindicación 7, en donde la pared interna está colocada sobre el mandril a
15 través de un extremo abierto de la pared interna.

 9.- Un método de conformidad con la reivindicación 8, que comprende el paso adicional de aplicar capas estructurales de plástico reforzado con fibra de vidrio a la capa interna de poliuretano.

20 10.- Un método de conformidad con la reivindicación 9, en donde la superficie interna del tambor incluye un elastómero que permite el mezclado de los contenidos del concreto en una capa de límite de concreto.

 11.- Un método de conformidad con la
25 reivindicación 10, en donde el miembro de refuerzo es una cuerda continua insertada en un rebajo en las cuchillas.

 12.- Un método de construcción de un tambor

122

mezclador de concreto de plástico, en donde el método incluye el uso de moldes interno y externo hechos de partes de molde separadas que están divididas a lo largo de dos líneas helicoidales, permitiendo de esta manera la formación de una pared interior de tambor de dos partes de molde complementarias.

13.- Un método de fabricación de un tambor mezclador de concreto giratorio montado en vehículo del tipo que tiene una abertura en un extremo para recibir y descargar concreto de la misma y en el otro extremo medios para acoplar un conjunto de impulsión de manera de hacer girar el tambor para mezclado y descarga de concreto; en donde, el tambor se fabrica de cuando menos un molde interno y por lo menos un molde externo opuesto; en donde el tambor incluye paletas integralmente fijadas que sobresalen de la superficie interna del tambor formando una espiral de Arquímedes dispuesta de modo que cuando el tambor se hace girar en una primera dirección, los contenidos de concreto se mezclan y cuando el tambor se hace girar en una segunda dirección, los contenidos se descargan del tambor; y en donde la superficie interna del tambor se forma o recubre con un elastómero que ocasiona el mezclado de los contenidos del concreto en la capa de límite de concreto; en donde el método comprende los pasos de:

(a) preparar un primer molde helicoidal interno

que contiene una superficie intermedia de los bordes del molde;

5 (b) colocar una varilla de refuerzo en un rebajo en el molde interno,

 (c) encerrar el conjunto de molde helicoidal interno dentro de cuando menos una parte de molde externo;

 (d) sellar una junta entre la parte de molde
10 interno y la cuando menos una parte de molde externo;

 (e) inyectar un elastómero de poliuretano hacia una cavidad definida por el molde interno y la cuando menos una parte de molde externo para formar un elemento de pared helicoidal interno que comprende la mitad de un interior de
15 la mezcladora y una cuchilla helicoidal;

 (g) dejar que el poliuretano se cure;

 (h) remover la cuando menos una parte de molde
 externo,

 (i) separar uno de los moldes internos;

20 (j) remover la parte moldeada de elemento de pared helicoidal interna de poliuretano interior del resto del conjunto de molde interno,

 (k) repetir los pasos (a) - (j) para formar un segundo elemento de pared interna.

25 14.- Un método de conformidad con la reivindicación 13, que comprende los pasos adicionales de:

 (a) colocar un segundo elemento de pared interna

junto con el primer elemento de pared helicoidal interno en una plantilla en donde las superficies de junta se mantienen
5 adyacentes de manera de formar una pared interna;

(b) sellar la junta formada por las superficies de junta.

15.- Un método de construcción de un tambor mezclador de plástico, que comprende los pasos de:

10 (a) insertar un mandril hacia un extremo de descarga abierto de un interior de tambor;

(b) arrollar capas estructurales de plástico reforzado con fibra de vidrio alrededor de una superficie externa de la pared interna.

15 16.- Un método de construcción de un tambor mezclador de plástico, que comprende los pasos de:

(a) preparar un primer molde interno que contiene una superficie que se extiende desde una línea de junta a la mitad entre dos paletas helicoidales a una línea de junta de
20 molde de línea media en un borde interno de las cuchillas;

(b) colocar una varilla de refuerzo en un rebajo en el molde interno,

(c) ajustar un segundo molde helicoidal interno coincidente para formar un conjunto de molde interno;

25 (d) encerrar el conjunto de molde helicoidal interno dentro de cuando menos una parte de molde externo;

(e) sellar una junta entre el conjunto de molde

interno y la cuando menos una parte de molde externo;

inyectar un elastómero de poliuretano hacia una
5 cavidad definida por el conjunto de molde interno y la cuando
menos una parte de molde externo para formar una mitad del
interior del la mezcladora y una de las cuchillas
helicoidales;

(f) dejar que el poliuretano se cure;

10 (g) separar la cuando menos una parte de molde
externo;

(h) remover uno de los moldes internos;

(i) remover la pieza moldeada de poliuretano
interior del resto del conjunto de molde interno;

15 (j) colocar las dos cuchillas helicoidales y
piezas moldeadas interiores en una plantilla en donde las
superficies de junta se mantienen adyacentes;

(k) insertar un mandril hacia un extremo de
descarga abierto del tambor;

20 (l) aplicar capas estructurales de plástico
reforzado con fibra de vidrio de la capa de poliuretano.

17.- Un método de conformidad con cualquiera de
las reivindicaciones anteriores, en donde el refuerzo se
ajusta con espaciadores que centralizan la varilla en su
25 rebajo.

18.- Un método de conformidad con la
reivindicación 17, en donde el primero y segundo elementos

de molde helicoidal internos están unidos con un compuesto de sello o empaques a lo largo de un borde interno.

5 19.- Un método de conformidad con la reivindicación 17, en donde el molde externo se forma en tres partes de molde separadas.

 20.- Un método de fabricación de un tambor mezclador de concreto montado en vehículo, que comprende los
10 pasos de:

 (a) tomar una parte de molde interno helicoidal y montar el molde en un soporte;

 (b) colocar cuando menos un molde externo en relación opuesta al molde interno,

15 (c) inyectar un material fluido hacia un espacio formado entre el molde interno y el molde externo de manera que el material fluido forme un elemento helicoidal que formará cuando menos parte de una superficie interna del tambor;

20 (d) remover el cuando menos un molde externo;

 (e) remover el elemento helicoidal del molde interno,

 (f) repetir los pasos (a) - (e) de manera de formar un segundo elemento helicoidal;

25 (g) preparar una superficie exterior de los elementos helicoidales para ligar la capa estructural de fibra de vidrio.

22.- Un método de conformidad con la reivindicación 21, en donde el material fluido es poliuretano.

23.- Un método de conformidad con la reivindicación 22, en donde, el primero y segundo elementos helicoidales se unen en una plantilla para formar una superficie interna del tambor.

24.- Un método de conformidad con la reivindicación 23, que comprende el paso adicional de preparar una superficie exterior de la mezcladora para ligarse a una capa estructural de fibra de vidrio.

25.- Un método de conformidad con la reivindicación 24, que comprende el paso adicional de arrollar una capa estructural de fibra de vidrio alrededor de la superficie exterior.

26.- Un tambor mezclador de concreto giratorio montado en vehículo del tipo que tiene una abertura en un extremo para recibir y/o descargar concreto del mismo y en el otro extremo, medios para acoplar un conjunto de impulsión de manera de hacer girar el tambor para mezclado y descarga de concreto; en donde, el tambor se fabrica de cuando menos un molde que utiliza por lo menos un material plástico; en donde el tambor incluye además paletas integralmente fijadas que sobresalen de la superficie interna del tambor formando una espiral de Arquímedes dispuesta de manera que cuando el

tambor se hace girar en una primera dirección, los contenidos de concreto se mezclan y cuando el tambor se hace girar en una segunda dirección, los contenidos se descargan del tambor; en donde el tambor se forma mediante un método que comprendè los pasos de:

(a) preparar una primera parte de molde interno generalmente helicoidal que contiene una superficie que se extiende entre primero y segundo bordes helicoidales;

(b) montar la primera parte de molde interno helicoidal sobre un soporte;

(c) encerrar el conjunto de molde helicoidal interno dentro de un molde externo formado por cuando menos una parte de molde externo,

(d) ajustar una segunda parte de molde helicoidal interno coincidente a la primera parte de molde interno para formar un conjunto de molde interno;

(e) inyectar un elastómero de poliuretano hacia una cavidad definida por el conjunto de molde interno y el conjunto de molde externo para formar un elemento de pared interna que comprende la mitad de una pared interior de la mezcladora y una cuchilla helicoidal;

(f) dejar que el poliuretano se cure;

(g) remover la cuando menos una parte de molde externo para exponer el elemento de pared interna;

(h) remover el elemento de pared interna de uno

de los moldes internos.

27.- Un tambor mezclador de concreto montado en
5 vehículo formado mediante un método de fabricación que
comprende los pasos de:

(a) tomar una parte de molde interno helicoidal y
montar el molde sobre un soporte;

(b) colocar el cuando menos un molde externo en
10 relación opuesta al molde interno,

(c) inyectar un material fluido hacia un espacio
formado entre el molde interno y el molde externo de manera
que el material fluido forme un elemento helicoidal que
formará cuando menos parte de una superficie interna del
15 tambor;

(d) remover el cuando menos un molde externo,

(e) remover el elemento helicoidal del molde
interno;

(f) repetir los pasos (a) - (e) de manera de
20 forman un segundo elemento helicoidal;

(g) preparar una superficie exterior de los
elementos helicoidales para ligarse a una capa estructural de
fibra de vidrio.

28.- Un tambor mezclador de concreto de
25 conformidad con la reivindicación 27, en donde el material
fluido es poliuretano.

29.- un tambor mezclador de concreto de

conformidad con la reivindicación 27, en donde las cuchillas helicoidales que se proyectan desde una superficie interna del tambor tienen una dimensión de paso de entre 1-2 metros y se forman mediante material elastomérico.

30.- Un tambor mezclador de conformidad con la reivindicación 28, en donde la resistencia de pared del tambor es alrededor de 600 MPa a un espesor de pared de 8 mm.

31.- Un tambor mezclador de conformidad con la reivindicación 29, en donde el poliuretano forma una capa interna que es de aproximadamente 3 mm de grueso.

32.- Un tambor mezclador de conformidad con la reivindicación 31, en donde la capa estructural comprende arrollamientos de filamento que forman una capa de aproximadamente 5 mm de grueso.

33.- Un método para hacer un tambor mezclador de concreto, el método comprendiendo:

combinar una primera sección helicoidal y una segunda sección helicoidal.

34.- Un método para hacer un tambor mezclador de concreto, el método comprendiendo:

proporcionar un molde que tiene un rebajo configurado para formar una paleta de tambor;

colocar un miembro de refuerzo en el rebajo; e insertar fluido polimérico en el rebajo de manera que fluido fluya alrededor y rodee substancialmente al

miembro de refuerzo.

5 35.- Un tambor mezclador de concreto que comprende:

un primer elemento helicoidal; y

un segundo elemento helicoidal unido al primer elemento helicoidal, en donde el primer elemento helicoidal y el segundo elemento helicoidal forman una capa
10 substancialmente continua que se extiende circunferencialmente alrededor de un eje longitudinal del tambor.

36.- El tambor de conformidad con la reivindicación 35, en donde el primer elemento helicoidal y
15 el segundo elemento helicoidal son poliméricos.

37.- El tambor de conformidad con la reivindicación 35, en donde el primer elemento helicoidal incluye una cuchilla.

38.- El tambor de conformidad con la reivindicación 37, en donde el segundo elemento helicoidal
20 incluye una cuchilla.

39.- El tambor de conformidad con la reivindicación 37, en donde la cuchilla es helicoidal.

40.- El tambor de conformidad con la reivindicación 37, que incluye un miembro de refuerzo dentro
25 de una punta de la cuchilla.

41.- El tambor de conformidad con la

reivindicación 35, que incluye una segunda capa
substancialmente continua que se extiende a través de una
5 junta del primer elemento y el segundo elemento.

42.- El tambor de conformidad con la
reivindicación 31, en donde la segunda capa continua es un
elastómero reforzado con fibra.

43.- El tambor de conformidad con la
10 reivindicación 35, en donde el primer elemento helicoidal y
el segundo elemento helicoidal forman un interior del tambor.

44.- Un elemento que comprende:

una coraza polimérica helicoidal; y

una cuchilla polimérica formada integralmente con y
15 que se extiende desde la coraza.

20
25
.

RESUMEN DE LA INVENCION

Un método de fabricación de un tambor mezclador de
concreto giratorio montado en vehículo del tipo que tiene una
abertura en un extremo para recibir y/o descargar concreto
del mismo y en el otro extremo, medios para acoplar un
conjunto de impulsión de manera de hacer girar el tambor para
mezclado o descarga de concreto. El tambor se fabrica de
cuando menos un molde utilizando por lo menos un material
plástico y que incluye además paletas integralmente fijadas
que sobresalen de la superficie interna del tambor formando
una espiral de Arquímedes dispuesta de manera que cuando el
tambor se hace girar en una primera dirección, los contenidos
de concreto se mezclan y cuando el tambor se hace girar en
una segunda dirección, los contenidos se descargan del
tambor; en donde el método comprende los pasos de:

(a) preparar una primera parte de molde interno
generalmente helicoidal que contiene una superficie que se
extiende desde el primero y segundo bordes helicoidales;

(b) montar la primera parte de molde interno
helicoidal sobre un soporte;

(c) encerrar el conjunto de molde helicoidal
interno dentro de un molde externo formado por cuando menos
una parte de molde externo;

(d) ajustar una segunda parte de molde helicoidal
interno coincidente a la primera parte de molde interno para

formar un conjunto de molde interno;

5 (e) inyectar un elastómero de poliuretano hacia
una cavidad definida por el conjunto de molde interno y el
conjunto de molde externo para formar un elemento de pared
interna que comprende una mitad de una pared interior del
mezclador y una cuchilla helicoidal;

 (f) dejar que el poliuretano se cure,

10 (g) remover la cuando menos una parte de molde
externo para exponer el elemento de pared interna;

 (h) remover el elemento de pared interna de uno de
los moldes internos.



FORMATO DE DIGITALIZACION
RELACION DE ANEXOS



Royni
Technologies S.A.
Bogotá, Colombia

135

Expediente No		No de Follo
Item	No de unidades	
1	CD	
2	DVD	
3	REVISTA	
4	LIBRO	
5	PERIODICO	
6	DISQUETES	
7	SOBRE DE MANILA	
8	SOBRE BLANCO TAMAÑO CARTA	
9	SOBRE BLANCO TAMAÑO OFICIO	
10	OTROS:	
Observaciones: ante final.		

RECIBO OFICIAL DE CAJA : 04 - 95,698
FECHA : DICIEMBRE 13 DE 2004

136
2

SUPERINDUSTRIA Y COMERCIO
Radicación : 04129792 00000000 Folios: 136
Fecha (AMD): 2004-12-29 18:04:00
Trámite : 011 PCT-PATENT 379 PAGE NACI 411 PRESENTAC
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CAVELIER ABOGADOS	CONSIGNACION	BANCO POPULAR	050-00110-6	32758707	13/12/2004	51,017,500.00

***** C O N C E P T O *****

CANT. RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1 50005-01-01 SOLICITUDES	1 TRAMITES DE SOL. DE PATENTE DE IN	422,000.00
	TOTAL :	\$ 422,000.00

SON: CUATROCIENTOS VEINTIDOS MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

Colo 14564-891-001-0

SUPERINDUSTRIA Y COMERCIO
 Radicación : 04129792 00000000
 Fecha (AMB): 2004-12-29 18:04:00
 Folios: 136
 Trámite : 011 PCT-PATENT 379 FASE INCI 411 PRESENTAR
 Dependencia: 2826 DIVISION DE NUEVAS CREACIONES

REQUISITOS NECESARIOS PARA PRESENTACION Y AGILIZACION DEL TRAMITE

	USUARIO	RADICADOR
PATENTE DE INVENCION ☒	()	() ☒
- Indicación de que se solicita la concesión de una patente.	()	() ☒
- Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	() ☒
- Descripción de la invención.	()	() ☒
- Dibujos de ser estos pertinentes.	()	() ☒
- Comprobante de Pago de las tasas establecidas.	()	() ☒

COMPLETA ☒ **INCOMPLETA** () ()

DISEÑO INDUSTRIAL ()

- Indicación de que se solicita el registro de Diseño Industrial	()	()
- Datos de identificación del solicitante o de la persona que presenta la solicitud.	()	()
- Representación gráfica o fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	()	()
- Comprobante de pago de las tasas establecidas	()	()

COMPLETA () **INCOMPLETA** () ()

ESQUEMA DE TRAZADO ()

- Indicación de que solicita el registro de un Esquema de trazado.	()	()
- Datos de identificación del solicitante o de la persona que presenta La solicitud.	()	()
- Representación gráfica del esquema de trazado	()	()
- Comprobante de pago de las tasas establecidas.	()	()

COMPLETA () **INCOMPLETA** () ()

Firma Responsable:

Fecha:

742
138



Industria y Comercio
SUPERINTENDENCIA

2020
Bogotá, D.C.,

Doctor:
EMILIO FERRERO
Apoderado
ANTHONY KHOURI

Oficio N° 12152

ASUNTO:	Radicación N°	04-129792
	Solicitud internacional	PCT/AU03/00684
	Fecha inicio fase nacional	31/12/2004
	Trámite	011
	Evento	379
	Actuación	430
	Folios	001

Como resultado del examen de forma, realizado con fundamento en el artículo 38 de la Decisión 486 de la Comisión de la Comunidad Andina, artículo 27 del Tratado de Cooperación en Materia de Patentes (PCT), regla 51 bis del Reglamento y Circular Única de la Superintendencia de Industria y Comercio, se le comunica que:

- La solicitud nacional no contiene la traducción de la solicitud internacional tal como fue presentada. (Numeral 5.2.5, capítulo quinto del título décimo de la Circular Única de la SIC).
- La solicitud no contiene la copia del documento en que consta la cesión del derecho a la patente del inventor al solicitante o a su causante. (Art. 26-k) Decisión 486).
- La solicitud no contiene el poder debidamente otorgado, con el lleno de los requisitos exigidos por los artículos 63 y subsiguientes del Código de Procedimiento Civil. Adicionalmente, deberá presentar el documento que acredita la existencia y representación legal de la sociedad solicitante, cuando ésta fuere persona jurídica.
- Deberá presentar de igual forma la correspondiente traducción de los dibujos.

En cumplimiento de lo dispuesto por el artículo 39 de la Decisión 486, se le requiere para que dentro del término de dos meses siguientes a la fecha de notificación del presente oficio, complete los requisitos anteriormente enunciados. En caso de no dar cumplimiento al presente requerimiento, la solicitud se considerará abandonada y perderá su prelación.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única N° 10 de 2001.

ALIX CARMENZA GESPEDES DE VERGEL
Jefe de la División de Nuevas Creaciones.

El anterior requerimiento fue notificado por fijación en lista de fecha, 18 FEB. 2005

202030

Carrera 13 No. 27-00 Piso 5 y 10
Commutador: 334 12 21-2-3-4
Fax 281 31 25 e-mail: info@sic.gov.co
Santa Fe de Bogotá D.C. - Colombia

18-2-05