TYRE PLACEMENT AND FILLING APPARATUS AND METHOD

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ABSTRACT

A tyre placement and filling apparatus (10) includes a receptacle for loose material (11). Movable legs (41) are adapted so that they couple to opposing sidewalls of a tyre. There is a movable leg assembly (12) which moves the legs to expand a tyre engaged therewith, and a forcing unit (13) is operable to cause the loose material from the materials hopper (11) to be transferred to, and be compacted within the tyre.
TYRE PLACEMENT AND PILLING APPARATUS AND METHOD

BACKGROUND TO THE INVENTION

[0001] This invention relates to a tyre placement and filling apparatus and method. Rubber vehicle tyres, once used, are very difficult to dispose of, and thus, are of limited use to the general public. Used tyres therefore, tend to lay around properties in piles, are a potential fire hazard, and generally create an environmental waste problem.

[0002] Used tyres that are in a reasonable condition may be retreaded and reused. However, tyres may only be retreaded if the tyre casing is in good condition.

[0003] There are people who remanufacture these tyres into tangible products, however, the number of tyres used is minimal compared to the total number of waste used tyres.

[0004] As there is a ready supply of used vehicle tyres, these can be obtained relatively cheaply. Thus, it is known to use the tyres in, for example, soil stabilisation, retaining walls, and residential buildings.

[0005] Typically retaining walls are constructed from materials such as concrete, concrete blocks of various shapes, and timber. These building materials are expensive, and in a lot of cases, once in place, are covered in foliage.

[0006] Residential buildings are built of many different types and kinds of materials. These materials too, are expensive, and timber used for the framing of houses is becoming more and more expensive. In countries where building materials are in limited supply, used tyres could be a viable alternative.

[0007] Used tyres can be used as building blocks in a similar manner to that of typical building block materials. Once a course of tyres has been laid, to provide stability to the structure, the tyres are typically filled with compacted local materials such as earth, gravel, or similar granular fill. The tyre sidewalls are expanded so that a person may place a small quantity of fill material into the tyre. Each quantity of fill material is then compacted in the tyre by an object such as, for example, a heavy hammer. This process continues until the tyre has been filled with hard, compacted fill material. Each adjacent tyre, and the courses above are filled and compacted in this manner, until the structure has been completed. Metal reinforcing materials can be used in the structure to provide stability to the structure.

[0008] The tyres, for example in a retaining wall construction, are typically laid on top of each other, and the filled weight of subsequent tyres effectively holds the structure together.

[0009] To build structures in this manner is very time consuming and labour intensive. However, once built, the structure is stable and solid due to its relatively large size.

[0010] Traditional methods of building structures from used vehicle tyres have a number of disadvantages. One disadvantage is that the process of filling the tyre with earth, and compacting the earth by hand is very time consuming and labour intensive.

[0011] Another disadvantage is that where large structures, for example, a residential dwelling or sizable retaining wall is to be built, this can potentially take a very long time.

[0012] A further disadvantage is where subsequent tyre courses are laid in a structure, the top course of tyres are generally offset half a tyre width from the lower course. This creates a gap between the upper and lower tyre whereby fill material may escape, and the tyre may be difficult to fill, and/ or the tyre may be inadequately filled, thereby compromising the Integrity of the structure.

[0013] Another disadvantage is that where subsequent courses of tyres are not coupled together, the structure, or a part of the structure may shift due to environmental factors such as earthquake or flooding.

SUMMARY OF THE INVENTION

[0014] It is therefore an object of the present invention to provide a tyre placement and filling apparatus that enables a person to utilise used vehicle tyres for building purposes, which overcomes one or more disadvantages of known construction methods with used vehicle tyres, or provides the public with a useful choice.

[0015] According to a further object of the invention there is provided a method of using used vehicle tyres for building purposes, whereby the courses of tyre are mechanically coupled together, which overcome one or more disadvantages of known construction methods, or provides the public with a useful choice.

[0016] Broadly according to one aspect of the invention there is provided a tyre placement and filling apparatus which includes a receptacle for loose material, movable legs adapted to couple to opposing sidewalls of the tyre, means to move the legs to expand a tyre engaged therewith, and a forcing unit operable to cause loose material deposited in the tyre to compact within the tyre.

[0017] Preferably, the tyre placement apparatus is adapted to be coupled to an hydraulic digger.

[0018] Preferably, the forcing unit is a movable vibrating unit in the form of a ram, which includes an hydraulic motor, which provides the motive power for a vibrating unit, encased within an upper portion of the ram.

[0019] In a further broad aspect of the invention there is provided a method of building a structure using used vehicle tyres including the steps of forming a first course of tyres, filling the tyres with material, compacting the material compacted, applying connector at the intersection between at least two tyres of the first course, placing a second course of tyres on top of the first course, filling the tyres of the second course with material and compacting material in the tyres of the second course Preferably the connector is a plate manufactured from a galvanised metal type material.

[0020] Preferably engagement means of the connector plate engage with adjacent tyres of the first and second courses

[0021] Preferably, the connector is a solid metal rod bent generally in the shape of a C.

[0022] Preferably the engagement means of the connector engage with the bead of adjacent tyres in a course.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In the following more detailed description of the invention according to preferred embodiments, reference will be made to the accompanying drawings in which:
FIG. 1 is a perspective view of the tyre placement and filling apparatus incorporating the invention,

FIG. 2 is a cross section of the tyre placement and filling apparatus of FIG. 1,

FIG. 3 is a perspective view of the legs and feet of the apparatus of FIG. 1,

FIG. 4A is a perspective view of a connector plate,

FIG. 4B is a perspective view of a section of a construction of used vehicle tyres incorporating the connector of the FIG. 4A,

FIG. 5A is a perspective view of a connector of an alternative embodiment,

FIG. 5B is a perspective view of a section of a construction of used vehicle tyres incorporating the connector of FIG. 5A,

FIG. 5C is a cross sectional view through the construction of used tyres illustrating the coupling of the connector of FIG. 5A,

FIG. 5D is a side elevation of a connector installation lever,

FIG. 6 is a perspective side elevation of an alternative embodiment of the tyre placement and filling apparatus incorporating the invention,

FIG. 7 is a sectional view through the apparatus of FIG. 6,

FIG. 8 is a side elevation of the apparatus of FIG. 6,

FIG. 9 is a top plan view of the movable leg assemblies of FIG. 6,

FIG. 10 is a bottom plan view of the apparatus of FIG. 6, and

FIG. 11 is a perspective view of the vibrating unit of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

According to one embodiment of the invention there is provided a tyre placement and filling apparatus that enables a tyre to be expanded in a desired position, as a part of a structure, and enable the tyre to be filled with compacted material. In one form the apparatus can be used to place the tyre in the desired position.

As is disclosed herein, the tyre placement apparatus of the invention is described as being in the orientation it will be in when coupled to the boom of a hydraulic digger. This is by way of example.

The tyre placement apparatus 10, according to a preferred embodiment, is illustrated in FIG. 1. The apparatus includes a material hopper 11 and a movable leg assembly 12. Coupled to or associated with the movable leg assembly 12 (preferably within the lower portion of the material hopper 11) is a movable vibrating unit 13. This is more particularly illustrated in FIG. 2.

The upper section 14 of the material hopper 11 is of an inverted conical shape. Thus, the wider end faces upwards forming a funnel, as illustrated in FIG. 1. The lower, and thus narrower end of the conical hopper 14 is coupled to a tube 15. Coupled to the base of tube 15 is a tyre clamping plate 16.

Clamping plate 16 is annular in shape. The central hole 18 is of the same diameter as the inside diameter of tube 15 to which it is coupled, as is illustrated in FIG. 3. A plurality of spaced apart holes 19 are provided adjacent the circumference of the inner peripheral edge of the clamping plate 16. The legs may pass through holes 19.

The movable leg assembly 12 includes a plurality of legs. As illustrated in FIG. 1, one set of legs 21 (lower legs) are located beyond plate 16 while other set (upper legs) of legs 22 are adjacent plate 16. Preferably, there are at least three lower legs 21 and at least three upper legs 22. Legs 21 and 22 are slidingly located within hollow support tubes 23 and 23a respectively.

To provide vertical movement to the legs 21 and 22, at least two hydraulic rams 24 and 25 are provided.

Each set of legs 21 and 22 are coupled at their upper ends to movable plates 26 and 26a respectively, as illustrated FIG. 1. This enables each set of legs 21 and 22 to be moved vertically and independently of each other by hydraulic rams 24 and 25. Hydraulic ram 24 moves the upper movable plate 26, and hydraulic ram 25 moves the lower movable plate 26a.

To the lower ends of the legs are coupled elongate feet 27 and 27a. Feet 27 and 27a are elongate in shape, with one surface of the foot being flat, and the opposing surface being slanted or inclined, as illustrated in FIG. 3. In use, the slanted face engages with the bead of the tyre.

The movable plate 26 is generally triangular in shape. It contains a plurality of holes through which the upper ends of legs 21 may pass. The movable plate 26 also contains a central hole through which the body of the hydraulic ram 24 may pass.

The legs 21 pass through the holes provided in the movable plate 26. Coupled to each of the legs 21, and located below the underside of the movable plate 26 are collets (not shown in the drawings). Above the movable plate 26, and coupled to each leg 21 is a sprocket 27.

Between the sprocket 27 and movable plate 26 is provided a frictionless material 28, which acts as a bearing. The movable plate 26 is therefore clamped firmly between the collet and the sprocket 27, on legs 21. An endless chain (not shown in the drawings) couples the sprockets 27 together, as is illustrated in FIG. 1.

It will be apparent to the skilled addressee that the endless chain coupling sprockets 27 on legs 21 may be replaced by a different form of actuation means. In one form of the invention one modification is to use a push rod arrangement in which the hydraulic ram 30 actuates a push rod assembly which thus results in legs 21 rotating in the manner as previously described.

Coupled to at least one sprocket 27 is arm 29. This arm is coupled to a hydraulic ram 30. The opposing end of hydraulic ram 30 is coupled to a mounting bracket 31 located on the movable plate 26. The hydraulic ram 30, when extended and retracted, enables the legs 21 to rotate.
The lower movable plate 26a is coupled to legs 22, and legs 22 are rotated as described above.

To the movable leg assembly 12 are provided at least two fixed plates. An upper fixed plate 32 is coupled to the upper portion of support tubes 23 of legs 21, and the lower fixed plate 32a is coupled to the support tubes 23a of legs 22, and below the lower movable plate 26a, as illustrated in FIG. 1.

Upper and lower fixed plates 32 and 32a are generally circular in shape, and contain a plurality of holes through which support tubes 23 and legs 21 or 22 may pass through. This is illustrated in FIG. 1.

To the upper and lower surfaces of upper plate 32 is provided pivotal couplings 33 for the attachment of the hydraulic rams 24 and 25. Hydraulic ram 24 attaches to coupling 33 on the upper surface of plate 32, and hydraulic ram 25 attaches to the coupling 33 on the lower surface of plate 32.

The movable leg assembly 12, as assembled, and illustrated in FIG. 1, shows the support tubes 23 extending through, and coupled to the material hopper 11 and to the tyre clamping plate 16 at the base of hopper 11. The upper edges of support tubes 23 and 23a are coupled together with upper and lower fixed plates 32 and 32a.

It will be apparent to the skilled addressee that the forcing unit may be any type of mechanism or non-mechanised apparatus that is capable of both providing movement of fill material from the hopper of the tyre placement apparatus and down into the tyre being filled, and thus resulting in the tyre being filled with compacted material. For example, an auger type arrangement may be used. However, as is disclosed herein and with reference to the accompanying drawings, the forcing unit is a movable vibrating unit in the form of a ram, whereby a hydraulic motor provides motive power to a vibrating unit enclosed within the ram.

A forcing unit in the form of a movable vibrating unit 13 is located within tube 15 of hopper 11. This includes an hydraulic motor 34 coupled to the top of a solid cylindrical ram 35. The hydraulic motor 34, in operation, powers a vibrating unit located adjacent motor 34. This imparts a vibratory motion to the ram 35. The ram 35 of the vibrating unit 12 is located within the tube 15, and coupled to the outer surface of ram 35 are a plurality of fins 17.

The metal fins 17, as illustrated in FIG. 3, are elongate in shape, and the ends are chamfered. Preferably, there are at least three fins 17 coupled to, and evenly spaced around the circumference of ram 35.

Coupled to the upper surface of the hydraulic motor 34 is a pivotal coupling 36, to which one end of hydraulic ram 37 is coupled. The opposing end of the hydraulic ram 37 is coupled to the underside of lower plate 32a. The hydraulic ram 37, when extended and retracted, allows the vibrating unit 13 to be moved vertically within tube 15.

A coupling (not shown in the drawings) is provided to the exterior surface of the hopper 11. This allows the apparatus to be coupled to the boom of an excavator. Also provided (though not shown in the drawings) are hydraulic connections which allow the apparatus to couple to the hydraulic system of the excavator.

A connector plate 38, according to a preferred embodiment, is illustrated in FIG. 4. In use a plurality of connector plates 38 are combined with used vehicle tyres T in the construction of structure S.

It will be apparent to the skilled addressee that the connector plates 38 may be of any size or shape, for example they can be round, square, octagonal, or rectangular. They can be manufactured from any thickness material, and have any number of teeth 39 protruding either side of the plate. Also, the teeth 39 may be of any profile or shape. As is disclosed herein (and shown in the drawings) is a rectangular connector plate with triangular shaped teeth.

Each connector plate 38, as illustrated in FIG. 4, is elongate in shape, and contains an engagement means, in the form of a plurality of teeth 39 extending from both sides of the plate 38.

Preferably, the size of the connector plate is greater than the inside diameter of the bead portion of the tyre being used in the structure.

The teeth 39 may be formed in a manner similar to traditional nail type plates, whereby the profile of the raised portion of each tooth 39, is cut or formed from the plate material 38. Thus, each tooth 39 may formed in a tab like manner.

In order for the connector plate 38 to be used, the formed teeth 39 must be folded outwards of the plate 38. As illustrated in FIG. 4, alternative teeth are folded outwards from one the surface of the plate 38, and the remaining teeth 39 are folded outwards of the opposing surface of the plate 38.

In use, the apparatus of the present invention is coupled to the boom of a hydraulic excavator (not shown in the drawings), and the excavator’s hydraulic system is coupled to the tyre placement apparatus via conventional hydraulic hoses and couplings. The operator of the excavator is thus able to control the functionality of the tyre placement apparatus.

Once the tyre placement apparatus 10 is coupled to the excavators hydraulic system, with the hydraulic ram 37 of the vibrating unit 13 extended. The vibrating unit 13 thus covers the outlet of tube 15 and the materials hopper 11 is filled with local material. Preferably, the local material is soil, gravel, or similar granular fill.

Preferably, the used tyres are laying on their sides in close proximity to the site of the proposed structure. In use, the operator positions the excavator at a convenient location in proximity to the site of the proposed structure. A tyre is picked up in readiness for placement.

To pick up a tyre, the operator positions the tyre placement apparatus 10 above a tyre which is, preferably, laying on the ground. The apparatus 10 is lowered downward until the clamping plate 16 comes into contact with the sidewall of the tyre. Preferably, during this operation, the tyre placement apparatus 10 is positioned so that its vertical centreline is positioned at a point corresponding to the centre point of the tyre, as the tyre is laying flat on the ground.
The upper legs 22 are moved in a downwards direction, by moving hydraulic ram 25 from its retracted position to its extended position. Once the feet 27a of legs 22 are within the tyre cavity, hydraulic ram 30 moves from its extended position to the retracted position, resulting in the legs 22 turning so that the bearing surfaces of the feet 27a are facing outwards. Hydraulic ram 25 is retracted until the feet 27a come into contact with the tyre bead, and the bead is moved towards the tyre clamping plate 16. The tyre is held securely against the clamping plate 16.

Once the above operation has completed, the lower legs 21 are rotated so that the bearing surfaces of the feet 27 are facing outwards, by the retraction of hydraulic ram 30. The legs are then moved in a downwards direction by the retraction of hydraulic ram 24, until the feet 27 come into contact with the other head of the tyre. Hydraulic ram 24 is extended further so that the tyre bead is expanded outwards, relative to the tyre.

The tyre, with the sidewalls expanded, is now ready for placement. The operator manoeuvres the boom of the excavator into a position so that the tyre can be placed into its desired location. Once the tyre is lowered and thus comes into contact with the ground, the operator turns on the hydraulic motor 34 to power the vibrator of the vibrating unit 13.

The operator moves the vibrating unit 12 vertically upwards into the materials hopper 11 by the retraction of hydraulic ram 37. Some of the local material within the hopper 11 is vibrated down into tube 15, around the edges of the vibrating unit 13. The vibrating unit 13 is moved downwards by extending hydraulic ram 37, which forces and vibrates the loose material within tube 15 both downwards and outwards within the centre of the tyre. As this process is repeated, the material moves out radially into the tyre and the tyre becomes filled with compacted material.

The loose fill is consolidated by means of vibration from the vibrating unit 13, and by compaction due to the vibrating unit 13 being pressed down by the hydraulic ram 37.

Once the tyre is, say, half filled with compacted material, the lower legs 21 may be retracted from inside the tyre. The legs 21 are lifted upwards by extending hydraulic ram 24, and the legs 21 are rotated so that the feet 27 are facing inwards, by extending hydraulic ram 30. The legs 21 can be moved upwards until they are clear of the remainder of the fill that will be inserted, and compacted, in the tyre.

The filling and compacting process is then continued until the tyre is filled with compacted material. The upper legs 22 can be released by from the head of the tyre by moving them slightly downward and rotating the legs until the feet 27a are facing inwards. The tyre placing device can be moved clear of the tyre and is ready to pick up another tyre, which can be placed adjacent to the previous placed and filled tyre. The process is thus repeated.

In one form of the invention, the connector means to tie adjacent tyres together is in the form of connector plates 38, as illustrated in FIG. 4A.

It will be apparent to the skilled addressee that there are many different patterns in which a tyre wall, for example a retaining wall constructed from used vehicle tyres may be constructed. As is disclosed herein a tyre wall in the running bond design is illustrated.

It will be apparent to the skilled addressee that the connector plates do not necessarily need to be placed at the vertical connecting position of each and every tyre, although it is preferable to do so.

Once the lowermost course of tyres forming the structure S have been placed and filled, as illustrated in FIG. 5A, a connector plate 39 is placed on the intersection between at least two adjacent tyres T, as illustrated in FIG. 5A. The next tyre T forming the second course of the structure S is picked up by the tyre placement apparatus.

The tyre placement apparatus is manoeuvred, with a tyre in its grip, to a position such that the tyre may be placed at a location over the top of the connector plate 38. As the tyre placement apparatus 10 moves the tyre T downwards towards the connector plate 38, the sidewall of the tyre comes into contact with teeth 39 of the connector plate 38. As the tyre is moved further downward, the pressure exerted on the connector plate teeth 39, and subsequently the connector plate 38 itself, result in the teeth 39 of the connector plate becoming embedded into the sidewall of the tyre currently placed, and the sidewall of the tyres of the lower course of the structure S.

This results in the tyres T forming the structure S, being mechanically coupled together. Preferably, the connector plate 38 is of a dimension which is larger than the diameter of the tyres bead, in order to prevent fill material from being lost during the filling and compacting operation, as there is typically a gap between the overlapping edges of the upper and lower course of tyres in structures of this kind, as illustrated in FIG. 4A.

The tyre placement apparatus may then fill the tyre with compacted material as previously described. The tyre can be filled completely, and the likelihood of the fill material being lost through gaps within the structure a lowered.

Subsequent connectors and tyres may be placed as desired, in order to complete the construction of the intended structure.

The connectors are open to modification as will be apparent to the skilled addressee.

According to an alternative embodiment, the connector 38 may be in the form of a metal rod bent in the shape of a, as illustrated in FIG. 5A.

The connector 38 includes an engagement means 38a to each end of the connector. The engagement means is in the form of each end of the rod being bent into a downwardly curving shape in the form of a hook, as illustrated in FIG. 5A.

It will be apparent to the skilled addressee that connectors may be manufactured of any metal material of any profile that is suitable for the environment in which it is to be used. For example the connectors may be formed from sections of round or deformed reinforcing rod, which may have a protective surface coating to protect the metal from environmental elements.

It may be advantageous for a length of reinforcing material, with protective coating to be delivered to the
construction site, whereby the connectors 38 are manufactured on site to suit the dimensions of the tyres being used.

[0093] As installed, at least one end of a connector 38 rod (engagement means 38a) will be engaged with the bead of a first filled tyre T, and the opposing end of the connector 38 (engagement means 38a) will be coupled to the bead of an adjacent filled tyre T located within the same course of the structure S, as illustrated in FIG. 5B.

[0094] The result will be that when a connector 38 is installed to first and second adjacent tyres T there is a compressive force pulling the tyres T together, thus preventing adjacent tyres T from moving laterally relative to each other.

[0095] To install the connectors to first and second adjacent tyres, an installation lever 90 is used. This is illustrated in FIG. 5D. In one form, the lever 90 includes a shaft 91 with an attached handle means 92, a hook pin 93, and a projecting tab 94.

[0096] Preferably the location and configuration of the handle 92 is such that a user may easily impart a rotational force to lever 90.

[0097] Tab 94 is of a shape as illustrated in FIG. 5D, so that the projecting portion may grip the inside of the bead of tyre T.

[0098] In use, at least one end of a connector 38 i.e. engagement means 38a is coupled to the bead of a first tyre T. In order to manoeuvre the opposing end of connector 38, engagement means 38a into a position such that it couples to the bead of a second tyre T, a lever 90 is used.

[0099] To achieve this, the upper side of tab 94 is located, by the user, adjacent the underside of the bead of the second tyre T. The opposing end of connector 38 is coupled to pin 93 of lever 90.

[0100] In this configuration, the user thus moves shaft 91 in a direction such that the opposing end of the connector is moved toward the centre of the second tyre T. As lever 90 is moved, it pivots around tab 94 which is engaged with the bead. This results in pin 93 rotating from a first position above the bead, to a second position below the bead of tyre T.

[0101] When the opposing end of connector 38 has been moved a sufficient distance toward the inside of the second tyre T, and thus engagement means 38a has been moved past the bead, the upper portion of connector is preferably in contact with the sidewalls of first and second tyres T. In this orientation, the connector 38 is ready to be released from the lever 90.

[0102] To release the connector 38 the user twists lever 90 in a preferably clockwise direction. Once the force on connector 38 has been released, this effectively results in the connector 38 moving back toward the first tyre until such time as the curved portion of the opposing end of connector 38 has engaged with the bead of the opposing tyre.

[0103] The first and second tyres are thus securely tied together.

[0104] In building structure S, it may be preferable to use both embodiments of the connector 38. Thus, adjacent tyres will be securely tied together in the lateral direction by the connector of the second embodiment, with each course coupled together by the connector of the first embodiment.

[0105] The tyre placement apparatus is open to modification as will be apparent to the skilled addressee.

[0106] The tyre placement and filling apparatus 10, according to an alternative embodiment, is illustrated in FIG. 6. The apparatus 10 includes a material hopper 11 and a plurality of movable leg assemblies 12, which activate legs 41 and legs in the form of clamping fingers 42. Coupled within the lower portion of the material hopper 11 is a movable vibrating unit 13. This is more particularly illustrated in FIG. 7.

[0107] A protective covering (not shown in the drawings) will extend between the outer surface of the material hopper 11, and the upper surface of the clamping plate 16, thus enclosing and protecting the movable leg assemblies 12.

[0108] The material hopper 11 is generally in the shape of an inverted cone, however, the upper section of material hopper 11 (the hopper inlet) is rectangular in shape, and the sides diverge toward the lower section of the hopper (the hopper outlet), which is circular in shape, as illustrated in FIG. 6.

[0109] The lower, and thus circular end of the material hopper is coupled to a tube 15. Coupled to the base of tube 15 is tyre clamping plate 16.

[0110] As illustrated in FIG. 6, metal reinforcing R is provided at the upper leading edge of the hopper 11. Preferably, reinforcing R may be extended the full perimeter of the upper edge of the hopper as illustrated.

[0111] It is preferable that reinforcing R as coupled to the leading edge of materials hopper 11, extends as a lip above the upper level of the hopper 11.

[0112] Clamping plate 16 is generally circular in shape, and as illustrated in FIG. 10, includes a generally rectangular shaped section 43 which extends rearwards of the apparatus 10.

[0113] The central hole 18 in the clamping plate is of the same diameter as the inside diameter of tube 15 to which it is coupled. As illustrated in FIG. 10, a plurality of spaced apart openings 19 are provided around the circumference of the inner peripheral edge of clamping plate 16. The lower portion of the leg 41 and clamping fingers 42 pass through these openings.

[0114] A movable vibrating unit 13 is located within tube 15 of hopper 11. The vibrating unit 13 is a generally cylindrical shape, as illustrated in FIG. 7.

[0115] A hydraulic motor 46 is coupled to a vibrating unit 47, both of which are located within the internal cavity of the vibrating unit 13.

[0116] Coupled to the outside surface, and parallel to the longitudinal centreline of the vibrating unit 13, are preferably at least three fins 17, as illustrated in FIG. 11.

[0117] The metal fins 17 are elongate in shape, and the lower section of each fin 17 is preferably rounded or chamfered. Preferably the fins 17 are evenly spaced around the circumference of the vibrating unit 13.
A circular flange 48 is coupled to the upper end of vibratıng unit 13. The outside diameter of the flange 48 is preferably less than the internal diameter of tube 15.

Coupled to the upper surface of the flange 48, and thus the vibratıng unit 13, is a rigid coupling 49. Refer to FIG. 11.

The coupling 49 includes a shaft 50 which is preferably of square section, and to the lower end of shaft 50 is coupled a generally inversed conical shaped portion 57. This is illustrated in FIG. 11.

To the upper section of shaft 50 is a mounting bracket 51. Mounting bracket 51 includes at least two spaced apart flanges 52, and a blanking plate 53 encloses the end of shaft 50.

To form a frame with clamping plate 16 as the base, at least two vertical side members 54 are coupled to the upper side of the clamping plate as illustrated in FIGS. 6 and 8. The rear edge of side members 54 are joined by a profiled end plate 55, the upper portion of which is generally triangular in shape.

A circular rotatable coupling 56 is coupled to the leading end of side members 54, as illustrated in FIGS. 6 and 8.

Located between end plate 55 and rotatable coupling 56 is a standard type hydraulic digger coupling DC, which allows the tire placement and filling apparatus 10 to be coupled to the boom of a hydraulic digger (which is not shown in the drawings).

An hydraulic ram 57 is provided which enables the tire placement and filling apparatus 10 to rotate independently of the digger coupling DC. One end of ram 57 couples to a bracket 58 on clamping plate 16, and the opposing end couples to a bracket 59 on the digger coupling DC.

To provide rigidity to the structure of the tire placement and filling apparatus 10 are at least two spaced apart side plates 60, which extend between, and are coupled to the rotatable coupling 56 and tube 15, as illustrated in FIGS. 6 and 8.

The lower portions of side plates 60 are profiled, as illustrated in FIGS. 6 and 8, to ensure the operation of the movable mechanical assemblies 12 coupled to the clamping plate 16 are not impeded.

Coupled to the inside surface of side plates 60 are at least two spaced apart mounting plates 61, as illustrated in FIG. 8. These extend upward of the upper level of the side plates 60, whereby their upper leading edge couples to hopper 11.

Each mounting plate 61 has at least three elongate slots 62, the centres of which are perpendicular to the clamping plate 16, as illustrated in FIGS. 7 and 8.

A movable arm 63, the distal end of which is coupled to the vibratıng unit 13, is provided. The movable arm 63 is generally U-shaped with preferably one leg of the U being shorter than the other, as illustrated in FIG. 6 and 7.

Provided to the lower section, and enclosed between side plates 60, is an hydraulic ram (not shown in the drawings) that imparts a vertical movement to the movable arm 63.

It will be apparent to the skilled addressee that the movable arm may be constructed from any metal of any available profile that is suitable for the purpose. For example, metal of steel hollow section (SHS), rectangular hollow section (RHS) may be used. As is disclosed herein and with reference to the accompanying drawings, a composite movable arm is described.

The movable arm 63 is formed of at least two spaced apart plates 64. At least two shaped spacers 65 conforming to the general shape of plates 64, are coupled between plates 64, thus forming a generally hollow structure, as illustrated in FIG. 6.

To the distal end of movable arm 63, a mounting bracket 66 is provided for coupling of the vibratıng unit 13.

A coupling member 67 is provided between the movable arm and vibratıng unit, where one end of which couples to the mounting flange 66 on movable arm 63, and the opposing end couples to flange 51 on the movable vibratıng unit 13. Refer to FIG. 6.

The coupling member is in the form of a first square hollow section member 68, and a second square hollow section member 69. The first and second members 68 and 69 are coupled together such that the longitudinal centreline of the first member 68 is at right angles to the longitudinal centreline of the second member 69. Refer to FIG. 6.

A rubber bush (which is not shown in the drawings) is located inside each of first and second members 68 and 69. A hole is provided through the centre of each bush to enable the coupling member 67 to be fixed to the movable arm 63 and vibratıng unit 13.

At least three spaced apart movable leg assemblies 12 are coupled to clamping plate 16, as illustrated in FIGS. 6 and 9.

It will be apparent to the skilled addressee that each of the movable leg assemblies are constructed, fixed, and operate in the same manner. As is herein described, one movable assembly will be described, and thus the description shall apply to all movable leg assemblies coupled to the tyre placement and filling apparatus.

The movable leg assembly 12 is pivotally coupled to clamping plate 16 as illustrated in FIG. 9. The movable leg assembly 12 pivots around the vertical axis of leg 41.

The movable leg assembly 12 includes a base plate 70, upon which is mounted at least two spaced apart flanges 71, which form the lower ram mount 72. The lower section of hydraulic ram 73 couples to flanges 71 of the lower ram mount 72. Preferably a bolt or pin 73 is used to couple the components together. Refer to FIG. 9.

Coupled to each outer face of the lower ram mount 72 are ram guides 74. To each ram guide 74 is provided at least two elongate slots 75, the ends of which are rounded, as illustrated in FIG. 8.

At least two connecting rods 76 are coupled to either side of the opposing end of the hydraulic ram 73, as illustrated in FIG. 9. The connecting rod 76 is generally rectangular in shape, containing at least one hole 77 in each of its ends.
[0144] As illustrated in FIG. 7, each end of the connecting rod is shaped such that mounting flanges 78 are provided at each end for coupling of one end of the connecting rod 76 to the hydraulic ram 73, and the opposing end to the movable leg 41.

[0145] As assembled, a pin 79 passes through hole 77 in the connecting rods 76, and extends through the slots 75 in ram guides 74. Refer to FIG. 8.

[0146] To provide relatively free movement of the connecting rod 76, a bearing arrangement 80 must be located on the ends of each pin 79, and within slots 75.

[0147] Coupled to the lower end of connecting rod 76 is leg 41, as illustrated in FIG. 7. Leg 41 extends through at least one hole 19 in clamping plate 16.

[0148] To the bottom of leg 41 is coupled an elongate foot 27. These feet 27 are elongate in shape, and the upper and lower surfaces of each of feet 27 is preferably parallel. Refer to FIG. 10.

[0149] As illustrated in FIG. 10, the leading and trailing edges of the feet 27 are chamfered.

[0150] Coupled to the clamping plate 16, below the movable leg assembly 12, is a semi circular shaped guide 81, which is non-movable. Above guide 81 is a second movable guide 82. Guide 82 is pivotally coupled to the clamping plate by means of a bolt/pin 83, as illustrated in FIG. 9.

[0151] To the lower edge of the movable leg assembly base plate 70 is a generally circular pin (which is not shown in the drawings). This pin extends from the underside of the movable leg assembly base plate 70, whereby there is a clearance between the distal end of the pin and the surface of the clamping plate 16.

[0152] To provide movement to the movable leg assembly 12 a hydraulic ram 84 is provided. One end of the hydraulic ram 84 is pivotally coupled to bracket 85 coupled to tube 15. The opposing end of the hydraulic ram 84 is coupled to a mounting flange 86 coupled to the movable leg assembly 12. This is illustrated in FIG. 9.

[0153] Coupled to the distal end of the movable guide plate 82 is a push rod 87. The opposing end of the push rod 87 is coupled to a movable finger 42. Movable finger 42 is pivotally coupled to the clamping plate 16, whereby a first section of the finger 42 is located above the clamping plate 16 and a second section of finger 42 located below the clamping plate 16. This is illustrated in FIG. 7.

[0154] To control the functionality, that is, the operation of the vibrating unit 13 and its relative vertical movement, the rotational orientation of the tire placement and filling apparatus 10, and the operation of the legs 41 and movable fingers 42, a dedicated joystick type control is provided (not shown in the drawings).

[0155] It is intended that the joystick will be movable in the fore and aft directions, as well as the left and right directions. A trigger is provided on the joystick and on the top of the joystick are provided at least four buttons.

[0156] Moving the joystick forward/aft results in the vibrating ram moving vertically up/down. By moving the joystick left/right results in the tire placement and filling apparatus 10 rotating to the left/right. Upon activation of the trigger on the joystick, the hydraulic motor 46 within the vibrating unit will be activated for as long as the trigger remains depressed.

[0157] A first button top of the joystick, upon activation, activates the movement of the clamping fingers 42, resulting in them moving from a first open state (unclamped) to a second closed state (clamped). Upon activation of a third button, the clamping fingers move from the second clamped state to the first unclamped state.

[0158] Correspondingly, upon activation of a second button, the legs 41 move from a first retracted position to a second extended position. Upon activation of a fourth button, the legs 41 move from a second extended position to a first retracted position.

[0159] In use, the apparatus of the present invention is coupled to the boom of a hydraulic digger (not shown in the drawings), and hydraulic drive from the hydraulic digger is coupled to the tire placement and filling apparatus 10, via the joysticks control circuitry, by conventional hydraulic hoses and couplings. The digger operator is thus able to control the functionality of the tire placement and filling apparatus 10.

[0160] Upon coupling of the tire placement and filling apparatus 10 to the hydraulic digger, the operator moves the joystick in the forward direction, thus moving the vibrating unit 13 into a downward position, until flange 48 effectively blocks the entrance to tube 15.

[0161] To fill the hopper with local material, the operator tilts the boom of the hydraulic digger to an angle such that the leading edge of materials hopper 11, reinforcing R, comes into contact with the ground surface. By movement of the hydraulic digger's boom, the operator can effectively use the materials hopper 11 as a scoop, thus scooping up a quantity of material into the hopper 11.

[0162] Once the hopper 11 is filled with local material, the operator moves the boom of the hydraulic digger, and thus the tire placement and filling apparatus 10, into the vicinity of a used tire, which are preferably laying on their side.

[0163] To pick up a tire, the operator positions the tire placement and filling apparatus 10 above a tire which is preferably laying flat on the ground where the ground is at a slop, the operator may rotate the tire placement and filling apparatus 10 by moving the joystick control left or right, depending on the slope of the ground.

[0164] The apparatus 10 is lowered downward until the circular area of the clamping plate 16 below the materials hopper 11 comes into contact with the sidewall of the tire. The operator thus activates button 1 on the joystick, and subsequently button two is activated. The aforementioned actions result in the tire being firmly clamped to the underside of the clamping plate 16.

[0165] Upon activation of button one, hydraulic ram 84 moves from a first retracted position to a second extended position.

[0166] Upon movement of ram 84, movable leg assembly 12 rotates about the axis of leg 41. As the movable assembly 12 moves, the pin located beneath the movable leg assembly 12 engages in the elongate recess of guide 82, resulting in
guide 82 moving in response to the force applied to it via the pin coupled to the movable leg assembly 12.

[0167] Effectively, as ram 84 becomes extended, the distal end of guide 82 has been moved in close proximity to tube 15, push rod 87 has thus been moved, which moves the upper portion of clamping finger closer to tube 15. Due to the pivotal action of clamping finger 42, the lower portion of clamping finger 42 moves in an upward direction toward the underside of the clamping plate.

[0168] As the tyre bead is in close proximity to clamping finger 42, upon movement of clamping finger 42, this action effectively clamps the tyre bead between clamping finger 42 and the underside of clamping plate 16.

[0169] Correspondingly, as leg 41 rotates due to the extension of ram 84, leg 41 and thus feet 27 rotate from a first position to a second position such that feet 27 are in an orientation to, in use, press against the opposing tyre bead.

[0170] Upon activation of button two on the joystick, this results in hydraulic ram 73 moving from a first extended position to a second retracted position. As ram 73 moves, a downward force is provided to connecting rod 76, resulting in connecting rod 76, and thus the attached leg 41, moving in a downward direction, until ram 73 is fully retracted.

[0171] As leg 41 is moving downward, feet 27 come into contact with the opposing tyre bead, and applying pressure to the bead resulting in the beads of the tyre, and thus the sidewalls of the tyre, being mechanically moved apart (the sidewalls of the tyre are expanded in an outward direction).

[0172] The operator manoeuvres the boom of the hydraulic digger such that the tyre placement and filling apparatus, with engages tyre, is moved into the desired location for placement of the tyre.

[0173] The hydraulic digger boom is lowered until the tyre comes into contact with the ground. The tyre is now ready for filling.

[0174] To fill the tyre, the operator squeezes the trigger in the joystick. This activates the hydraulic motor 46 within vibrating unit 13, resulting in the vibrating unit oscillating in a generally sideways movement within tube 15. The joystick is thus moved in a fore/aft direction, resulting in the vibrating unit moving vertically within tube 15 as clamping unit 13 is moved to it upper limits of travel, a void is created between the inner sides of tube 15 and the outer surface of vibrating unit 13, thus allowing fill material to be assisted from the materials hopper 11 into the tyre cavity. Upon movement of the vibrating unit 13 downward to its limit of travel, the vibrating unit 13 forces any fill material within the tube 15 downwards in to the tyre cavity.

[0175] The operator repeatedly moves the joystick in the fore/aft direction, forcing fill material from the hopper into the cavity of the tyre, whereby due to the vibratory action of the vibrating unit, the fill material is forced in a downwards and outwards direction. The tyre is thus filled with compacted material.

[0176] To move vibrating unit 13 in the upward and downward direction, movable arm 63 is moved by the action of the associated hydraulic ram beneath it.

[0177] At this time, the operator presses buttons 3 and 4 on the joystick. Button three results in ram 84 moving from the extended position back into its retracted position, resulting the clamping fingers releasing the upper tyre bead.

[0178] Correspondingly, upon activation of button four, ram 73 moves from its retracted position to an extended position, resulting in legs 41 rotatably moving in an upward direction, thus releasing the pressure on the opposing tyre bead.

[0179] The operator may now repeat the process and place successive tyres within the structure.

[0180] According to a further embodiment motor 46 within vibrating unit 13 may be an electric motor. The electrical supply will preferably be via the hydraulic excavator to which the tyre placement apparatus is coupled. Alternatively, there may be provision for an electrical energy source, such as a battery or other power generating means to be located on the tyre placement apparatus itself.

[0181] The apparatus of the present invention provides a less labour intensive solution for the placement, and particularly the packing of the placed tyre with soil or like material. This will speed up the process of building structures with used vehicle tyres, and therefore, will make this form of construction economically viable.

[0182] Traditional structures of this kind have gaps where the tyres of an upper course overlap this of a lower course, thereby making the filling of the tyre difficult. An advantage of using the connector plates is that the connector plates cover this gap, thereby making the filling of the tyre with compacted material more effective.

[0183] An advantage of the construction of retaining or soil stabilisation structures with used tyres are they are extremely stable and solid due to the densely compacted soil, gravel, or similar granular fill within, and the use of connector plates ensures that there is a mechanical bond locking the tyres together.

[0184] Once vegetation has grown the structure, after a period of time, the structure is no more unsightly than any other structure of this kind.

[0185] Rubber tyres, due to the nature of the materials from which they are manufactured, should remain intact and for many years. Thus, the life of a structure manufactured from used tyres should be comparable, if not superior, to those structures built of conventional building materials.

1. A tyre placement and filling apparatus which includes a receptacle for loose material, movable legs adapted to engage to opposing sidewalls of the tyre, mechanism to move the legs to expand a tyre engaged therewith, and a forcing unit operable to cause loose material deposited in the tyre to compact within the tyre.

2. A tyre placement and filling apparatus as claimed in claim 1 wherein the apparatus includes a connection device arranged to, in use, be coupled to a hydraulic digger.

3. A tyre placement and filling apparatus as claimed in claim 1 wherein the receptacle has a tabular outlet.

4. A tyre placement and filling apparatus as claimed in claim 1 wherein the forcing unit is provided at or adjacent an outlet of the receptacle.

5. A tyre placement and filling apparatus as claimed in claim 4 wherein the forcing unit is operable to force material contained within the receptacle into and through the receptacle outlet.
6. A tyre placement and filling apparatus as claimed in claim 5 wherein the forcing unit is movable from a first position above or adjacent the outlet of the receptacle to a second position below the outlet of the receptacle.

7. A tyre placement and filling apparatus as claimed in claim 1 wherein the forcing unit includes a motor and a vibrator.

8. A tyre placement and filling apparatus as claimed in claim 7 wherein the motor is an hydraulic motor.

9. A tyre placement and filling apparatus as claimed in claim 7 wherein the forcing unit, in response to the operation of the vibrator enables the forcing unit to oscillate in at least one plane.

10. A tyre placement and filling apparatus as claimed in claim 1 wherein at least one set of movable legs are adapted to engage with the upper bead of a tyre.

11. A tyre placement and filling apparatus as claimed in claim 10 wherein at least one set of movable legs is adapted to engage with the lower bead of a tyre.

12. A tyre placement and filling apparatus as claimed in claim 11 further including an actuator device operable to move the movable legs from a first rest position to a second working position.

13. A tyre placement and filling apparatus as claimed in claim 12 wherein the actuator device is an hydraulic ram.

14. (canceled)

15. A method of building a structure using used vehicle tyres including the steps of forming a first course of tyres, filling the tyres with material, compacting the material compacted, applying connector at the intersection between at least two tyres of the first course, placing a second course of tyres on top of the first course, filling the tyres of the second course with material and compacting material in the tyres of the second course.

16. The method as claimed in claim 15 wherein the tyres are placed, filled with material, and the material compacted by use of tyre placement apparatus.

17. The method as claimed in claim 16 wherein the tyre placement apparatus is coupled to an hydraulic digger.

18. The method as claimed in claim 16 wherein the tyre placement apparatus includes a forcing unit operable to force material contained within a receptacle through a receptacle outlet, the forcing unit being movable from a first position above or adjacent the outlet of the receptacle to a second position below the outlet of the receptacle.

19. The method as claimed in claim 18 wherein the forcing unit is cased to oscillate in at least one plane.

20. The method as claimed in any one of claims 15 wherein at least one set of movable legs are coupled to an upper bead of a tyre and at least one set of movable legs are coupled to the lower bead of a tyre, the movable legs being movable from a first rest position to a second working position to cause expansion of the tyre to occur.

21. The method as claimed in any of claims 15 wherein a connector with engagement means is coupled to adjacent pairs of tyres with the engagement means thereof engaging with adjacent tyres in the first and second courses.

22. (canceled)