(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 August 2020 (13.08.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/161589 A1

(51) International Patent Classification:
B28C 5/42 (2006.01)

(21) International Application Number:
PCT/IB2020/050825

(22) International Filing Date:
03 February 2020 (03.02.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2019/00785 07 February 2019 (07.02.2019) ZA

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(54) Title: A MOBILE CEMENT PROCESSING MACHINE

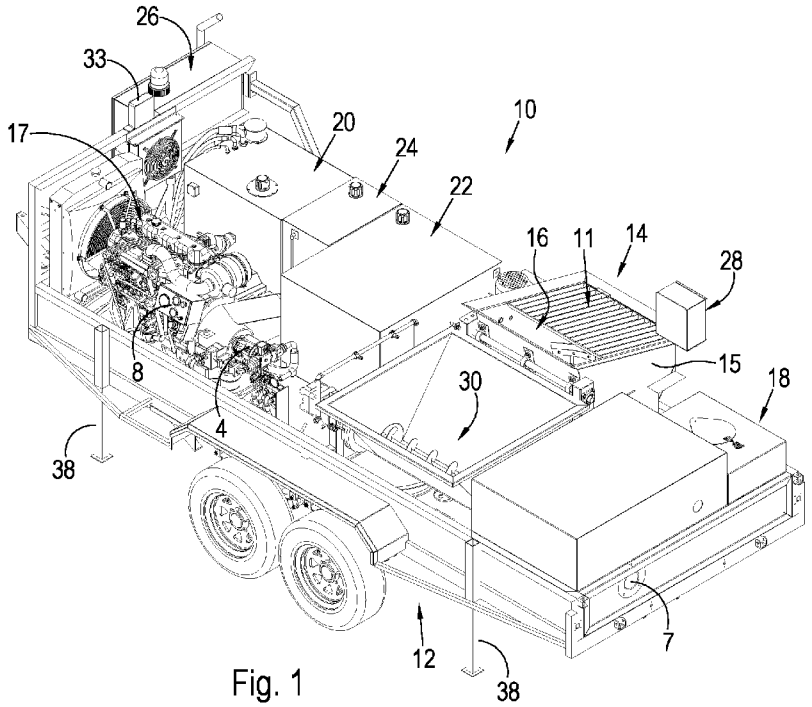

Fig. 1

(57) Abstract: The invention relates to a mobile cement processing machine 10 which is configured to produce at least two different concrete products, namely aircrete or foam concrete and regular cement. To this end, the machine 10 includes a trailer 12 and a 5 concrete mixer 14 mounted to the trailer for mixing sand, cement and aggregate together. The machine 10 includes a diesel engine 17 drivingly connected to an electrical generator 3 and hydraulic pump 4, a water tank 22, a chemical tank 24, a hopper 30 for receiving concrete from the mixer and a screw pump 6 and stator pump 32 for discharging the concrete. The machine includes a control unit 28, having 10 a user interface, which is configured automatically to control metered dosing of water and/or admixture into the concrete mixer based upon a user selection of either a pre-programmed or user-specified concrete mix design or recipe.

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(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*
— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

A mobile cement processing machine

FIELD OF INVENTION

This invention relates broadly to the construction industry. More specifically, it relates to cement processing plants or mixers and to a mobile machine for processing, preparing and discharging different concrete mixtures.

BACKGROUND OF INVENTION

Concrete has been used in the construction industry for many years for construction of buildings and other infrastructure. Cementitious mixtures have enjoyed ubiquitous application across various industries for a couple of reasons. One reason is its relative ease of handling and transportation due to the fact that it can be prepared as a fluid slurry which can be easily poured or moulded into shape. A mobile or volumetric concrete mixer consists of a concrete mixer mounted on a truck or trailer which includes separate compartments for housing sand, stone, cement and water. These materials can be mixed on site to produce the exact amount of concrete needed. Ready-mix concrete is usually manufactured at a centralised plant based on a specific engineered mix design or recipe and transported to site in a plastic or fluid state in a barrel truck or in-transit mixer. This is referred to as a centralised batch system. A volumetric concrete mixer, on the other hand, mixes the concrete on site and can seamlessly change aspects of the mix design.

Different cement-based slurries are used in industry. Regular cement comprises a combination of cement, sand, water and aggregate. On the other hand, foam concrete, also known as Cellular Lightweight Concrete (CLC), has almost no coarse aggregate. Instead, the coarse aggregate used in regular cement is replaced by foam in foam concrete. Although, as mentioned before, a site-mix truck or volumetric concrete mixer may be able to change aspects of a mix design or recipe on-site,

these trucks or trailers are specific to only one type of cement, usually regular cement. Furthermore, cost is a major drawback associated with these machines or trucks as they tend to be very expensive.

Cement pumping trucks have the ability to pump the mixed concrete for pouring. However, traditional or conventional cement pumping trucks tend to be very expensive.

It is an object of the invention to provide a mobile cement processing machine which addresses, or at least alleviates, the drawbacks discussed above.

SUMMARY OF INVENTION

According to a first aspect of the invention, there is provided a mobile cement processing machine which is configured to produce at least two different concrete products, the mobile cement processing machine including:

a wheeled chassis;

a concrete mixer mounted to the wheeled chassis, the mixer being configured to receive a combination of sand, cement and aggregate into a drum of the mixer and to mix the contents of the drum together;

a power source mounted to the wheeled chassis and configured to power the concrete mixer;

a water dosing system which is configured to discharge water from an onboard water storage vessel into the concrete mixer;

an admixture dosing system which is configured to discharge admixture from an onboard admixture storage vessel into the concrete mixer; and

at least one control unit having a user interface, wherein the control unit is configured automatically to control metered dosing of water and/or admixture into the concrete mixer based upon a user selection of either a pre-programmed or user-specified concrete mix design or recipe.

The control unit may include at least one programmable logic controller (PLC).

The power source may include a combustion engine. The combustion engine may be a diesel engine. The power source may include an electrical power source in the form of a generator. The power source may include a hydraulic power source in the form of a hydraulic pump. The hydraulic pump may be drivingly connected to the concrete mixer. The concrete mixer may be configured to rotate in forward and reverse directions. In addition, the drum of the concrete mixer may be displaceable relative to the chassis between a loading and a discharging position by way of a hydraulically controlled piston. The combustion engine may be mechanically, drivingly connected to the generator and the hydraulic pump.

The concrete mixer may include an agitator mounted to a shaft which is configured to rotate relative to the drum, about its own axis, to mix contents of the drum. The concrete mixer drum may be pivotally displaceable relative to the wheeled chassis between loading and discharging positions by way of a hydraulically controlled piston.

The admixture dosing system may be configured to dose or discharge an air entraining chemical admixture into the concrete mixer. The admixture may be an air entraining admixture. To this end, the machine may include an air compressor. Pressurised air from the air compressor may be mixed with the chemical admixture to form the air entraining chemical admixture which is introduced into the concrete mixer. The chemical admixture may include foam. Accordingly, the machine may be configured to produce foam concrete or aircrete. In addition, the machine may be configured to produce regular cement. The machine may therefore be able to alternate between foam concrete and regular cement production. In the case of foam concrete, the aggregate is replaced with foam from the air entraining admixture dosing system.

The wheeled chassis may be configured to be towed by a draught vehicle. The wheeled chassis may take the form of a trailer. The trailer may be a twin-axle trailer. The wheeled chassis may also take the form of a truck. Alternatively, the machine may be mounted to a skid.

The machine may further include a feeding bin or hopper for receiving concrete discharged from the concrete mixer. A delivery pump may be in flow communication with the hopper in order to discharge, deliver or pump the concrete fed from the mixer into the hopper away from the machine to a site application. The delivery pump may include a screw pump or auger which may be hydraulically driven. The delivery screw pump may have variable speed which is user controllable. The delivery pump may further include a stator pump.

The machine may include an accessory for loading material into the concrete mixer. The accessory may include a portable feeding conveyor. The feeding conveyor may be a screw feeding conveyor. The machine may include an auxiliary electrical outlet for powering and connecting the portable screw feeding conveyor to the machine. The machine may include a flood light for lighting up operations.

The machine may be configured to spray air entrained concrete, also known as "Shotcrete", onto a surface using suitable hoses and fittings which are operatively connected to an outlet of the delivery pump. The air compressor provides the compressed air to entrain a slurry pumped from the delivery pump.

In accordance with a second aspect of the invention, there is provided a method of processing cement using a mobile cement processing machine as described above to form a concrete product, the method including:

providing, via the user interface of the control unit, a user with a selection of either one or more pre-programmed product mix designs or an option manually to control operation of the machine;

receiving user input via the user interface of the control unit;

provided that the user selected a pre-programmed product mix design, automatically controlling dosing of water and/or an admixture to the concrete mixer using the control unit to form one of two different concrete products; and

discharging or delivering the concrete product.

Discharging may include delivering the product using a delivery pump. Delivering may include pumping the product to an elevation higher than the machine itself. The delivery pump may have a vertical head of 20 metres.

Discharging may include spraying an air-entrained concrete product to a surface using suitable hoses and fittings.

The method may include manually feeding material into the concrete mixer. Alternatively, the method may include feeding material into the concrete mixer using a material feeding conveyor.

The invention extends to a computer readable medium having instructions stored thereon, which, when executed by a computing device or controller, enable the controller to perform any one of the method steps described above.

BRIEF DESCRIPTION OF DRAWINGS

The invention will now be further described, by way of example, with reference to the accompanying drawings.

In the drawings:

Figure 1 shows a three-dimensional view of a mobile cement processing machine in accordance with the invention, from the rear;

Figure 2 shows a view of the mobile cement processing machine of Figure 1 from the top;

Figure 3.1 shows another top view of the mobile cement processing machine, a compressor and stator pump toward the rear being visible;

Figure 3.2 shows a side view of the mobile cement processing machine of Figure 1;

Figures 4.1 and 4.2 show face-on views of a main control box and secondary control unit, respectively; and

Figures 5 to 7 illustrate exemplary graphical user interfaces.

DETAILED DESCRIPTION OF AN EXAMPLE EMBODIMENT

The following description of the invention is provided as an enabling teaching of the invention. Those skilled in the relevant art will recognise that many changes can be made to the embodiments described, while still attaining the beneficial results of the present invention. It will also be apparent that some of the desired benefits of the present invention can be attained by selecting some of the features of the present invention without utilising other features. Accordingly, those skilled in the art will recognise that modifications and adaptations to the present invention are possible and can even be desirable in certain circumstances, and are a part of the present invention. Thus, the following description is provided as illustrative of the principles of the present invention and not a limitation thereof.

In the Figures, reference numeral 10 refers generally to a mobile cement processing machine in accordance with the invention. The machine 10 is configured to produce at least two different types of concrete. For example, the machine 10 may be configured selectively to produce and deliver regular cement or foam concrete also known as Cellular Lightweight Concrete (CLC). In the example embodiment illustrated in the figures, the machine 10 includes a wheeled chassis in the form of a twin-axle trailer 12 which includes a coupling 13 for securing the trailer to a tow hitch of a draught vehicle. Alternatively, the machine 10 may be mounted to the back of a truck or on a skid (not shown). The machine 10 further includes a concrete mixer 14 which is securely mounted to a base of the trailer 12. The concrete mixer 14 has a hollow drum 15 having a U-shaped transverse cross-section. The drum 15 defines a mouth through which material such as sand, water, cement and aggregate are introduced into an inner mixing cavity 16. A grid 11 is hingedly connected to one side of an operatively upper periphery of the drum 15 and extends at least partially over the mouth to prevent ingress of oversized particles. In another embodiment which has not been illustrated, the concrete mixer 14 may include a rotary cylindrical drum.

A power source in the form of a diesel combustion engine 17 is mounted to the trailer 12 toward a front thereof. A fuel tank 18 is provided toward a rear of the trailer 12 for supplying the diesel engine 17 with fuel. The diesel engine 17 is drivingly connected to an electrical generator or alternator 3 via a belt and pulley arrangement. The electrical generator 3 is configured to generate electrical power for powering electrical components of the machine 10. The diesel engine 17 is also mechanically drivingly connected to a hydraulic pump 4 for hydraulically powering a number of other components, which will be discussed in more detail below. To this end, a hydraulic oil reservoir 20 or tank is provided adjacent to the diesel engine 17 for holding a hydraulic oil.

The machine 10 further includes a water dosing system which includes an onboard water storage tank 22, and an electrically operated water pump 23 which is configured to dose or discharge water from the water storage tank 22 into the inner mixing cavity 16 of the concrete mixer 14. For the purposes of producing foam concrete, an admixture dosing system is also provided on the trailer 12. In this example embodiment, the admixture dosing system includes an onboard foam/chemical storage tank 24 which, by way of an electrically operated chemical pump 25 is configured to dose or discharge air entrained chemical into the inner mixing cavity 16 of the concrete mixer 14 in order to produce foam concrete or aircrete. To this end, the machine 10 also includes an air compressor 5 (see Figure 3.1) which is configured to introduce a pressurised air supply into a chemical supply or delivery line of the admixture dosing system in order to aerate or air-entrain the chemical to produce foam. The chemical may be a synthetic foam generator or foaming agent.

The machine 10 includes a control unit or system having a user interface. The control unit may include a programmable logic controller (PLC). The control unit is configured automatically to control metered dosing of water and/or admixture into the concrete mixer 14 based upon a user selection of either a pre-programmed or user-specified concrete mix design or recipe. The control unit includes a main control box 26 (see Figure 4.1) which is secured to a front face of the trailer chassis and a

secondary control unit 28 (see Figure 4.2) which is provided toward a rear of the machine 10, above the fuel tank 18. A material feeding bin or hopper 30 is provided adjacent to the concrete mixer 14 so that mixed concrete can be discharged from the inner mixing cavity 16 of the concrete mixer 14 directly into the feeding bin 30. When not receiving material, an open top of the bin 30 may be closed by a cover to prevent ingress of unwanted particles into a delivery pump below the bin 30. As mentioned, a delivery screw pump or auger 6 is provided at a base of the bin 30 and is configured to pump or deliver concrete received into the feeding bin 30 to a stator or eccentric screw pump 32 which is disposed in a linear fore-and-aft direction. A pump outlet socket 7 is provided at a rear of the trailer 12 to which a suitable pipe or hose may be connected to deliver the concrete to site. The eccentric screw pump 32 is configured to deliver a 20-metre vertical and horizontal head. The delivery screw pump 6 may have variable speed which is user-controllable by way of a potentiometer 36 provided as part of the secondary control unit 28. In addition, an electrically powered floodlight 33 is provided for illuminating the machine 10 during low light or night-time operations.

Power to the water and chemical pumps 23, 25 and the floodlight 33 is obtained from the electrical generator 3. Electrical outlet sockets 37 (see Figures 3.2 and 4.1) are also provided on the main control box 26 to power other electrical devices. In particular, an industrially-rated power outlet socket may be provided for powering an accessory in the form of a portable, electrically powered, material feeding conveyor (not shown). The material feeding conveyor is configured to supply the concrete mixer 14 with material by way of an elongate auger or screw.

As can be seen in Figure 3.1, the concrete mixer 14 further includes an agitator 2 which is mounted to a shaft 19 which is supported between opposing end walls of the hollow drum 15. The agitator 2 has a plurality of angularly spaced apart mixing members 2.1, 2.2, 2.3, mounted to the shaft 19 at axially spaced apart positions. The mixing members 2.1, 2.2, 2.3 protrude radially from the shaft 19. An electrical motor 1 is drivingly connected to the shaft 19 and is configured to rotate the shaft 19 relative to the hollow drum 15 about its own axis in order to displace the agitator 2

such that it mixes the contents of the concrete mixer 14. Furthermore, activation of a hydraulic piston (not shown) connected between a mounting frame and the drum 15 of the concrete mixer 14 results in pivotal displacement of the drum 15 of the concrete mixer 14 relative to the trailer 12, about a pivot axis X, from a loading position, (shown in Figure 1) in which the mouth faces upward for receiving material into the inner mixing cavity 16, to a discharging position (not shown) in which the mouth is at least partially downwardly directed toward the feeding bin 30 for discharging the mixed concrete into the bin 30, and vice versa. The screw pump 32 is also hydraulically powered.

The machine 10 is configured to spray air-entrained concrete, also known as "Shotcrete", onto a surface using a suitable hose and nozzle which are operatively connected to the pump outlet 7 of the screw pump 32. The air compressor provides compressed air to aerate the slurry pumped from the delivery pump and it is then sprayed on the surface using the nozzle. The machine 10 can therefore also be used for product finishing.

The machine 10 can also accept cement products from a ready-mix truck. The machine 10 can receive ready-mix cement poured from a truck into the feeding bin 30 at $5m^3$ per hour. The machine 10 can, with minor modifications, be mounted on a base-type platform or skid for static use. The trailer 12 includes a plurality of retractable struts or legs 38 which extend downward from the base of the trailer to the ground in order to support and stabilise the machine 10 during use. The PLC of the secondary control unit 28 has been designed to be easily programmable to allow user-specified cement recipes or designs to be entered for automatic preparation by the machine 10 from mixing, to adding a foaming agent, to pumping the product in a continuous flow.

The steps of operating the machine 10 will now be explained in more detail. With reference to Figure 4.2, the user interface of the secondary control unit 28 includes a touchscreen 39. An emergency or E-stop button 40, system fault light 41, and fault reset button 42 are also provided as part of the secondary control unit 28. The

operator controls operation of the various components of the machine 10 by merely interacting with the buttons 40, 42 and graphical representations of buttons illustrated on the touchscreen 39. A main switch 43, alarm and strobe light 44 are provided as part of the main control box 26 (see Figure 4.1). First, the diesel engine 17 is started by pushing a start button and then the operator selects "System start" 45 on the touchscreen 39 (see Figure 5). This will automatically start the rest of the electrical system and open the main hydraulic valve to enable hydraulic control. The operator then selects a control mode, i.e. either manual control 46 or automatic control by selecting, "GO TO RECIPE SELECTION SCREEN" 47.

Selecting "Manual Control" 46 takes the operator to another screen (see Figure 6) which allows the operator to control all features of the machine manually. All safety features are still built into the PLC program to protect electrical and hydraulic equipment from malfunctioning. Through interaction with the touchscreen 39, the operator can start / stop 48 the agitator 2 of the mixer 14, open and close the water valve 49, open and close the foam / chemical valve 50 as required, start and stop the screw pump 51, start and stop the screw conveyor 52 if plugged in, move the mixer to its loading and discharging positions 53 as and when required and select "Home Screen" 54 to return to the main screen. Whilst operating on this screen the hydraulic oil pressure, hydraulic oil temperature and screw speed can be monitored.

In automatic mode, a pre-programmed product recipe is selected. Through interaction with the user interface, the operator then starts rotation of the agitator 2 of the concrete mixer 14 and prepares the materials in the prescribed quantities in accordance with the recipe and introduces them into the mixer 14. The material feeding conveyor may be used for this purpose. If a pre-programmed product recipe has been selected, the control unit will automatically control dosing of water from the water dosing system into the mixer 14 using the PLC. If CLC is being prepared based upon a predefined recipe, the control unit doses the required quantity of foaming agent into the mixer 14. Once the concrete mixture in the mixer 14 has been prepared, the operator starts the delivery screw pump 6 in the forward direction through use of the touchscreen 39. Through activation of the hydraulic

piston, the mixer 14 is then pivoted into its discharging position in which the contents of the mixer 14 is dumped into the feeding bin 30. In order to control the delivery rate of product, the operator adjusts the delivery screw pump's speed using the potentiometer 36 provided on the secondary control unit 28. The mixer 14 is then moved back into its loading position in preparation for the next batch of materials to be mixed.

Having selected a specific pre-programmed recipe, the user interface displays a message 55 (see Figure 7) communicating that water and foam/chemicals will be added automatically and specifies what quantities of sand and cement need to be added to the mixer 14 to complete the mix. The prescribed total quantity of water and foam that will be dosed as well as a presently discharged quantity 56 is indicated on the touchscreen 39. Even if the operator stops the water or foam dosing process before completion, the remainder of the prescribed amounts will be discharged once the process is reinitiated. When the "Open Water" button 57 is selected the required quantity of water will be discharged and will stop automatically once the prescribed threshold has been reached. Similarly, when the "Open Foam" button 58 is selected, the required quantity of foam will be discharged and will stop automatically once the pre-programmed amount has been reached. After discharging the mix into the feeding bin 30, the prescribed water and foam quantities to be dosed are reset for the next mix. A "MIX ADJUST SCREEN" button 59 is also provided. By utilising this function, a password is required before being permitted to adjust prescribed water and foam dosing quantities. A number of different fault screens can also be displayed to the operator, highlighting which components are malfunctioning, if any.

The diesel engine 17 mechanically drives the hydraulic pump 4 for the hydraulic applications. The engine 17 is equipped with an electrical starting control box 8 with an onboard 12volt battery and low oil failure protection, running hours meter and on/off indication lights. The hydraulic pump 4 is controlled via a main hydraulic solenoid valve from the PLC. This enables the PLC to shut off the hydraulic pump 4 in the event of hydraulic oil pressure loss or pipe failure, as well as hydraulic motor and piston failures which may result in loss of hydraulic oil thus protecting the main

hydraulic pump 4. The hydraulic pump 4 feeds a hydraulic valve bank 9 consisting of three valves. In the alternative embodiment having a rotary cylindrical mixing drum, a first valve may control rotation of the mixer drum in either the forward or reverse directions. In the embodiment illustrated, however, the agitator 2 of the mixer 14 is electrically driven. The second valve controls the concrete mixer hydraulic piston to move the mixer 14 into either of its loading or discharging positions. The third valve controls supply to the delivery screw pump 6. All three these hydraulic valves are fitted with a mechanical lever for mechanical override, if so required.

The electrical air compressor 5 includes a pressure vessel, an auto starting/stopping pressure switch, a hand operated flow control valve, a hand adjustable air pressure control valve and an electrical air solenoid valve which is controlled by the PLC. The onboard water tank 22 has a water level sensor with low level indication fed to the PLC as well as a mechanical level indicator. Water transfer from the water storage tank 22 to the mixer 14 is controlled via an electrically-driven water dosing solenoid valve by the PLC.

Presently, building contractors' solution for structures up to three stories tall is to make use of wheelbarrows with scaffolding or a cement pumping truck. The first requires strenuous labour and is a tedious process whilst the second significantly impacts upon the cost of the construction. The machine 10 in accordance with the invention is capable of vertical and horizontal head of between 15 and 20 metres depending on the product pumped. Finishing of a construction site may require spraying of Shotcrete, plaster, Gunite or stucco. For this purpose, contractors need to hire or purchase additional equipment to accomplish this task. However, the machine 10 addresses this need and may be provided with a spray nozzle as an accessory which facilitates spraying of various products as finishing.

The mobile cement processing machine 10 in accordance with the invention provides the user with the advantageous functionality of being able to mix both regular cement and CLC on the same platform. Depending on the product and recipe, the machine 10 can be used to pour either regular cement utilizing aggregate up to

15mm or CLC foundations, walls, ceilings and blocks at $2m^3$ per hour. The mobile cement processing machine 10 combines three solutions which comprise product selection, automatic preparation, product delivery or pumping and product spraying or finishing into one mobile unit. The machine 10 can be easily towed by a regular truck or SUV and can be used in urban and rural areas. The applicant believes that the machine 10 provides a more versatile and cost-effective solution than products currently available to the market.

CLAIMS

1. A mobile cement processing machine which is configured to produce at least two different concrete products, the mobile cement processing machine including:

a wheeled chassis;

a concrete mixer mounted to the wheeled chassis, the mixer being configured to receive a combination of sand, cement and aggregate into a drum of the mixer and to mix the contents of the drum together;

a power source mounted to the wheeled chassis and configured to power the concrete mixer;

a water dosing system which is configured to discharge water from an onboard water storage vessel into the concrete mixer;

an admixture dosing system which is configured to discharge admixture from an onboard admixture storage vessel into the concrete mixer; and

at least one control unit having a user interface, wherein the control unit is configured automatically to control metered dosing of water and/or admixture into the concrete mixer based upon a user selection of either a pre-programmed or user-specified concrete mix design or recipe.

2. The mobile cement processing machine as claimed in claim 1, wherein the control unit includes at least one programmable logic controller (PLC).

3. The mobile cement processing machine as claimed in claim 1 or 2, wherein the power source includes a combustion engine, an electrical power source in the form of a generator, and a hydraulic power source in the form of a hydraulic pump.

4. The mobile cement processing machine as claimed in claim 3, wherein the combustion engine is mechanically, drivingly connected to the generator and the hydraulic pump.

5. The mobile cement processing machine as claimed in any one of the preceding claims, wherein the concrete mixer includes an agitator mounted to a

shaft which is configured to rotate relative to the drum, about its own axis, to mix contents of the drum and wherein the concrete mixer drum is pivotally displaceable relative to the wheeled chassis between loading and discharging positions by way of a hydraulically controlled piston.

6. The mobile cement processing machine as claimed in any one of the preceding claims, wherein the admixture dosing system is configured to dose or discharge an air entraining chemical admixture into the concrete mixer.

7. The mobile cement processing machine as claimed in claim 6, which includes an air compressor, pressurised air from the air compressor being mixed with the chemical admixture to form the air entraining chemical admixture which is introduced into the concrete mixer.

8. The mobile cement processing machine as claimed in claim 6 or 7, wherein the chemical admixture includes foam and wherein the machine is configured to produce foam concrete or aircrete.

9. The mobile cement processing machine as claimed in claim 8, which is configured to alternate between foam concrete and regular cement production.

10. The mobile cement processing machine as claimed in any one of the preceding claims, wherein the wheeled chassis is configured to be towed by a draught vehicle.

11. The mobile cement processing machine as claimed in any one of the preceding claims, which includes:

a feeding bin or hopper for receiving concrete discharged from the concrete mixer;

a delivery pump which is in flow communication with the hopper in order to pump the concrete fed from the mixer into the hopper away from the machine to a

site application, wherein the delivery pump includes a screw pump or auger and a stator pump which are hydraulically driven.

12. The mobile cement processing machine as claimed in claim 11, wherein the screw pump has variable speed which is user controllable.

13. The mobile cement processing machine as claimed in any one of the preceding claims, which includes an accessory for loading material into the concrete mixer, the accessory including a portable screw feeding conveyor and wherein the machine includes an auxiliary electrical outlet for powering and connecting the portable screw feeding conveyor to the machine.

14. The mobile cement processing machine as claimed in claim 11, which is configured to spray air entrained concrete onto a surface using suitable hoses and fittings which are operatively connected to an outlet of the delivery pump, wherein an air compressor provides compressed air to entrain a slurry pumped from the delivery pump.

15. A method of processing cement using a mobile cement processing machine as claimed in any one of the preceding claims to form a concrete product, the method including:

providing, via the user interface of the control unit, a user with a selection of either one or more pre-programmed product mix designs or an option manually to control operation of the machine;

receiving user input via the user interface of the control unit;

provided that the user selected a pre-programmed product mix design, automatically controlling dosing of water and/or an admixture to the concrete mixer using the control unit to form one of two different concrete products; and

discharging or delivering the concrete product.

16. The method as claimed in claim 15, wherein discharging includes delivering the product using a delivery pump having a vertical head of 20 metres.

17. The method as claimed in claim 15, wherein discharging includes spraying an air-entrained concrete product to a surface using suitable hoses and fittings.

18. The method as claimed in any one of claims 15 to 17, which includes feeding material into the concrete mixer using a material feeding conveyor.

19. A computer readable medium having instructions stored thereon, which, when executed by a computing device or controller, enable the controller to perform the method steps of any one of method claims 15 to 18.

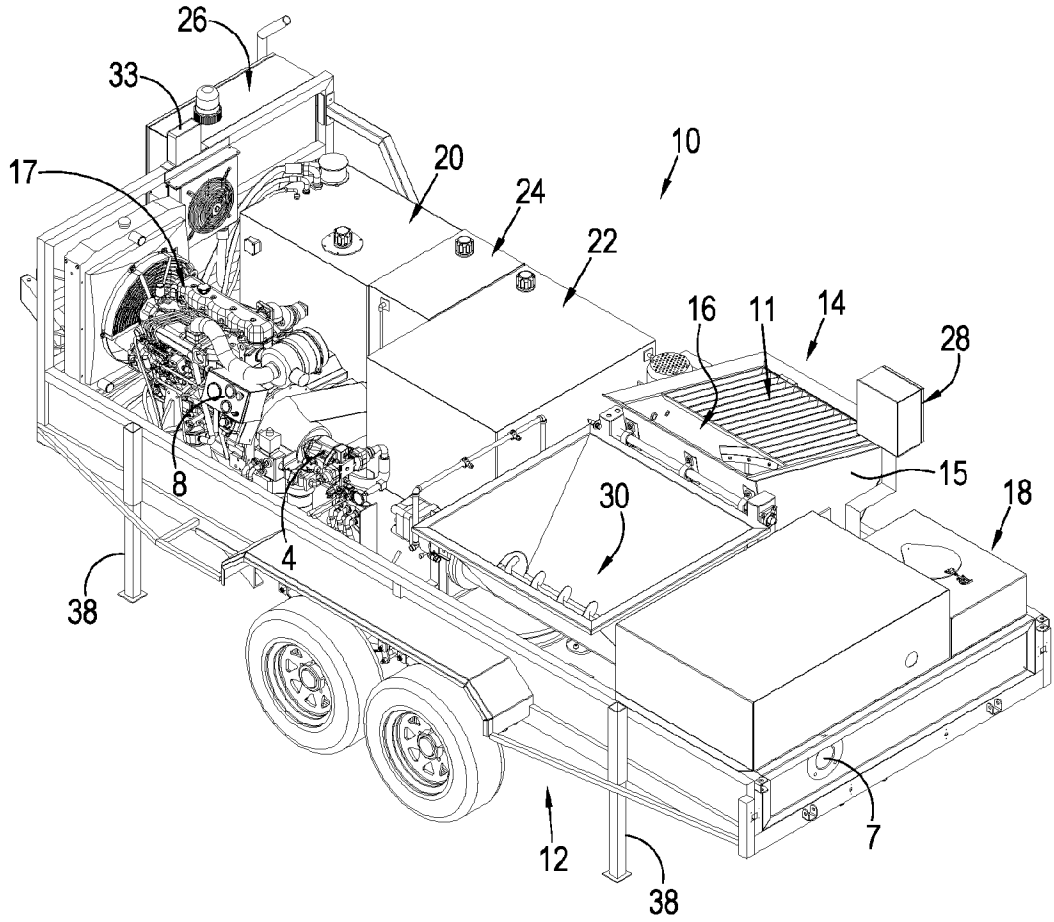

Fig. 1

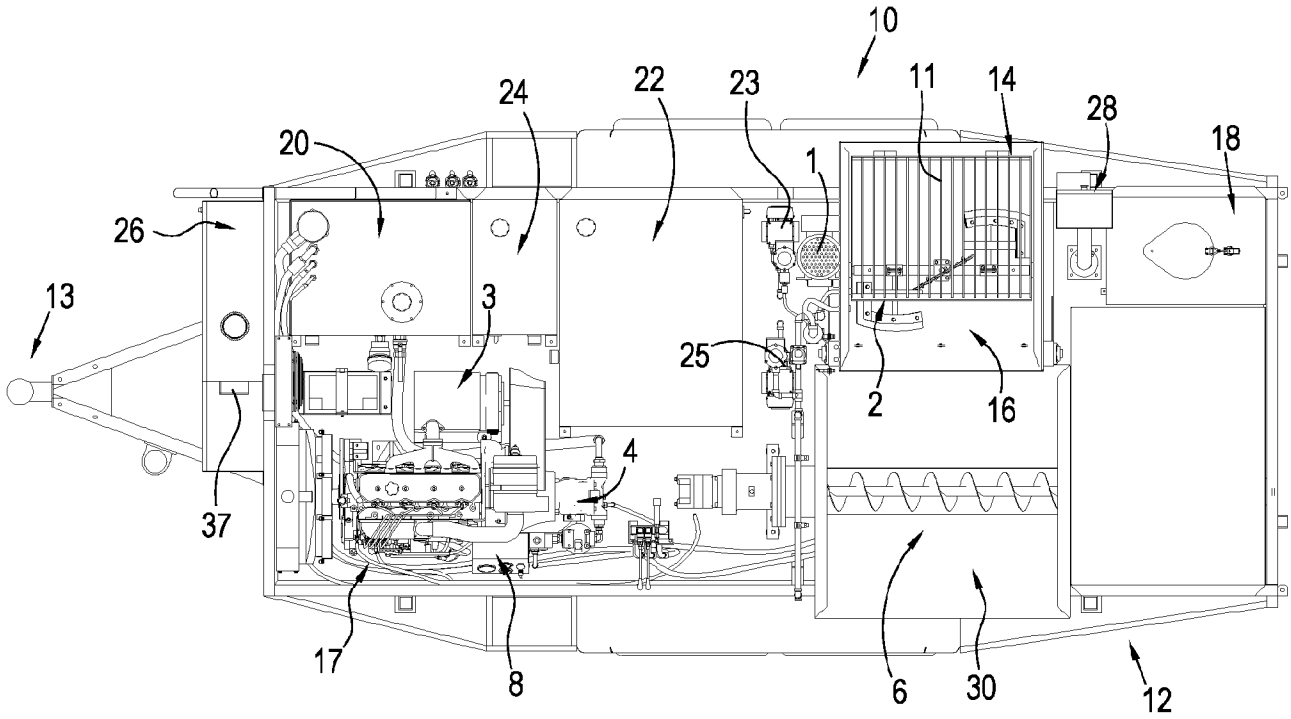
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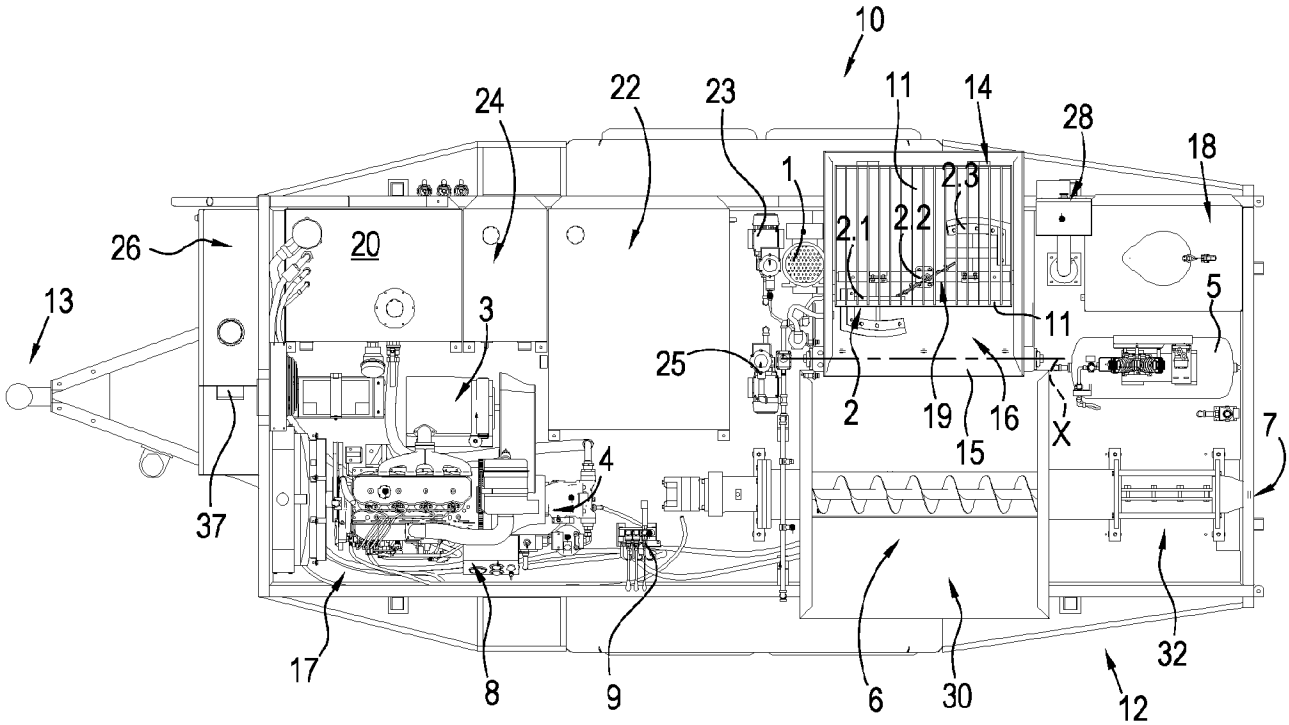
Fig. 2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11
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2
19
16
15
X
7
4
37
17
8
9
6
30
32
12

Fig. 3.1

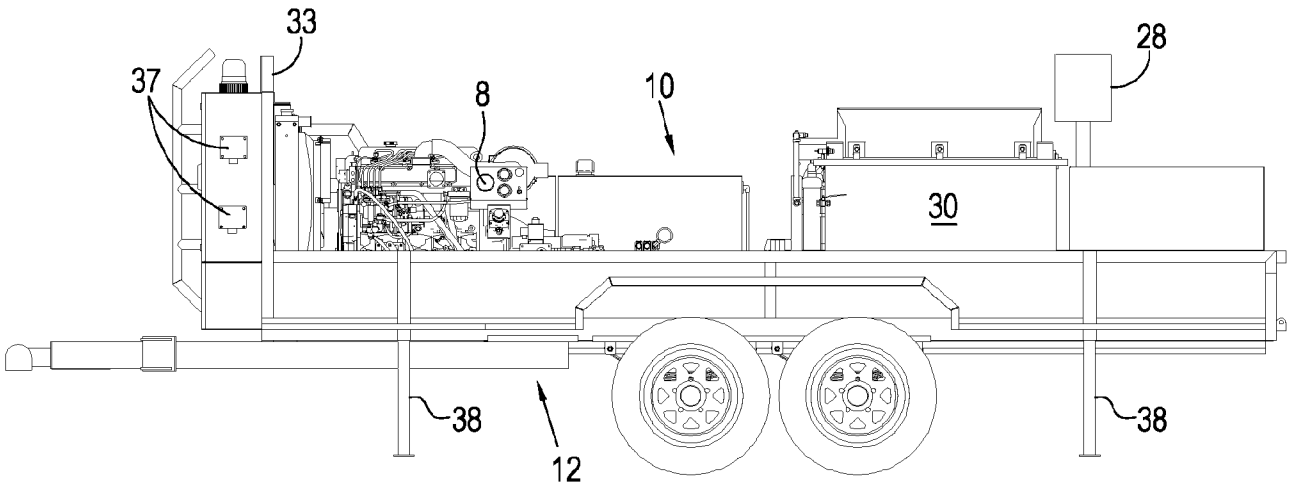

Fig. 3.2

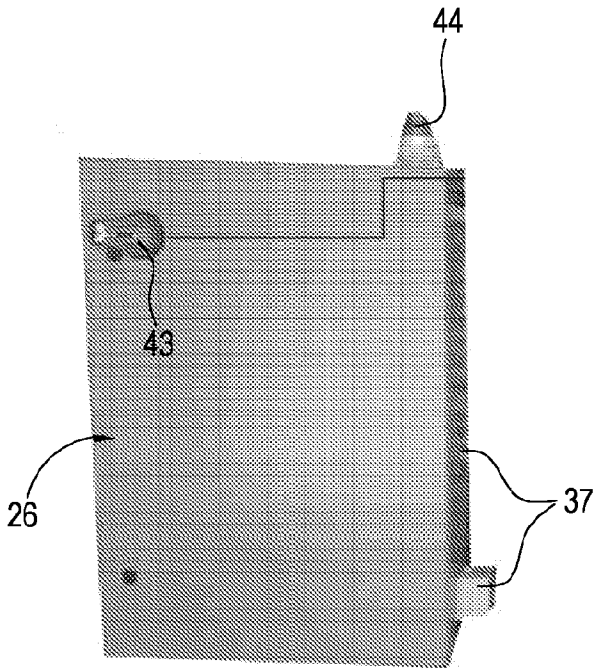

Fig. 4.1

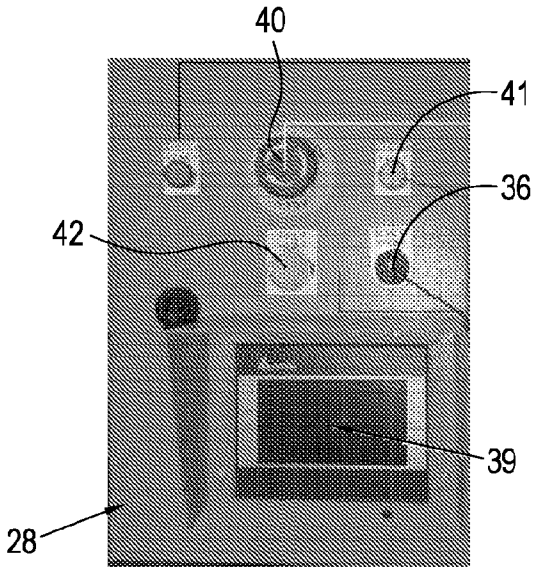

Fig. 4.2

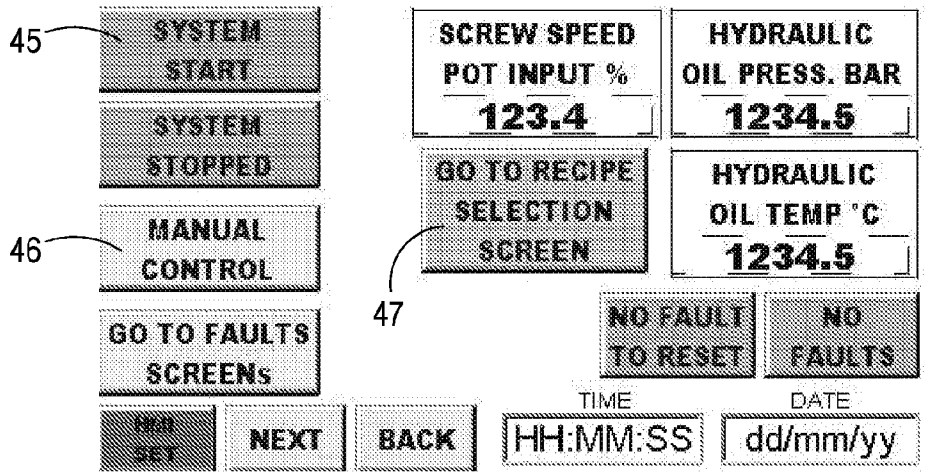
45
SYSTEM START
SYSTEM STOPPED
46
MANUAL CONTROL
GO TO FAULTS SCREENs
SCREW SPEED POT INPUT %
123.4
HYDRAULIC OIL PRESS. BAR
1234.5
GO TO RECIPE SELECTION SCREEN
47
HYDRAULIC OIL TEMP °C
1234.5
NO FAULT TO RESET
NO FAULTS
TIME
DATE
HH:MM:SS
dd/mm/yy
NEXT
BACK

Fig. 5

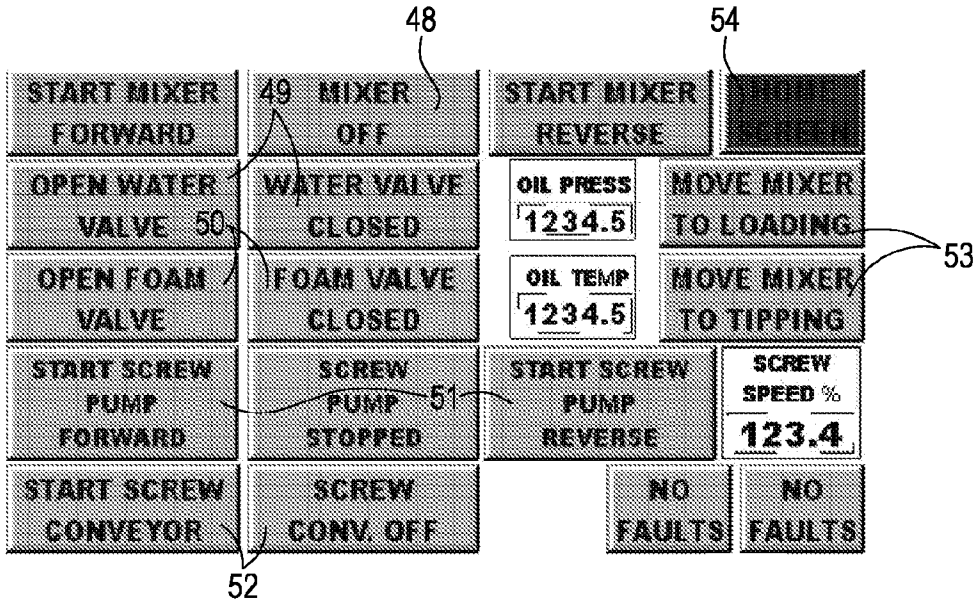
48
54
START MIXER FORWARD
49
MIXER OFF
START MIXER REVERSE
OPEN WATER VALVE
50
WATER VALVE CLOSED
OIL PRESS
1234.5
MOVE MIXER TO LOADING
53
OPEN FOAM VALVE
FOAM VALVE CLOSED
OIL TEMP
1234.5
MOVE MIXER TO TIPPING
START SCREW PUMP FORWARD
SCREW PUMP STOPPED
51
START SCREW PUMP REVERSE
SCREW SPEED %
123.4
START SCREW CONVEYOR
SCREW CONV. OFF
NO FAULTS
NO FAULTS
52

Fig. 6

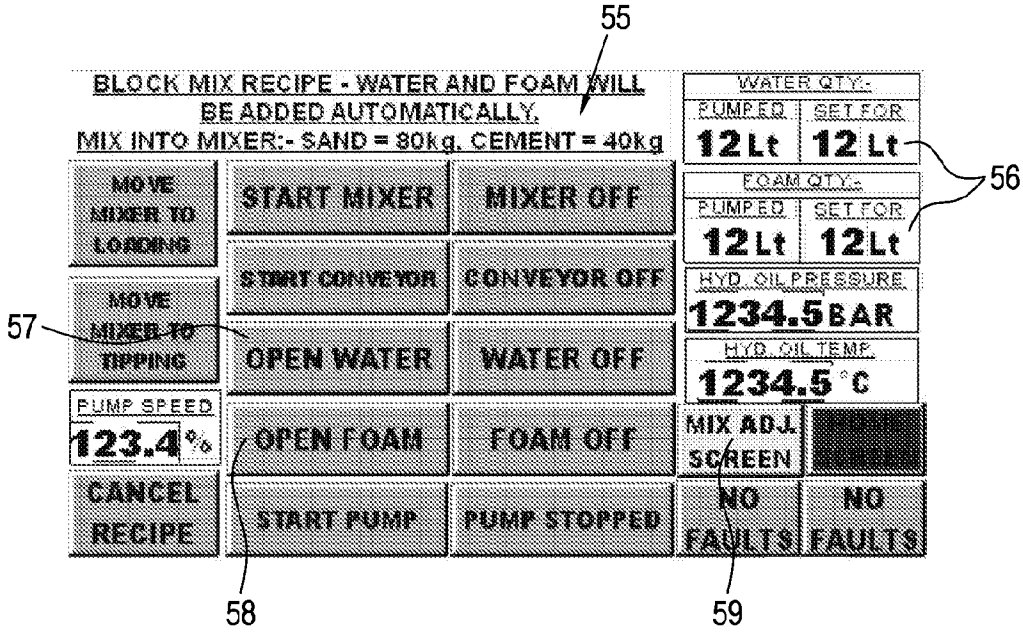
55
BLOCK MIX RECIPE - WATER AND FOAM WILL BE ADDED AUTOMATICALLY.
MIX INTO MIXER:- SAND = 80kg, CEMENT = 40kg
WATER QTY:-
PUMPED
SET FOR
12 Lt
12 Lt
FOAM QTY:-
PUMPED
SET FOR
12 Lt
12 Lt
56
MOVE MIXER TO LOADING
START MIXER
MIXER OFF
START CONVEYOR
CONVEYOR OFF
HYD OIL PRESSURE
1234.5 BAR
MOVE MIXER TO TIPPING
57
OPEN WATER
WATER OFF
HYD OIL TEMP
1234.5 °C
PUMP SPEED
123.4 %
OPEN FOAM
FOAM OFF
MIX ADJ. SCREEN
CANCEL RECIPE
START PUMP
PUMP STOPPED
NO FAULTS
NO FAULTS
58
59

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT / IB 2020/050825

A. CLASSIFICATION OF SUBJECT MATTER

IPC: ***B28C 5/42***

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

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)

EPODOC, WPI, TXTG

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 20090050385 A (WON CONSTRUCTION ENGINEERING CO., LTD, CONSTRUCT&ENVIRONMENT, JEONG, KWANG BOK, WON ENGINEERING) 20 May 2009 (20.05.2009) whole document	1-19
A	CN 202336936 U (SHANDONG LUQIAO GROUP CO., LTD) 18 July 2012 (18.07.2012) whole document	1-19
A	EP 2366518 A2 (LIEBHERR-MISCHTECHNIK GMBH) 21 September 2011 (21.09.2011) whole document	1-19

☐ 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

"E" 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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 April 2020 (28.04.2020)	18 June 2020 (18.06.2020)
Name and mailing address of the ISA/AT Austrian Patent Office Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24-535	Authorized officer WANKMÜLLER A. Telephone No. +43 / 1 / 534 24-415

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT / IB 2020/050825

Patent document cited in search report			Patent family member(s)			Publication date
KR	A	20090050385	KR	A	20090050385	2009-05-20
CN	U	202336936	CN	U	202336936	2012-07-18
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			DE	U1	202010003642	2011-07-12
			CN	A	102189601	2011-09-21