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(54) **Mobile concrete mixing apparatus.**

(57) The apparatus 1 is mounted on a lorry 3 and comprises a frame 10, and a sand and aggregate hopper 13, a cement hopper 16 and water storage tanks 19 mounted on the frame. A mixing drum 45 is provided for mixing quantities of sand and aggregate and cement supplied from the hoppers 13, 16 with a quantity of water supplied from the tanks 19 to produce the required mix. The sand and aggregate is supplied to an opening 51 of the drum 45 by a belt conveyor 20 positioned below the hopper 13, and the cement is supplied to the opening 51 by a screw conveyor 36 by way of a discharge chute 43. The mix may be held within the drum 45 until required for use and may be discharged from the opening 51 by tipping the drum 45.

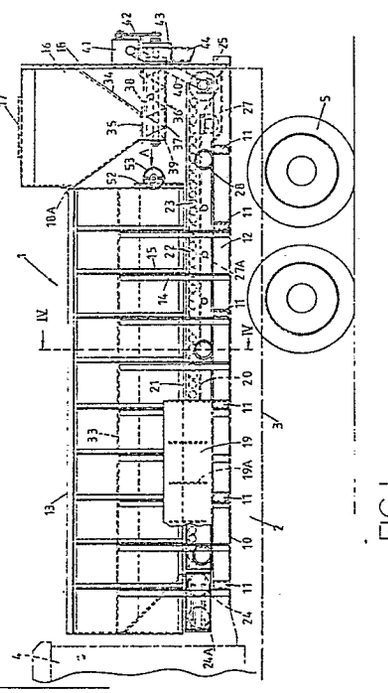

FIG.1.

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Description

Mobile Concrete Mixing Apparatus

This invention relates to mobile concrete mixing apparatus. By "concrete mixing apparatus" is meant apparatus for mixing cement with granular and/or powdered materials and a wetting agent such as water in order to produce a mix of concrete, mortar or the like.

It is common practice to transport concrete in a ready-mixed and therefore wetted condition. However, once water has been added to the mix, the setting process inevitably begins, and this means that there is little time available for working the concrete after delivery at the site before the concrete sets. Furthermore, with this method of delivery, it is both impractical and uneconomic to supply small quantities of concrete.

British Patent Specification No. 1039724 discloses concrete mixing vehicle which includes a storage container for mixed aggregate, sand and cement in the dry state, a water tank and a mixing device in the form of a screw conveyor to which the dry materials and water are supplied. The conveyor provides both mixing and conveying of the resultant mix to a point at a rear of the vehicle from which the mix is continuously discharged.

U.S. Patent Specification No. 3310293 discloses similar apparatus including separate containers for cement and for sand and gravel. The dry materials are supplied to a belt conveyor from which they are discharged into a mixing trough in which they are mixed with water by a screw conveyor which simultaneously conveys the mix towards an outlet from which it is continuously discharged.

These previous arrangements suffer from various disadvantages. Since the concrete is mixed and discharged in a single operation, it is not possible to hold the mix in the apparatus until required for use. Furthermore there will be a tendency for the screw conveyor to become clogged with concrete rendering it difficult to clean, particularly if some of the concrete has hardened.

It is an object of the invention to provide improved mobile concrete mixing apparatus.

According to the invention there is provided mobile concrete mixing apparatus comprising a frame for mounting on a vehicle, a first storage container mounted on the frame for storing a first component in a dry state, a second storage container mounted on the frame for storing a second component in a dry state, a third storage container mounted on the frame for storing water, and mixing means for mixing quantities of the first and second components supplied from the first and second storage containers with a quantity of water supplied from the third storage container to produce the required mix, characterised in that the mixing means comprises a rotatable mixing drum within which the mix is held until required for use having an opening to which the components and the water are supplied by conveying means.

In order that the invention may be more fully understood, a preferred embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic side view of the apparatus, with portions cut away;

Figure 2 is a diagrammatic side view of a further portion of the apparatus;

Figure 3 is a diagrammatic rear view of the apparatus;

Figure 4 is a cross-section taken along the line IV-IV in Figure 1; and

Figure 5 is a view of part of the apparatus in the direction of the arrow A in Figure 1.

The illustrated apparatus 1 is shown in Figure 1 mounted on the chassis 2 of a lorry 3 having a driving cab 4 and wheels 5. The lorry 3 has an engine (not shown) which generates hydraulic pressure in a hydraulic fluid system, and may also include a power take-off shaft.

The apparatus 1 includes a frame 10 comprising spaced box-section members 11 extending the full width of the frame and longitudinal box-section members 12 extending between the members 11 and connected thereto. The frame 10 may be bolted to the chassis 2 of the lorry 3.

An open-topped hopper 13 for sand and aggregate is mounted on the frame 10 by means of support plates 14 (see Figure 4) secured to the frame 10 and to strengthening members 15 secured to the inclined sides of the hopper 13. Furthermore a closed hopper 16 for cement having a lid 17 is mounted on the frame 10 by means of box-section support members 18, as best seen in Figure 3, and also by means of brackets 18A connected to the hopper 13. In addition two water storage tanks 19 are mounted on the transverse members 11 on opposite sides of the frame 10 and are of, sufficient size to accommodate the quantity of water required in use (although broken away in Figure 1 in order to render the figure easier to read). Baffles 19A are disposed within the tanks 19 to prevent surging of the water during transport, the spaces on each side of each baffle 19A being placed in communication by means of gaps above and below the baffle 19A.

A belt conveyor 20 is disposed below a longitudinal outlet slot 21 extending the full length of the bottom of the hopper 13 and comprises a continuous belt 22 having an upper run supported by free-running rollers 23 and receiving thereon mixed aggregate and sand from the hopper 13. If required for a particular application, the free-running rollers 23 may be replaced by plates which support the upper run of the belt 22 from below and which preferably incorporate free-running rollers spaced at intervals along the length of the upper run. The belt 22 passes over a free-running end roller 24 and a further end roller 25 driven by a hydraulic motor 26 (see Figure 2). The belt 22 is tensioned by a standard screw-type tensioning device 24A acting on the roller 24, and in addition the lower run of the belt 22 is engaged from below by a snub roller 27 and by support idling rollers 27A for tracking the belt 22.

The conveyor 20 is mounted on the frame 10 by means of six rollers 28 which engage two parallel rails 29 on the frame 10, as best seen in Figure 3, so as to enable the conveyor 20 to be withdrawn from its position beneath the hopper 13 by running along the rails 28, for cleaning or maintenance. Three rollers 27 are mounted on each of two side members 29 and 30 of the conveyor 20 on stub axles 31 allowing the rollers 27 to freely rotate. The side members 29 and 30 of the conveyor 20 are connected together by spacer bars 32 (see Figure 4).

Although not specifically shown in the drawings, it should be appreciated that, when the conveyor 20 is in its operative position beneath the hopper 13, the rollers 27 are received in ramped depressions so that, as the rollers 27 enter these depressions as the conveyor 20 is moved into its operative position, the conveyor 20 is lowered so that the side members 29 and 30 rest on parts of the frame 10.

As shown in Figure 4, the hopper 13 incorporates a longitudinal member 33 therein which, as shown in the figure, is of substantially inverted V-shaped cross-section, but which may also be of diamond-shaped cross-section. The purpose of this member 33 is to prevent compaction of the materials within the hopper 13 and to enable the materials to flow easily through the outlet slot 21, as well as to prevent damage to the conveyor 20 when the hopper 13 is being loaded.

The cement hopper 16 has inclined side walls 34 which converge towards a central outlet aperture 35 which opens into a screw conveyor 36 comprising a duct 37 incorporating a feed auger 38. The auger 38 is mounted on a horizontal shaft 39 which is driven by the hydraulic motor 26 by way of a chain 40, a variable speed unit 41 and a further chain 42. The variable speed unit 41 enables the ratio of the speed of the belt conveyor 20 to the speed of the screw conveyor 36 to be varied. The duct 37 communicates with a downwardly extending discharge having a portion 44 which is removable to enable the conveyor 20 to be withdrawn from its position below the hopper 13. The discharge chute 43 includes a manually operable shut-off gate (not shown) by means of which the chute 43 and the screw conveyor 36 may be isolated from the outside when not in use so as to prevent penetration of moisture into the chute 43, the conveyor 36 and the hopper 16.

Although not shown in Figure 1, it will be appreciated from Figure 2 that a rotatable mixing drum 45 having an upper opening 51 is connected to the frame 10 by a sub-frame 46. A hydraulic motor (not shown) mounted on the sub-frame 46 is arranged to drive the drum 45 about an axis 47 of rotation. The drum 45 may also be pivoted about a transverse axis 48 by rotating a handwheel 49 acting through gearing 50. Either by manual operation of the handwheel 48 or by automatic operation of hydraulic pivoting means, the drum 45 can be moved between tilt positions A, B and C representing respectively "fill", "mix" and "discharge" positions of the drum 45.

In the "fill" position A shown in Figure 2, the drum 45 has its upper opening 51 inclined upwardly towards the end of the conveyor 20 and the discharge chute 43 to receive the dry materials therefrom, and also to receive water from the water storage tanks 19 by way of a valved water outlet (not shown). Mixing initially takes place with the drum 45 in the "fill" position A, and further mixing generally occurs with the drum 45 in the "mix" position B, that is with the drum 45 pivoted so that its axis 47 lies along the line B in Figure 2, although mixing may also take place in any other convenient position in which the opening 51 is inclined upwardly. The drum is pivoted into the "discharge" position C in order to discharge the mix for use.

The sub-frame 46 is pivotally mounted on the frame 10 so that, on release of a catch, it can be swung downwardly to allow the conveyor 20 to be withdrawn for maintenance or cleaning. A hydraulic pump (not shown) is provided for supplying water under pressure from the water storage tanks 19 to the water outlet.

Figure 5 shows an adjustable gate assembly 52 located at the rear end of the hopper 13 and manually operable by a handwheel 53. The assembly 52 comprises an adjustable plate 54 mounted between guides 55 so as to be slidable vertically to vary the amount of an opening 56 in the end of the hopper 13 uncovered by the plate 54. The plate 54 incorporates a rack 57 which engages with a gear 58 on a shaft 59 to which the handwheel 53 is connected so that rotation of the handwheel 53 serves to adjust the vertical position of the plate 54 and hence the amount of the opening 56 uncovered by the plate 54. The gate assembly 52 is located above the upper run of the conveyor belt 22 so that the quantity of sand and aggregate which is permitted to pass on the belt 22 beyond the gate assembly 52 towards the mixing drum 45 is determined by the vertical position of the plate 54 above the upper surface of the belt 22. Thus the rate of supply of sand and aggregate to the mixing drum 45 at a particular conveyor speed may be varied by manual adjustment of the handwheel 53.

The apparatus is hydraulically powered from the hydraulic fluid system of the lorry 3, and in addition the electrical control circuits of the apparatus are powered from the electrical system of the lorry.

In operation, after loading of the apparatus with appropriate quantities of aggregate and sand, the cement and water, the vehicle is driven to the required site, and, with the mixing drum 45 in its "fill" position A, a push-button is depressed to actuate a hydraulic solenoid valve which starts the hydraulic motor for rotating the drum 45. An interlock system ensures that the drum 45 is in the correct position before filling of the drum begins. A further push-button is then depressed to actuate a hydraulic solenoid valve to start the hydraulic motor 26 to drive the belt conveyor 20 and the screw conveyor 36. As the upper run of the belt 22 moves rearwardly towards the drum 45, it takes with it a quantity of aggregate and sand from the bottom of the hopper 13 which is regulated by the gate assembly 52 and which is delivered into the opening 51 of the drum 45. At the same time a proportional quantity of cement is

supplied by the screw conveyor 36 from the hopper 16 to the drum 45 by way of the discharge chute 43. When sufficient dry materials have been delivered to the drum 45, the motor 26 is stopped by closing of the solenoid valve to stop the conveyors 20 and 36.

Water is added from the storage tanks 19 to the drum 45 either at the same time as or subsequent to the supply of materials, either by operation of a further solenoid valve or automatically depending on the required mode of use. When the required mix consistency is achieved, the drum 45 is either pivoted into the "mix" position B in which further mixing takes place until the mix is required for use, or the drum 45 is pivoted directly into the "discharge" position C in which the mix is discharged from the drum 45 for use. If only some of the mix is required to be discharged initially, the drum 45 may be returned to the "mix" position for further mixing of the remaining mix until required for use, and further water may be added to the remaining mix from the water outlet if required. If the delivery of concrete required is to comprise more than one batch, the cycle is then repeated to prepare a further batch for use. A counter may be provided for automatically registering the number of batches dispensed.

A hold button is provided to enable a cycle to be interrupted if required, for example to enable variations to be made in the quantities of materials supplied to the drum 45. Furthermore the speed of the motor 26 may be regulated in order to vary the rate of supply of materials to the drum 45.

The apparatus may also include other features for ease of operation. A further hydraulic motor may be provided for use in the event of the motor 26 failing. Also a pull cable may be provided to stop rotation of the drum 45, or to stop the whole apparatus, in an emergency. Also a manually operable hose connected to the water storage tanks 19 may be provided for washing concrete from parts of the apparatus or from the area around the vehicle.

In a modification of the apparatus described the cement hopper 16 additionally includes an auger extending horizontally across the full width of the hopper 16 and having two sets of opposite helical blades arranged to convey cement inwardly within the hopper 16 towards a central position above the outlet aperture 35 to the screw conveyor 36.

The apparatus described is particularly advantageous as it enables mixing of concrete to take place on site immediately prior to discharge for use, and permits economic supply of small quantities of concrete. The fact that mixing takes place within the mixing drum means that the mix need only be dispensed when required and minimal cleaning of the apparatus is required after mixing.

Claims

1. Mobile concrete mixing apparatus comprising a frame (10) for mounting on a vehicle, a first storage container (13) mounted on the frame for storing a first component in a dry state, a second storage container (16) mounted on the frame for storing a second component in a dry state, a third storage container (19) mounted on the frame for storing water, and mixing means for mixing quantities of the first and second components supplied from the first and second storage containers (13, 16) with a quantity of water supplied from the third storage container (19) to produce the required mix, characterised in that the mixing means comprises a rotatable mixing drum (45) within which the mix is held until required for use having an upper opening (51) to which the components and the water are supplied by conveying means (20, 36).

2. Mobile concrete mixing apparatus according to claim 1, characterised in that the mixing drum (45) is capable of being tipped to discharge the mix through the opening (51).

3. Mobile concrete mixing apparatus according to claim 1 or 2, characterised in that the conveying means includes a belt conveyor (20) for conveying a quantity of the first component in the dry state from the first storage container (13) to the mixing drum (45).

4. Mobile concrete mixing apparatus according to claim 3, characterised in that the belt conveyor (20) is mounted on the frame (10) by means of rollers (28) so as to enable the conveyor to be withdrawn for cleaning or maintenance.

5. Mobile concrete mixing apparatus according to claim 3 or 4, characterised by adjustable gate means (52) located above an upper surface of the belt conveyor (20) on which the first component is conveyed and adjustable in height to vary the quantity of the first component which is permitted to pass beyond the gate means (52) towards the mixing drum (45).

6. Mobile concrete mixing apparatus according to claim 3, 4 or 5, characterised by a second component discharge chute (43) for supplying a quantity of the second component directly into the upper opening (51) of the mixing drum (45) without said quantity of the second component contacting the belt conveyor (20).

7. Mobile concrete mixing apparatus according to claim 6, characterised in that the second component discharge chute (43) includes a shut-off gate.

8. Mobile concrete mixing apparatus according to any preceding claim, characterised in that the conveying means includes a screw conveyor (36) for conveying a quantity of the second component in the dry state from the second storage container (16) to the mixing drum (45).

9. Mobile concrete mixing apparatus according to any preceding claim, characterised in that the conveying means includes respective conveyors (20, 36) for conveying quantities of the first and second components towards the mixing drum (45), the conveyors (20, 36) being driven by a common drive (26) and at least one of the conveyors incorporating speed varying means (41) by means of which the relative conveying speeds of the conveyors (20, 36) may be varied.

10. Mobile concrete mixing apparatus according to any preceding claim, characterised in that the mixing

drum (45) is mounted on a sub-frame (46) which is coupled to the frame (10) and which is pivotable downwardly for cleaning or maintenance.

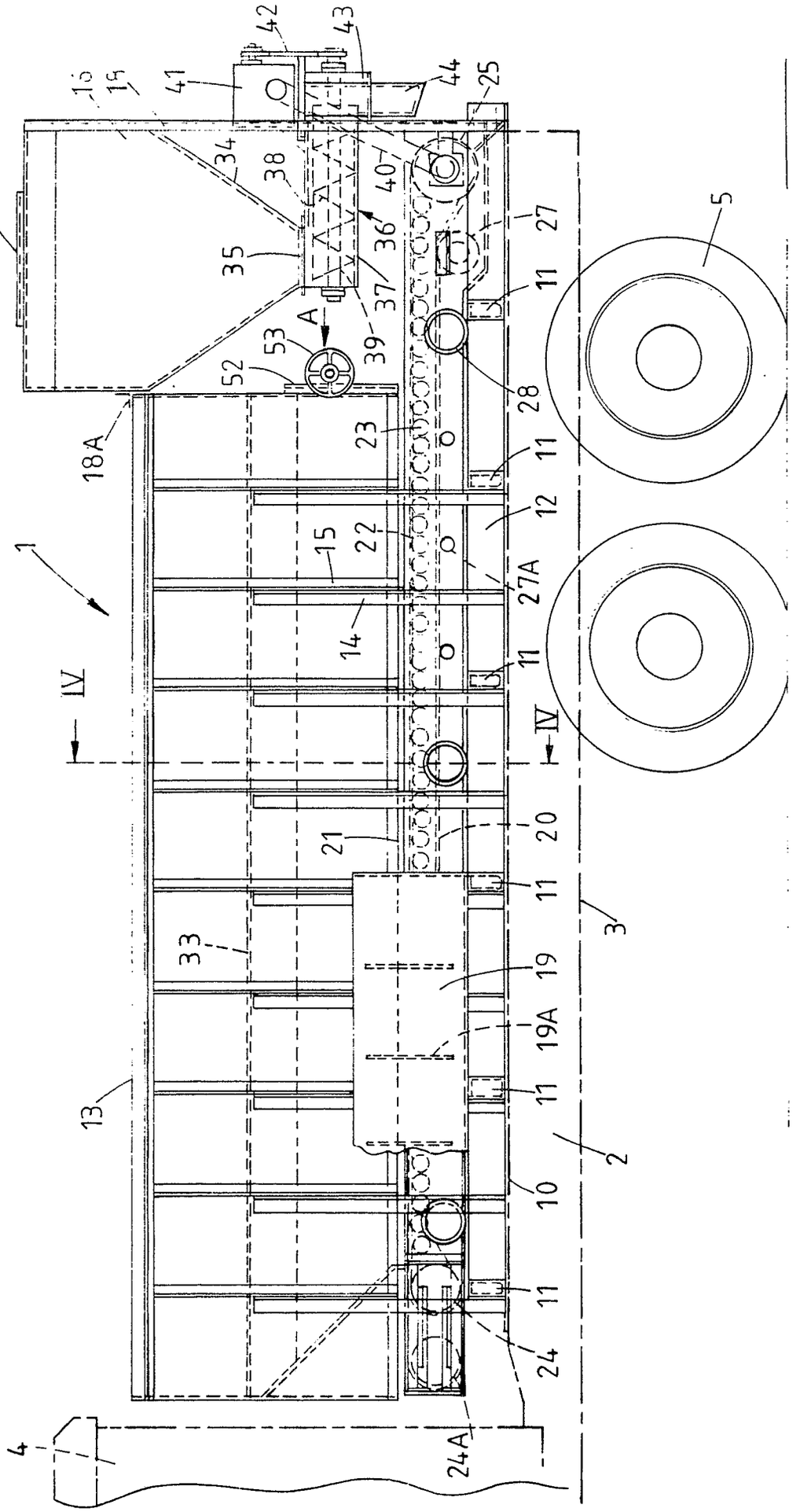
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FIG.1.

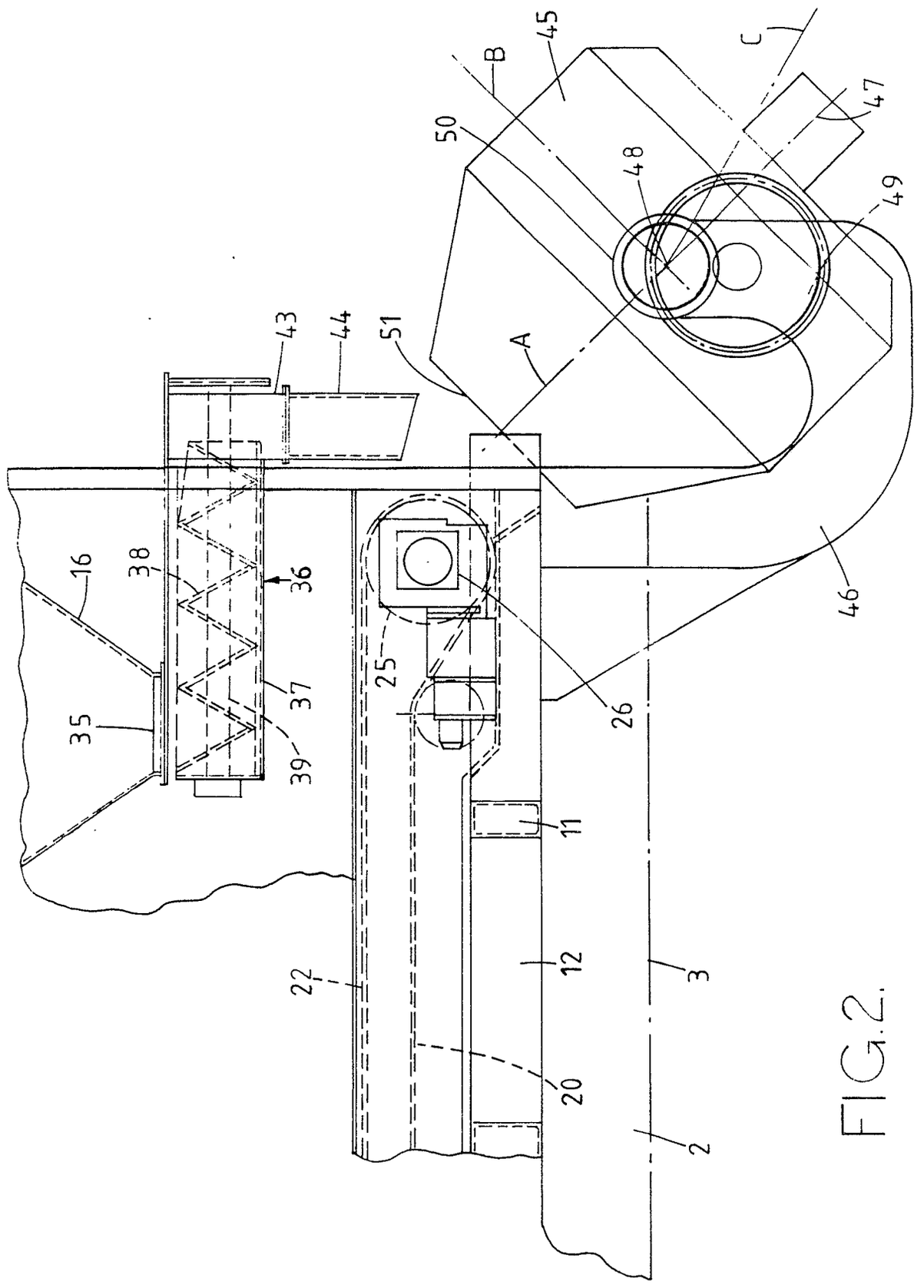

FIG.2.

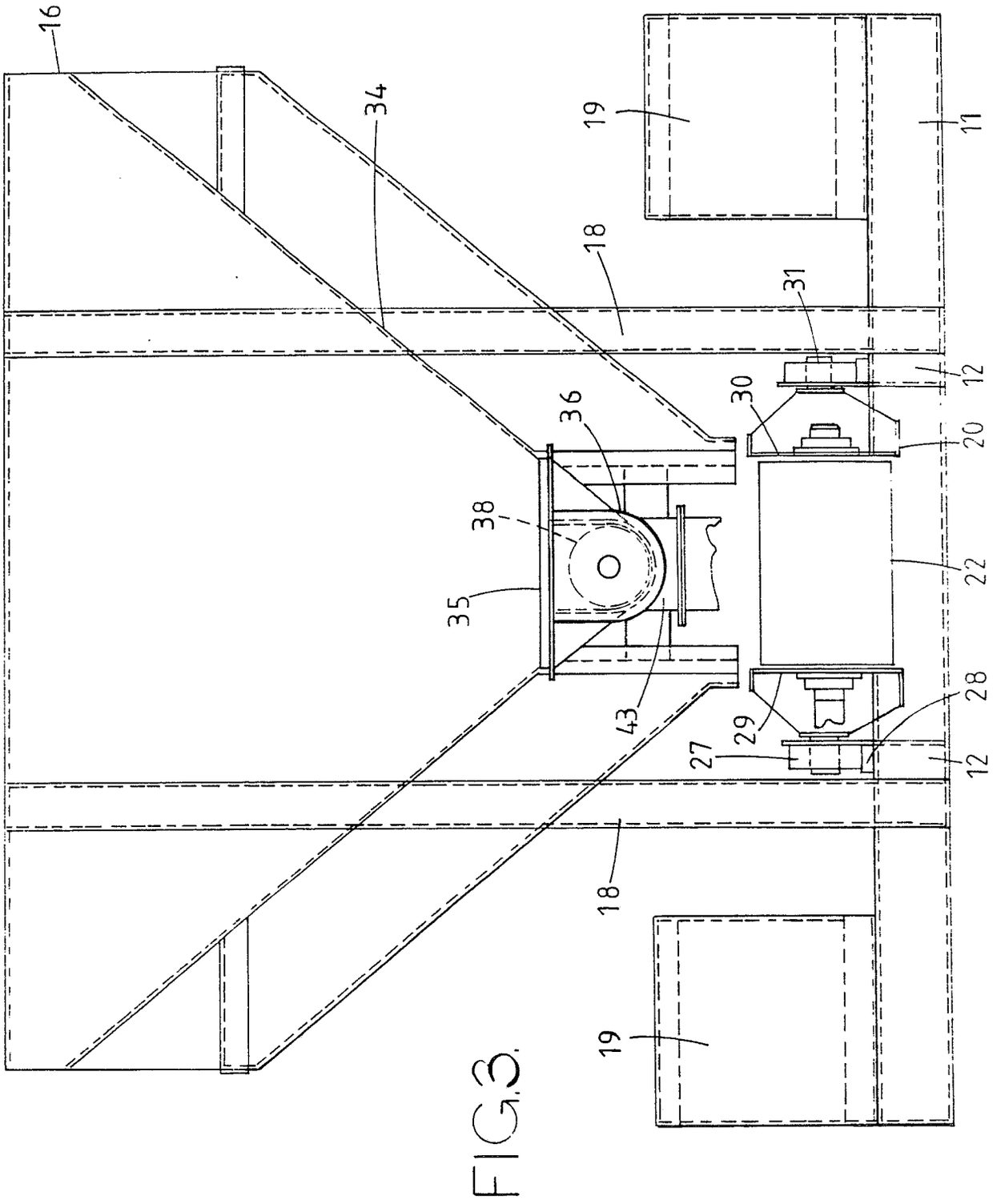

FIG.3.

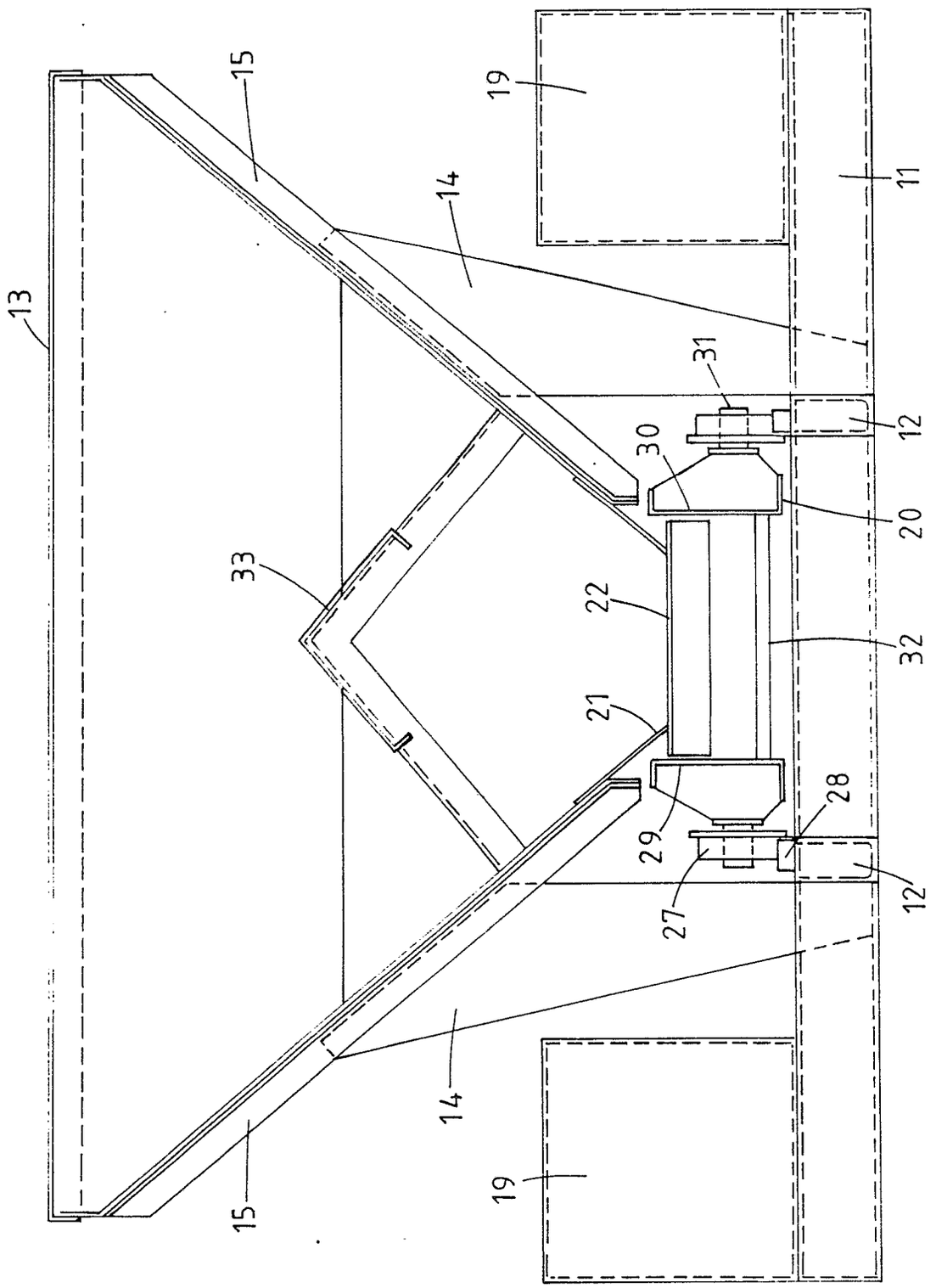

FIG. 4.

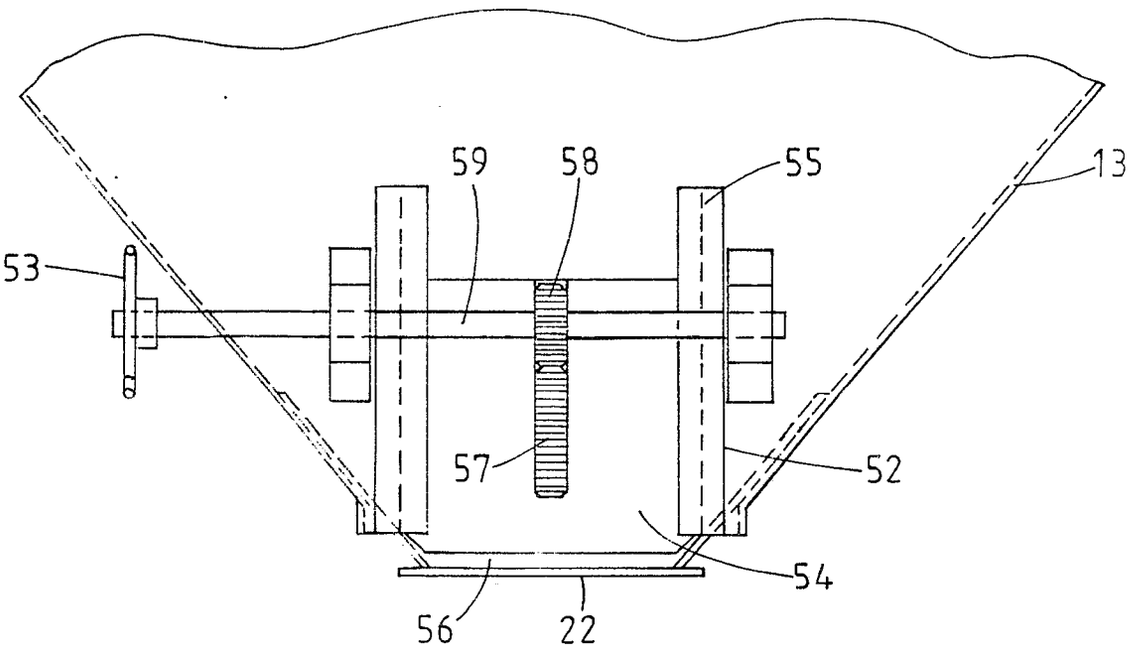

FIG.5.