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APPARATUS FOR MANUFACTURING BATCH TYPE DOUBLE MIXED COLD
ASPHALT MIXTURE AND METHOD THEREFOR

Technical Field

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The present invention relates to an apparatus for manufacturing a batch type double mixed cold asphalt mixture that can be manufactured with a granularity appropriate for road pavement with recycled asphalt in cold state without heating it up and a method therefor; and, more particularly, to an apparatus and the method for manufacturing a batch type double mixed cold asphalt mixture wherein virgin aggregates and recycled asphalt are inputted in a batch type and coated with a predetermined asphalt emulsion effectively.

15

Background Art

In general, there are three kinds of asphalt mixtures: hot-mix asphalt mixture that is manufactured by being heated up; cutback asphalt mixture, manufactured with petroleum being used as a solvent; and cold-mix asphalt emulsion mixture, manufactured with water based asphalt emulsion without heat.

The hot-mix asphalt mixture requires a great deal of heat in the manufacturing procedures. Particularly, due to a dramatic increase in the volume of traffic that surpasses the capacity of a road, the oxidation deterioration action of asphalt components during the manufacturing process may form cracks by cementing and deteriorating the asphalt mixture. Cutback asphalt can be manufactured at a normal temperature without heating procedure but it must use expensive petroleum as a solvent. Other European countries and U.S.A are regulating the use of it because its high oil content exhausts oil into streams and soil during the curing after construction and pollutes the environment.

As a solution to the above problem, suggested is an

apparatus for manufacturing cold-mix asphalt emulsion mixture which can manufacture a product with granularity appropriate for road pavement materials in cold state where the aggregates and asphalt are not heated, that is, at a
5 ambient temperature. With no need to be heated, the mixture obtained from this apparatus can save energy. Moreover, it is environment-friendly and it can take recycled asphalt pavement (RAP) as resources and use it continuously.

In addition, when the cold-mix asphalt mixture is
10 manufactured, the oxidation deterioration action that directly contributes to the deterioration of asphalt does not occur, and the air is not polluted because the problem of hot-mix asphalt mixture that it emits much carbon dioxide is solved. The cold asphalt mixture is very economical
15 because it's free from the effect of temperature and it can be kept after production, while a hot asphalt mixture should be used in time or, stored in a special silo for 2-3 days and its remainder after the use has to be disused.

Conventionally, as an apparatus for manufacturing the
20 cold asphalt mixture with this positive property, a continuous type plant has been used.

Referring to Fig. 1, the continuous type apparatus is for manufacturing cold-mix asphalt emulsion mixture by putting aggregates with different granularities into each of
25 the separately set-up three hoppers 101, 102, 103, inputting them to the mixer 105 while mixing and providing them to the tilting conveyer 104 continuously, and putting water and bituminous emulsion asphalt into the mixer 105. It can control granularity very well and improve quality. With a
30 wheel on it, this apparatus can be moved easily. However, the continuous type apparatus for manufacturing cold-mix asphalt emulsion mixture has a bridge effect that hinder easy ladle-out caused by adhesive RAP or virgin aggregates containing moisture stuck to the incline plane, while the
35 RAP (recycled asphalt pavement) is taken out of the inversed-trapezoid-shaped hopper.

In other words, the recycled aggregates, which are waste aggregates made of crushed or selected RAP, has adhesiveness to each other by the atmospheric temperature and gravity because they have a great deal of small particles and asphaltic components. Also, the properties of waste aggregates getting lumped together and solid in a hopper stops the supply of the aggregates and hinder normal production, as only those in the lower end part of the hopper are put out leaving the sticky waste aggregates accumulated on the incline plane.

In addition, it's difficult to mix aggregates in a mixer with a fixed amount of asphalt emulsion, because large size aggregates, medium size aggregates and fine aggregates inputted in the respective three hoppers are conveyed while being provided to the conveyer and mixed continuously.

In particular, with short mixing time, a continuous type plant can hardly coat aggregates of large particles with asphalt emulsion, so it may be used for a low volume road but cannot be used for high volume road, for instance, for the surface of a road pavement.

Disclosure of Invention

It is, therefore, an object of the present invention to provide an apparatus for manufacturing a batch type double mixed cold asphalt mixture and method therefor.

In accordance with one aspect of the present invention, there is provided an apparatus for manufacturing a batch type double mixed cold asphalt mixture, the apparatus comprising: a plurality of hoppers for inputting aggregates with different granularity in order of coarse aggregates to fine aggregates; a conveyer unit placed under the plurality of hoppers, for conveying the aggregates therefrom; a mixing unit placed at the vertical end of the conveyer unit, for mixing an asphalt emulsion injected from outside into the conveyed and dropped coarse aggregates on a first time and

then mixing the fine aggregates with the primary mixture of the coarse aggregates and asphalt emulsion on a second time, and discharging the mixture; and an asphalt emulsion supply unit for providing a predetermined amount of asphalt
5 emulsion into the mixing unit, wherein the plurality of hoppers arrayed in order from one for coarse aggregates to one for fine aggregates and the aggregates are provided onto the conveyer unit in a batch type.

In accordance with one aspect of the present invention,
10 there is provided a method for manufacturing a batch type double mixed cold asphalt mixture, the method comprising the steps of: a) separating aggregates with different granularity into coarse aggregates and fine aggregates and putting them into a plurality of hoppers, respectively; b)
15 conveying the aggregates let out of the respective hoppers in a batch type to a mixer in order of coarse aggregates to fine aggregates; C) inputting in the mixer the coarse aggregates and such additives as an asphalt emulsion in a predetermined ratio and mixing the aggregates and the
20 asphalt emulsion together; d) inputting the fine aggregates into the first mixture of the coarse aggregates and asphalt emulsion, and mixing them on a second time; and e) discharging the asphalt mixture mixed in the mixer.

25 Brief Description of Drawings

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in
30 conjunction with the accompanying drawings, in which:

Fig. 1 represents a schematic view of a conventional continuous type apparatus for manufacturing cold-mix bituminous emulsion asphalt;

Fig. 2 is a schematic view illustrating the process for
35 manufacturing a batch type double mixed cold asphalt mixture in accordance with an embodiment of the present invention;

Figs. 3A and 3B show a front-view and a plane figure of an apparatus for manufacturing a batch type double mixed cold asphalt mixture in accordance with an embodiment of the present invention; and

5 Figs. 4A and 4B are a plane figure and a side view depicting the configuration of a hopper in accordance with an embodiment of the present invention.

Best Mode for Carrying Out the Invention

10 Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. With reference to the accompanying
15 drawings, an embodiment of the present invention is described below.

An apparatus for manufacturing a batch type double mixed cold asphalt mixture and method therefore are embodied to produce a stable cold-mix asphalt emulsion mixture by
20 putting virgin aggregates and fine recycled aggregates obtained by crushing reclaimed asphalt pavement (RAP), together in a mixer in a batch type and mixing them with such an additive as an asphalt emulsion. As illustrated in Figs. 2 and 3, this embodiment is equipped with a plurality
25 of hoppers 2 for holding aggregates with large particles (i.e., coarse aggregates) and aggregates with small particles (i.e., fine aggregates) that have different granularities to each other; a scale hopper 2 placed on the perpendicular lower part of the hoppers 1, for measuring the
30 aggregates coming therefrom in a predetermined weight and discharging them; a belt conveyer 3 provided in the lower part of the scale hopper 2, for transferring the aggregates from the scale hopper 2, thus the aggregates being provided and conveyed in order of coarse aggregates to fine
35 aggregates from the hoppers 1 onto the belt conveyer 3 in a batch type.

The present embodiment shows an example where four
hoppers 1 are arranged on a straight line, and in the lower
part of each, two or more outlets 1A are formed. Each hopper
1 is inputted with one among coarse aggregates of 13mm, 20mm,
5 25mm and 40mm or fine aggregates including screenings of 6mm
size agreeably to the condition on granularity required by
the regular industrial standard or a specification.

Also, the fine aggregates inputted to the hopper 1 are
inputted in one or two hoppers among the four and in the
10 other hoppers, virgin aggregates such as pebbles or crushed
aggregates that belong to coarse aggregates are inputted.

Here, the fine aggregates are sands or, screenings or,
obtained by crushing lumps of reclaimed asphalt pavement
from road excavation works.

15 Referring to Figs. 4A and 4B, the hoppers 1 of the
present embodiment comprises a hopper body 31 provided with
a plurality of outlets in the lower part; a switching door
32 for opening and shutting the outlets of the hopper body
31; a driving cylinder 33 placed at a predetermined position
20 on the external incline plane of the hopper body 31, one end
of which is fixed on the switching door 32, for opening and
shutting the switching door by its expansion and contraction
movement.

In addition, the hopper for fine aggregates further
25 comprises an oscillator 4 for separating the aggregates
attached to an incline plane of the hopper 1.

The oscillator 4 includes a spring 36 for buffering
placed on the external surface of the hopper 1; a motor for
providing the buffering force to the spring 36; an
30 oscillation plate 38 placed on the internal surface of the
hopper 1, for moving up and down by the buffering force of
the spring 36 and hitting the incline plane of the hopper 1;
and a rubber plate 39 provided between the oscillation plate
38 and the incline plane, for increasing the efficiency of
35 oscillation.

This embodiment represents an example of adding an

oscillator as a means for getting rid of the aggregates attached to the incline plane of the hopper 1. However, this invention is not limited to it but scrapers for scraping them off the incline plane can possibly be added thereto, and the detailed description on this will be omitted since it is shared knowledge that can be embodied by those skilled in the art easily.

The vertical end of the belt conveyer 3 includes a mixer 5 for mixing the conveyed and dropped aggregates with an additive or an asphalt emulsion consisting of water, asphalt and a emulsifying agent and discharging them; an asphalt emulsion supply device 6 for providing a predetermined amount of asphalt emulsion into the mixer 5; and an additive supply device 7 equipped in the upper part of the mixer 5, for providing additives for increasing the adhesiveness of the aggregates mixed with asphalt emulsion inside, each time at a predetermined amount.

The asphalt emulsion supply device 6 includes an emulsifier tank 11; a supply pump 12 for providing asphalt emulsion into the asphalt emulsion tank 11; an electric heating line 14 for heating up asphalt emulsion provided through the supply pump 12; a three-way valve 14 placed at a predetermined position on the electric heating line 14, for converting the flow path of asphalt emulsion towards the asphalt emulsion tank 11 when suspending the production of cold-mix asphalt emulsion mixture temporarily; an emulsifier asphalt emulsion scale bin 15 for measuring asphalt emulsion provided through the three-way valve 14 to be inputted into the mixer 5 in a uniform amount; a surge tank 16 for containing asphalt emulsion discharged from the asphalt emulsion scale bin 15 and jetting it out into the mixer 5 by the flux fluctuation from the shaking of asphalt emulsion inside; a spray pump 17; a flux control valve 18 for controlling the amount of asphalt emulsion to be sprayed and flowed in the mixer through the spray pump 17; and a compressed air spray device 19 for spraying the emulsifying

agent provided through the flux control valve 18 with compressed air. Here, the flux control valve 18 is formed with a three-way valve for converting the flow path of asphalt emulsion towards the surge tank 16 when the
5 production of cold-mix asphalt emulsion mixture is suspended.

Also, the additive supply device 7 includes a silo 21 with additive inside; a discharge subsidiary device 22 set up on the outlet of the lower part of the silo 21, for letting out the additive smoothly; a rotary feeder 23 for
10 supplying the additive let out by the discharge subsidiary device 22; an additive scale bin 24 for measuring the additive provided by the movement of the rotary feeder 22; and a discharge valve 25 for providing the additive measured at the additive scale bin 24 to the mixer 5. Meanwhile, it
15 is still possible to add a powder supply device 8 and a liquid supply device 9 for providing pigments, transparent or not, to the mixer 5 in order to manufacture cold-mix asphalt emulsion mixture using RAP as recycled aggregates.

The powder supply device 8 includes a powder storage 41
20 for storing powdered pigment; a powder scale bin 42 for measuring the amount let out of the powder storage 41; and a discharge door 43 opened or closed so as to add the powder measured at the powder scale bin 42 to the aggregates conveyed by the belt conveyer 3.

The liquid supply device 9 is provided with a liquid
25 tank 51 for storing liquid such as liquid additives; a liquid supply pump 52 for providing the liquid in the liquid tank 51 to the mixer; a liquid storage 53 for storing the liquid provided by the liquid pump; a liquid scale bin 54
30 for measuring the amount of the liquid let out of the liquid storage 53; and a discharge valve 55 opened and closed for providing the liquid measured in the liquid scale bin 54.

The input amount of powder or liquid provided by the powder supply device B and the liquid supply device 9 is
35 commonly determined to occupy more or less 1 per cent of the whole asphalt emulsion mixture.

The procedures of the present invention of the above configuration will be described with reference to Fig. 2.

First of all, aggregates with different granularity are inputted to the four hoppers 1 according to the required granularity. At this moment, one or two among the four hoppers are inputted with fine aggregates including screenings and in the remaining hopper, coarse aggregates including medium size aggregates are inputted. In case the fine aggregates are RAP, they are inputted to a crushing device, crushed into granularity appropriate for the production of cold-mix asphalt emulsion mixture and inputted in the hopper 1.

The virgin aggregates and the fine aggregates inputted in the hopper 1 are measured in the scale hopper 2 established in the perpendicular lower part of the hopper, provided onto the conveyer 3 in a batch type and conveyed.

When the aggregates are let out of the hopper 1, the RAP and virgin aggregates stuck to the incline plane are scraped off and dropped into the outlet by giving oscillation force on the incline plane of the hopper 1 with the movement of the oscillator 4 set up to prevent the bridge effect.

When the aggregates let out of the respective hoppers 1 in a batch type are inputted to the mixer 5 through the conveyer 3, asphalt emulsion and additives are measured out in a predetermined amount at the asphalt emulsion supply device 6 and the additive supply device 7, inputted in the mixer 5 and the surface of the aggregates are coated with asphalt emulsion, thus the particles of the aggregates get stuck to each other by the adhesive component of asphalt emulsion and the additive.

The asphalt mixture manufactured through the mixing procedures is loaded on a truck through the outlet formed on the mixer 5.

The present embodiment arranges the hoppers 1 to have the mixture of the aggregates and asphalt emulsion coated

double in the mixer 5. That is, the hopper 1 containing coarse aggregates is placed in front so as for the coarse aggregate with a predetermined granularity to be provided onto the conveyer 3 first, followed by the hoppers 1 holding aggregates with smaller granularities as it goes back.

With this arrangement of hoppers 1, the coarse aggregates are put into the mixer 5 first and mixed with an appropriate amount of the emulsifying agent on a primary round. Then fine aggregates are inputted into the first mixture of coarse aggregates and asphalt emulsion in the mixer 5, and they are mixed on a second time adding the remaining asphalt emulsion therein. This way, the coating efficiency of the coarse aggregates is improved and the fine aggregates forms mastic, producing stable cold asphalt mixture.

As described above, the present invention coats the whole aggregate mixture with the marginal amount of asphalt emulsion efficiently and manufactures stable cold asphalt mixture by providing fine aggregates made of RAP and coarse aggregates to a conveyer in a batch type and putting them in the mixer 5 in order of coarse aggregates to fine aggregates.

That is, this invention addresses the problem of a continuous type plant that aggregates with large particles are not coated with an asphalt emulsion evenly by putting and mixing the fine aggregates in the primary mixture of coarse aggregates and asphalt emulsion on a second time, after having coarse aggregates and emulsifying agent inputted therein get mixed first and coating the asphalt emulsion on the coarse aggregates evenly. Therefore, the asphalt mixture manufactured in the method of the present invention has an advantage of high quality enough to be used for high volume roads with a little amount of asphalt emulsion, i.e., the least amount of an asphalt emulsion that can bring the optimum effect.

Also, when the aggregates in the hoppers are put out, the aggregates stuck on the incline plane of the hopper can

be easily taken off with oscillation force, thus improving the productivity and the machine operation rate because the aggregates supply doesn't halt.

5 While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. An apparatus for manufacturing a batch type double mixed cold asphalt mixture, the apparatus comprising:

5 a plurality of hoppers for inputting aggregates with different granularity in order of coarse aggregates to fine aggregates;

a conveyer means placed under the plurality of hoppers, for conveying the aggregates therefrom;

10 a mixing means placed at the vertical end of the conveyer means, for mixing an asphalt emulsion injected from outside into the conveyed and dropped coarse aggregates on a first time and then mixing the fine aggregates with the primary mixture of the coarse aggregates and asphalt
15 emulsion on a second time, and discharging the mixture; and

an asphalt emulsion supply means for providing a predetermined amount of asphalt emulsion into the mixing means,

wherein the plurality of hoppers arrayed in order from
20 one for coarse aggregates to one for fine aggregates and the aggregates are provided onto the conveyer means in a batch type.

2. The apparatus as recited in claim 1, wherein the
25 hopper for fine aggregates among the plurality of hoppers is inputted with fine aggregates obtained from crushed Reclaimed Asphalt Pavement (RAP).

3. The apparatus as recited in claim 1, further
30 comprising an additive supply means placed on one side of the mixing means, for providing an additive that will increase the adhesiveness of the aggregates to be mixed with the asphalt emulsion inside at a predetermined ratio.

35 4. The apparatus as recited in claim 2, further including an additive supply means placed on one side of the

mixing means, for providing an additive that will increase the adhesiveness of the aggregates to be mixed with the asphalt emulsion inside at a predetermined ratio.

5 5. The apparatus as recited in claim 1, further comprising an aggregate control means placed confronting to each other in the lower part of the plurality of hoppers, for controlling the amount of aggregates let out of the hoppers and providing the aggregates to the conveyer means.

10

6. The apparatus as recited in claim 1, further comprising a crushing means placed a predetermined space apart from the fine aggregate input hopper, for pulverizing the fine aggregates inputted therein according to
15 granularity.

7. The apparatus as recited in claim 2, further including a crushing means placed a predetermined space apart from the fine aggregate input hopper, for pulverizing
20 waste aggregates inputted therein according to granularity.

8. The apparatus as recited in claim 1, wherein the plurality of hoppers includes:

25 a hopper body formed with a multiple number of outlets in the lower part;

 a switching door for opening and shutting the outlets of the hopper body; and

30 a driving cylinder placed at a predetermined position on the external incline plane of the hopper body, of which one end is fixed on the switching door, for opening and shutting the switching door with the expansion and contraction movement.

9. The apparatus as recited in claim 1, further
35 comprising a separation means placed at a predetermined position of the one or more hoppers, for separating the

recycled aggregates stuck to the incline plane of the hopper.

10. The apparatus as recited in claim 8, further including a separation means placed at a predetermined position of the one or more hoppers, for separating the recycled aggregates stuck to the incline plane of the hopper.

11. The apparatus as recited in claim 9, wherein the separation means includes:

10 a spring placed on the external surface of the hopper, for buffering;

a motor for providing buffering force to the spring;

an oscillation plate placed on the internal surface of the hopper body, for providing oscillation force to the incline plane of the hopper by moving up and down with the buffering force of the spring; and

15 a rubber plate placed between the oscillation plate and the incline plane of the hopper body, for increasing the oscillation efficiency.

20

12. The apparatus as recited in claim 1, wherein the asphalt emulsion supply means includes:

an asphalt emulsion tank;

25 a supply pump for providing the asphalt emulsion in the asphalt emulsion tank;

a heating means for heating up the asphalt emulsion provided through the supply pump;

30 an asphalt emulsion scale bin for measuring out the asphalt emulsion conveyed through the heating means to be inputted in the mixing means in a uniform amount; and

an asphalt emulsion spray means for spraying the asphalt emulsion let out of the asphalt emulsion scale bin into the mixing means at a predetermined pressure.

35 13. The apparatus as recited in claim 12, further including a three-way valve placed at a predetermined

position on the heating means, for converting the flow path of the asphalt emulsion towards the asphalt emulsion tank when suspending the production of cold mix asphalt emulsion mixture temporarily.

5

14. The apparatus as recited in claim 1, wherein the additive supply means includes:

a silo with an additive inside;

10 a discharge subsidiary device set up on the outlet of the lower part of the silo, for sending out the additive smoothly;

a rotary feeder for supplying the additive let out by the discharge subsidiary device;

15 an additive scale bin for measuring out the additive provided by the movement of the rotary feeder; and

a discharge valve for providing the additive measured at the additive scale bin to the mixing means.

20 15. A method for manufacturing a batch type double mixed cold asphalt mixture, the method comprising the steps of:

a) separating aggregates with different granularity into coarse aggregates and fine aggregates and putting them into a plurality of hoppers, respectively;

25 b) conveying the aggregates let out of the respective hoppers in a batch type to a mixer in order of coarse aggregates to fine aggregates;

30 c) inputting in the mixer the coarse aggregates and such additives as an asphalt emulsion in a predetermined ratio and mixing the aggregates and the asphalt emulsion together;

d) inputting the fine aggregates into the first mixture of the coarse aggregates and asphalt emulsion, and mixing them on a second time; and

35 e) discharging the asphalt mixture mixed in the mixer.

16. The method as recited in claim 15, wherein the step
a) includes the step of providing the aggregates let out of
the respective hoppers in order of virgin aggregates with a
predetermined granularity to sand or, fine recycled
5 aggregates obtained by crushing Reclaimed Asphalt Pavement
(RAP) onto the conveyer in a batch type.

17. The method as recited in claim 15, wherein the step
a) includes the step of controlling the amount of aggregates
10 let out of the hoppers with a scale hopper providing them
onto the conveyer.

18. The method as recited in claim 16, wherein the step
a) includes the step of controlling the amount of aggregates
15 let out of the hoppers with a scale hopper the of the and
the of the and providing them onto the conveyer.

19. The method as recited in claim 15, wherein the step
c) includes the step of measuring the asphalt emulsion and
20 the aggregates inputted into the mixer in a predetermined
ratio and providing them to the mixer.

20. The method as recited in claim 15, wherein the step
c) further includes the step of inputting an adhesive
25 additive into the mixer in a predetermined ratio and mixing
them.

21. The method as recited in claim 15, wherein the step
c) includes the step of mixing on a primary time the coarse
30 aggregates inputted in the mixer with an appropriate amount
of asphalt emulsion added therein, inputting the remaining
amount of asphalt emulsion in the mixer when the fine
aggregates are inputted in the mixer and mixing them
entirely again.

35

FIG. 1

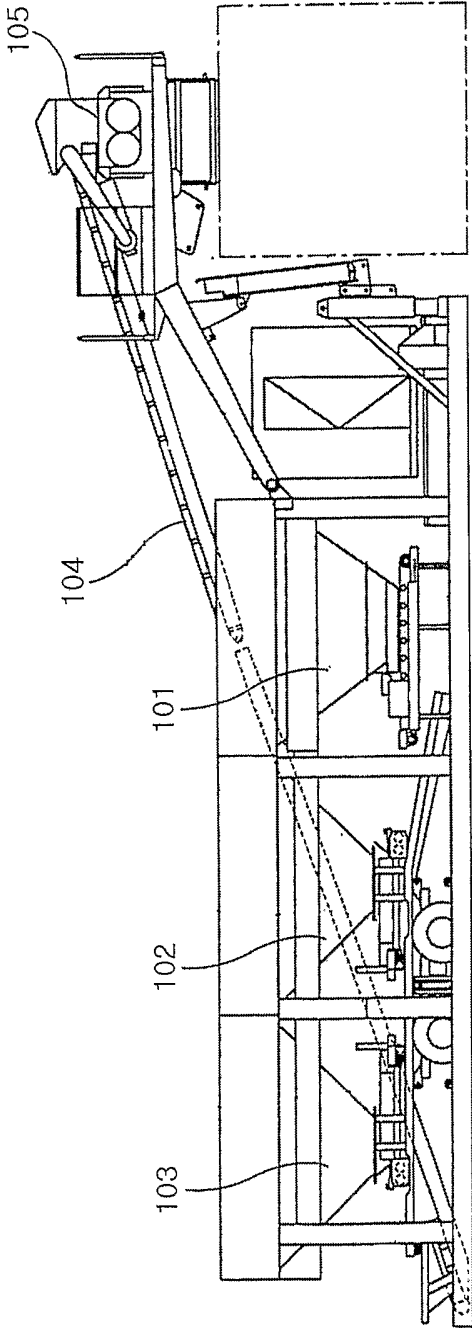


FIG. 2

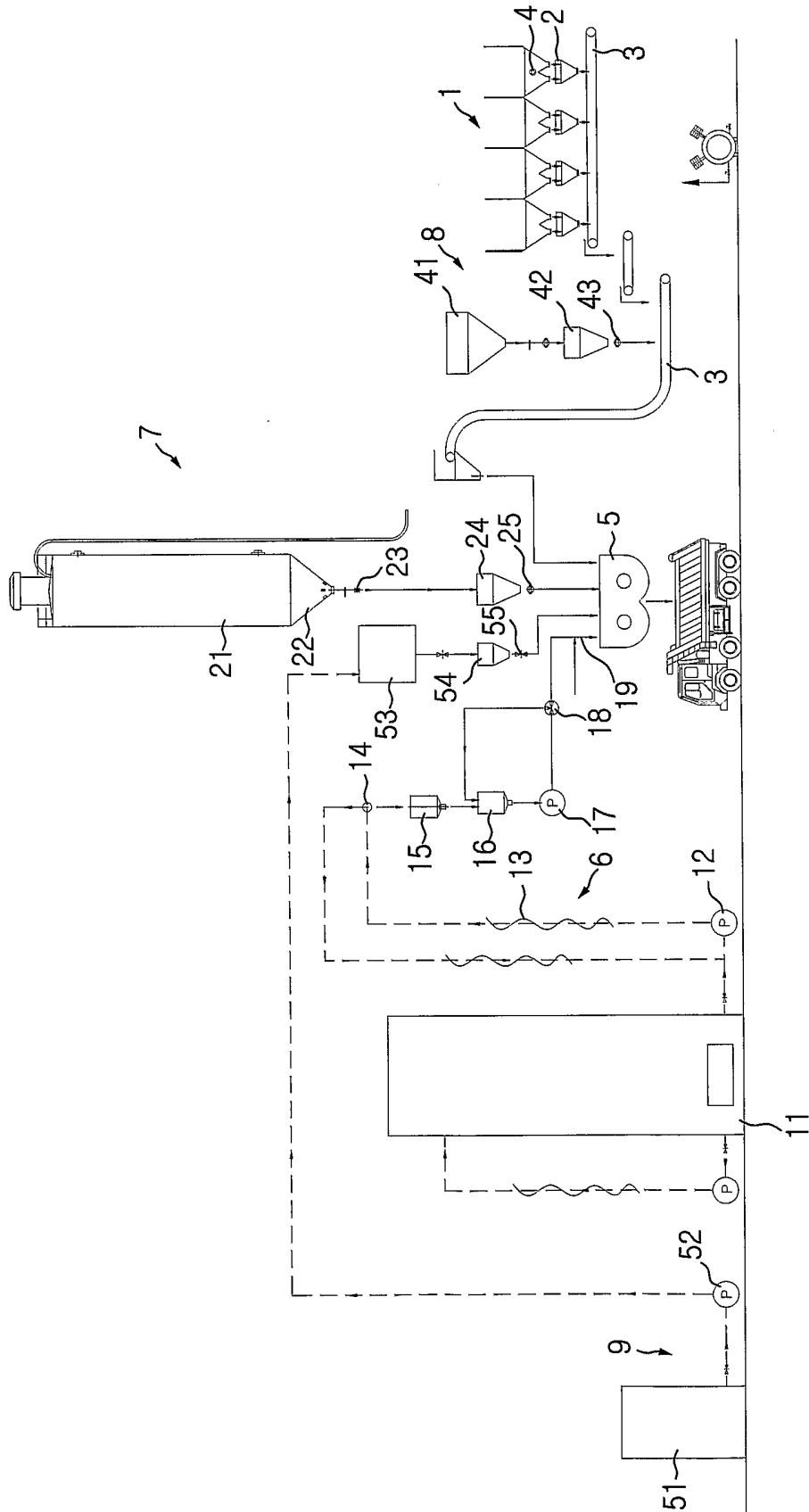


FIG. 3A

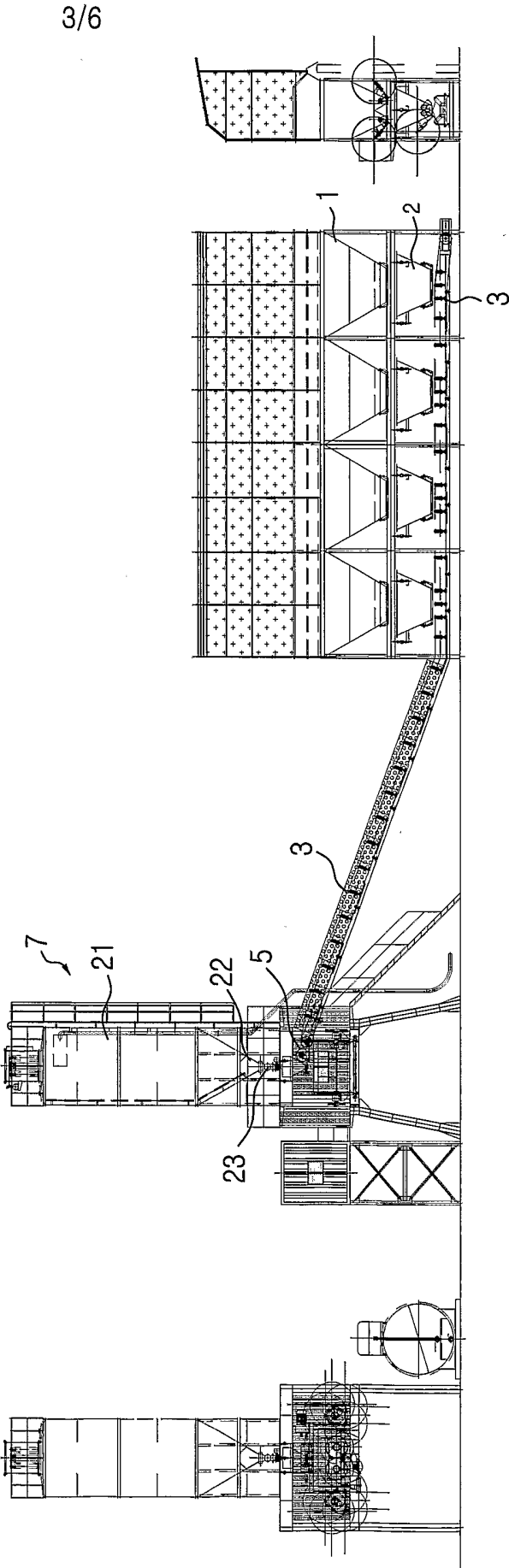


FIG. 3B

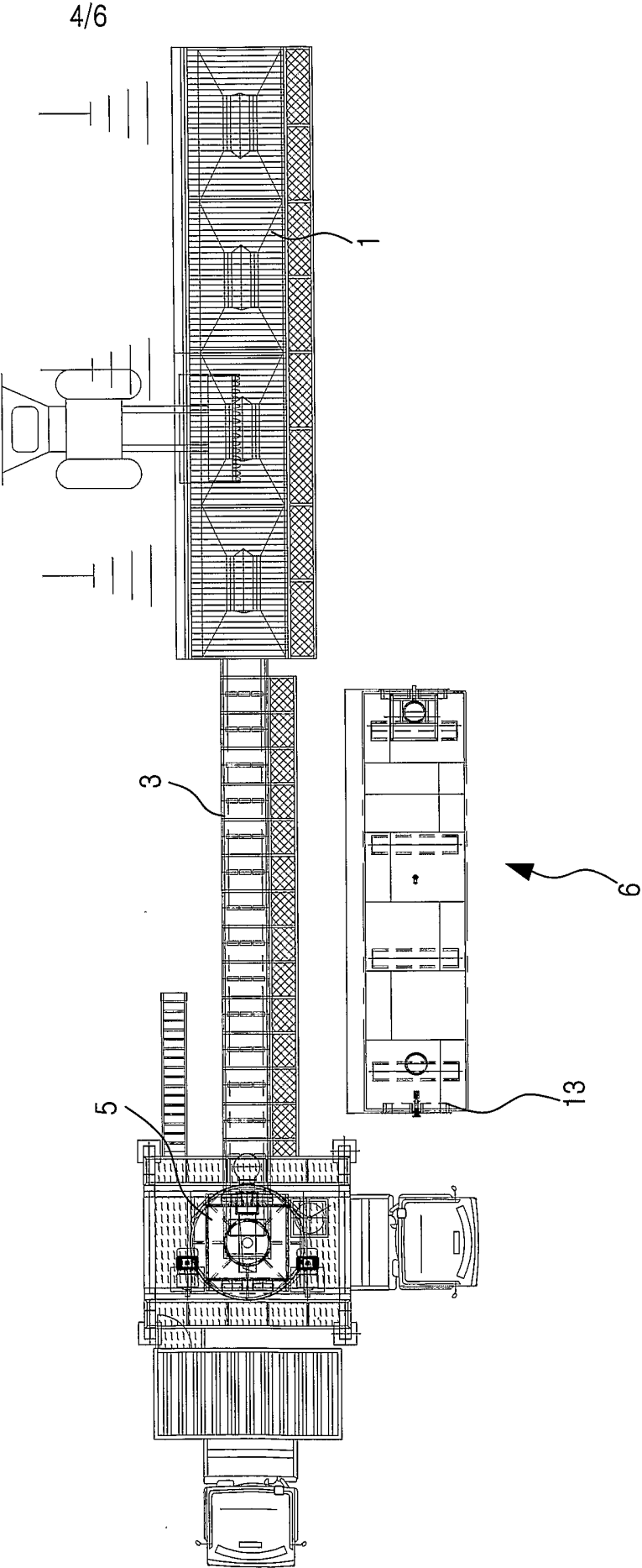


FIG. 4A

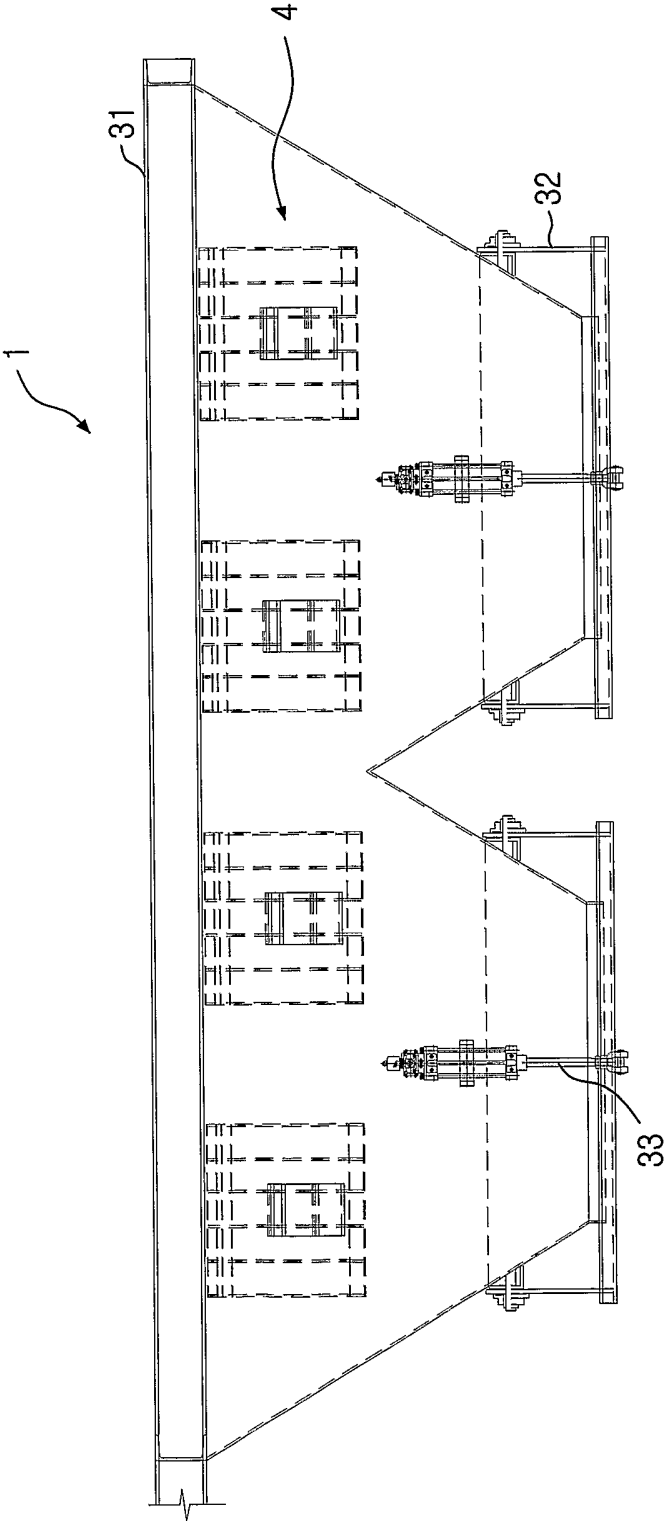
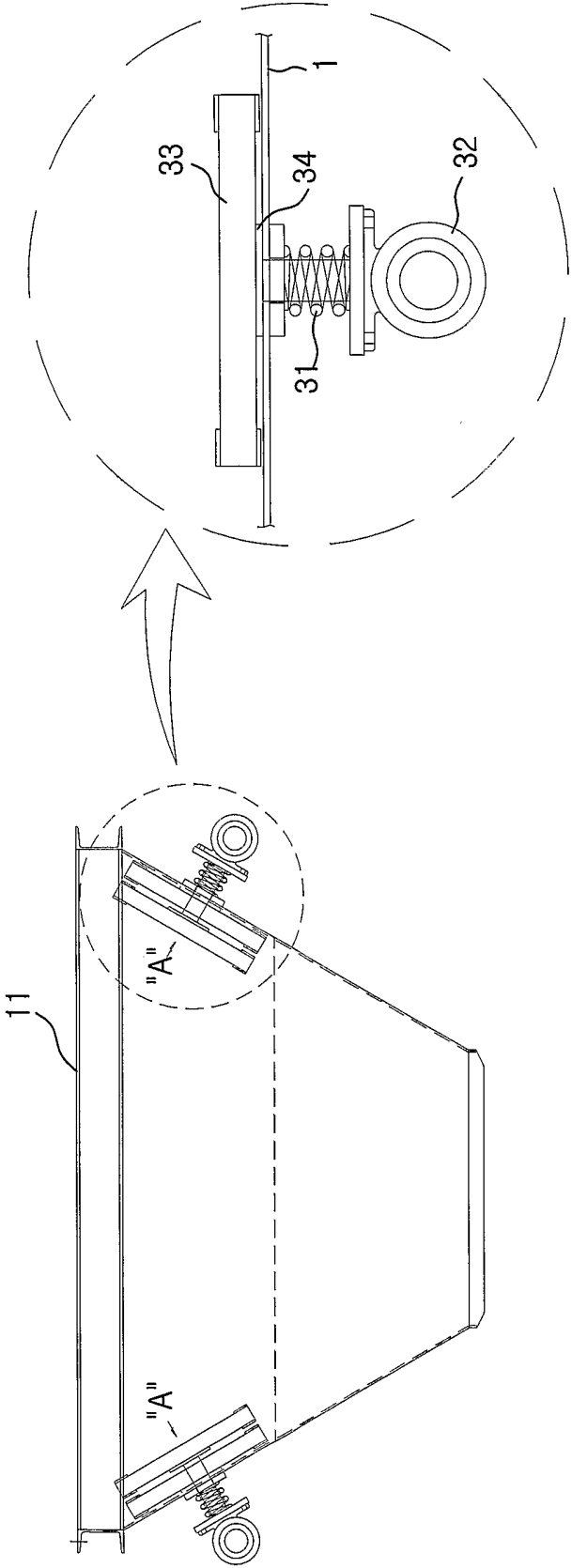


FIG. 4B



INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER**IPC7 B28C 7/00, B28C 5/00**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B28C 5/00, B28C 1/14, C04B 24/36, C04B 28/02, E01C 19/10, E01C 19/05

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korea Patents and Applications for Invention since 1975.

Korea Utility Models and Applications for Utility Models 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NPS, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2000-0033596 A (SUHWON CO, LTD) 15. JUNE. 2000.	1-13
A	KR 2000-0033597 A (SUHWON CO, LTD) 15. JUNE. 2000.	1-21
A	KR 1998-0000839 A (DONG IL CHUN) 30. MARCH.1998.	1-21
A	JP 3-37148 A (DAE PAN CEMENT CO, LTD) 18.FEB.1991.	1-21
A	JP 7-197412 A (DONG YANG ROAD CO, LTD) 1.AUG.1995.	1-21
A	JP 5-132910 A (JAPAN ROAD CO, LTD) 28.MAY.1993.	1-21

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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