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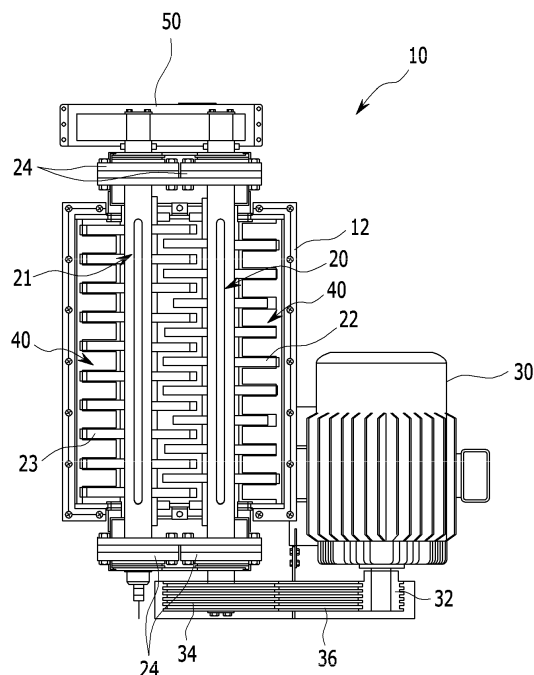
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(54) **APPARATUS FOR MANUFACTURING COAL BRIQUETTE**

(57) In order to surely crush lumps of coal and minimize occurrence of attachment of coals in crushing of coals, the present invention provides a coal briquette manufacturing apparatus including a mixer forming a mixture of powered coal and a binder, a gravity feeder connected to a lower end of the mixer and feeding the mixture, a molding device connected to a lower end of the gravity feeder and molding the mixture fed from the gravity feeder, and a crusher provided in an upper end of the gravity feeder and crushing the mixture flown into the gravity feeder, wherein the crusher may include rotation rotors rotatably provided in a housing and having crushing plates disposed at a distance from each other along the shaft direction, a driver rotating the rotation rotors, and a scraper member provided in the housing and disposed in front surfaces of the crushing plates to scrape mixtures attached to the crushing plates.

FIG. 2



Description**[Technical Field]**

[0001] The present invention relates to a coal briquette manufacturing apparatus. More particularly, the present invention relates to a coal briquette manufacturing apparatus that can minimize attachment of coal when lump coal is crushed.

[Background Art]

[0002] In a melting reduction iron-manufacturing method, a reducing furnace reducing iron ores and a melter-gasifier melting reduced iron ores are used. In the case of melting iron ores in the melter-gasifier, as a heat source to melt iron ores, coal briquettes are charged into the melter-gasifier. Here, reduced irons are melted in the melter-gasifier, transformed to molten iron and slag, and then discharged outside. The coal briquettes charged into the melter-gasifier form a coal-packed bed. After oxygen is injected through a tuyere installed in the melter-gasifier, the coal-packed bed is burned to generate combustion gas. The combustion gas is transformed into reduction gas at a high temperature while increasing a temperature through the coal-packed bed. The high-temperature reduction gas is discharged outside the melter-gasifier to be supplied to the reducing furnace as the reducing gas.

[0003] Reaction efficiency and heat-transfer efficiency may be increased by ensuring permeability and flow so that gas and liquid smoothly pass through the melter-gasifier. Thus, the coal briquettes are manufactured in the shape of predetermined-sized briquettes by mixing coal containing a sufficient amount of moisture and molasses and then compression-molding the mixture in the molding device.

[0004] The molding device is formed of two compression molding rolls provided in a lower portion thereof and a gravity feeder provided in an upper portion thereof to feed coal to the molding rolls. Further, the gravity feeder is provided with a chopper to crush lump coal among coals fed into the gravity feeder. When the lump coal is provided directly into the gravity feeder, the lump coal is grown to a ball having a large diameter, thereby causing deterioration of quality of coal briquettes. The chopper has a structure in which a rotation shaft where a plurality of crushing plates are installed rotates to crush lumped coals.

[0005] However, conventionally, coals mixed with moisture and sticky molasses are used to be attached to a plate in a process of crushing coals. Thus, the chopper cannot properly crush the lumped coals, thereby causing deterioration of quality of coal briquettes, and when the attachment of the coal is severe, the process should be stopped, thereby deteriorating productivity.

[DISCLOSURE]**[Technical Problem]**

[0006] The present invention has been made in an effort to provide a coal briquette manufacturing apparatus that can clearly crush lumped coals.

[Technical Solution]

[0007] Further, the present invention provides a coal briquette manufacturing apparatus that can minimize occurrence of attachment of coals when crushing coals.

[0008] A coal briquette manufacturing apparatus according to an exemplary embodiment of the present invention includes a mixer forming a mixture of powered coal and a binder, a gravity feeder connected to a lower end of the mixer and feeding the mixture, a molding device connected to a lower end of the gravity feeder and molding the mixture fed from the gravity feeder, and a crusher provided in an upper end of the gravity feeder and crushing the mixture flown into the gravity feeder, wherein the crusher may include rotation rotors rotatably provided in a housing and having crushing plates disposed at a distance from each other along the shaft direction, a driver rotating the rotation rotors, and a scraper member provided in the housing and disposed in front surfaces of the crushing plates to scrape mixtures attached to the crushing plates.

[0009] The rotation rotors may include at least two rotation rotors and arranged in parallel with each other in the housing, and crushing plates provided in each of neighboring rotation rotors may be alternately arranged

[0010] The scraper member may include an upper end portion extended toward the crushing plates and having a groove through which the crushing plate passes formed at location corresponding to each crushing plate of the rotation rotor and a lower end portion connected to a lower end of the upper end portion and extended downward while passing through the crushing plates of the rotation rotor to guide a mixture.

[0011] The scraper member formed with a structure in which the upper end portion located in the crushing plate may be inclined with respect to a rotation direction of the rotation rotor.

[0012] The two neighboring rotation rotors may have different rotation directions.

[0013] The two neighboring rotation rotors may have different rotation speed.

[0014] The coal briquette manufacturing apparatus may further include a reduction gear provided between the two neighboring rotation rotors and differentiating relative rotation speed of the two rotation rotors.

[0015] Crushing plates provided in one rotation rotor among the two neighboring rotation rotors may be formed in the shape of a round plate, and crushing plates of the other rotation rotor may have a structure in which a plurality of wings extended in a radial direction are arranged

while respectively having an angle along a circumference direction.

[Advantageous Effects]

[0016] According to the exemplary embodiment of the present invention, attachment of coals in a coal crushing process can be prevented, and lumps of coal can be surely crushed such that quality of coal briquette can be improved.

[0017] Further, as coal attachment can be minimized, the process can be continued, thereby improving productivity.

[Description of the Drawings]

[0018]

FIG. 1 schematically shows a coal briquette manufacturing apparatus provided with a crusher according to an exemplary embodiment of the present invention.

FIG. 2 is a planar cross-sectional view of the crusher of the coal briquette manufacturing apparatus according to the exemplary embodiment of the present invention.

FIG. 3 and FIG. 4 are cross-sectional side views of the crusher of the coal briquette manufacturing apparatus according to the exemplary embodiment of the present invention.

FIG. 5 schematically illustrates a scraper structure in the crusher of the coal briquette manufacturing apparatus according to the exemplary embodiment of the present invention.

[Mode for Invention]

[0019] The present invention will be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. Unless it is mentioned otherwise, all terms including technical terms and scientific terms used herein have the same meaning as the meaning generally understood by a person with ordinary skill in the art to which the present invention belongs. Like reference numerals are used for like components in the drawings.

[0020] The technical terms used in the present invention are only for describing a special exemplary embodiment, but it is considered that the present invention is not limited thereto. The singular forms used in the present invention include plural forms as long as the phrases do not clearly have a contrary sense. The meaning of "including" used in the specification specifies a specific characteristic, area, integer, step, action, element, and/or component, but it is not considered to eliminate the existence or addition of other characteristics, areas, integers, steps, actions, elements, and/or components.

[0021] Unless otherwise defined, all the terms includ-

ing technical terms and scientific terms have the same meanings as those generally understood by a person skilled in the art of the present invention. The terms that are defined in a dictionary and are generally used are not to be interpreted with idealized meanings or overly formal meanings unless the terms are further interpreted and defined to have the meanings corresponding to the related technique documents and the content disclosed now.

[0022] FIG. 1 schematically illustrates a coal briquette manufacturing apparatus according to an exemplary embodiment of the present invention.

[0023] A coal briquette manufacturing apparatus 100 of FIG. 1 is an example of the present invention, and the present invention is not limited thereto. Thus, a structure of the coal briquette manufacturing apparatus 100 can be variously modified.

[0024] As shown in FIG. 1, the coal briquette manufacturing apparatus 100 includes a mixer 110 mixing powered coal and a binder, a molding device 120 manufacturing briquettes by compression-molding the mixture of the coal and the binder, and a gravity feeder 130 feeding the mixture to the molding device 120. As necessary, the coal briquette manufacturing apparatus 100 may further include other constituent elements, for example, at least one of kneaders 140 connected to a rear end of the mixer 110 and kneading the mixture and a transfer screw 150 that transfers a mixture discharged from the kneader 140.

[0025] The transfer screw 150 that transfers the mixture discharged from the mixture 110 is provided in an upper end of the gravity feeder 130, and a crusher 10 that crushes a lump of coal included in the mixture fed to the gravity feeder 130 is provided between the transfer screw 150 and an upper end of the gravity feeder 130.

[0026] The crusher 10 crushes a lump of coal of which the size of greater than or equal to a predetermine size.

[0027] FIG. 2 to FIG. 4 exemplarily illustrate a structure of the crusher 10 according to the present exemplary embodiment.

[0028] In the present exemplary embodiment, the crusher 10 includes rotation rotors 20 and 21 rotatably provided in a housing 12 and where crushing plates 22 and 23 are provided with a gap therebetween along a shaft direction, a driver that drives the rotation rotors 20 and 21, and a scraper member 40 provided in the housing 12 and disposed in the entire surfaces of crushing plates 22 and 23 so as to scrape the mixture attached to the crushing plates 22 and 23.

[0029] Thus, the mixture attached to the crushing plates 22 and 23 of the rotation rotors 20 and 21 is continuously removed by the scraper member 40 and thus the crushing plates 22 and 23 can be maintained in a clean state, and accordingly, crushing of lumps of coal can be continuously performed without stopping the operation. In the following description, the mixture implies viscid coal mixed with a binder.

[0030] The housing 12 forms an outer shape of the

crusher 10, and an opening and closing door 14 is provided in the side surface of the crusher 10 to check the inside thereof. The housing 12 is formed in the shape of a quadrangular container into which the mixture moves, and an upper end and a lower end of the housing 12 are respectively connected to an outlet of the transfer screw 150 and an upper end inlet of the gravity feeder 130.

[0031] The rotation rotors 20 and 21 are rotatable provided in a horizontal direction in the housing 12. In the rotation rotors 20 and 21, a plurality of crushing plates 22 and 23 are respectively provided at a distance from each other along the shaft direction. The shafts of the rotation rotors 20 and 21 are rotatably supported by bearing blocks 24 provided in the housing 12. The driver may include a driving motor 30, a driving wheel 32 provided in the driving shaft, a driven wheel 34 provided in the shaft of the rotation rotor 20, and a belt 36 connected to the driving wheel 32 and the driven wheel 34. Thus, when the driving motor 30 operates, power is transferred to the rotation rotor 20 through the driving wheel 32, the belt 36, and the driven wheel 34 such that the rotation rotor 20 rotates.

[0032] In the present exemplary embodiment, two rotation rotors 20 and 21 are provided and disposed in parallel with each other in the housing 12. In addition, the crushing plates 22 and 23 provided in the respective rotation rotors 20 and 21 are alternately arranged between the neighboring rotation rotors 20 and 21. The alternate arrangement implies that crushing plates 22 and 23 provided in rotation rotors 20 and 21 overlap crushing plates 22 and 23 of other rotation rotors 20 and 21 that neighbor between the crushing plates 22 and 23 such that the crushing plates 22 and 23 are alternately arranged.

[0033] The crushing plates 22 and 23 may have a thickness that is smaller than a gap between crushing plates 22 and 23 and other crushing plates 22 and 23 that are engaged with each other such that the crushing plates 22 and 23 can respectively rotate between the respectively engaged crushing plates 22 and 23. Thus, when two rotation rotors 20 and 21 rotate, crushing plates 22 and 23 provided in each rotation rotor 20 and 21 scrape mixtures attached to neighboring crushing plates 22 and 23 while passing therebetween such that the mixtures can be prevented from being attached to the crushing plates 22 and 23.

[0034] One rotation rotor 20 among the two rotation rotors 20 and 21 is connected with the driver. The other rotation rotor 21 receives power from the rotation rotor 20 and rotates. Accordingly, the crushing plates 22 and 23 provided in the rotation rotors 20 and 21 rotate and thus lumped coals included in the mixture are crushed. The scraping member 40 separates the viscid mixture attached to the entire surfaces of the crushing plates 22 and 23 by scraping the same, and this will be described in detail later.

[0035] The two rotation rotors 20 and 21 have different rotation directions. That is, as shown in FIG. 3, the respective rotation rotors disposed in the left and right sides

of the drawing respectively rotate in the clockwise direction and the counterclockwise direction. The mixture charged into the housing 12 are passed through between the rotation rotors 20 and 21 by the two rotating rotation rotors 20 and 21 and then moved downward. In such a process, the lumped coals included in the mixture are crushed by the crushing plates 22 and 23 rotating in the two rotation rotors 20 and 21.

[0036] Further, every neighboring two rotation rotors 20 and 21 have different rotation speed. For this, a reduction gear 50 is provided between the two rotation rotors 20 and 21, and differentiates relative rotation speed of the two rotation rotors 20 and 21 while providing power between the two rotation rotors 20 and 21. A relative rotation speed difference between the two rotation rotors 20 and 21 is variously changed, and not limited to a specific value.

[0037] The reduction gear 50 may be formed of, for example, gear groups respectively provided in the two rotation rotors 20 and 21 and each having a different number of teeth. Thus, when the rotation rotor 20 connected to the driver rotates, the other rotation rotor 21 connected to the reduction gear 50 rotates. In this case, since a rotation ratio is varied and transferred through the reduction gear 50, the rotation rotor 20 connected to the driving motor and the rotation rotor 21 connected through the reduction gear 50 have different rotation speed. Accordingly, the two rotation rotors 20 and 21 respectively rotate with different speed. Thus, when a mixture is attached to the crushing plates 22 and 23 provided in one rotation rotor 20 and 21, the crushing plates 22 and 23 provided in other rotation rotors 20 and 21 that rotate with relatively low or fast speed scrape the attached mixture while passing through the opposite crushing plates 22 and 23 such that attachment of the mixture can be prevented.

[0038] In the present exemplary embodiment, the respective crushing plates 22 and 23 provided in the two rotation rotors 20 and 21 may be formed in shapes that are different from each other. As shown in FIG. 3, the crushing plate 23 provided in one rotation rotor 21 is formed in the shape of a round plate, and the crushing plate 22 provided in the other rotation rotor 20 is formed with a structure in which a plurality of wings 25 extended in a radial direction are arranged while each having an angle along a circumference direction. The wings 25 of each crushing plate 22 may be formed in the same location along the shaft direction of the rotation rotor, or may be formed respectively in different locations.

[0039] In case of the above-stated structure, when the two rotation rotors 20 and 21 relatively rotates, side surfaces of the wings 25 wholly scrape the crushing plate 23 while passing between the round-shaped crushing plate 23 such that the attached mixture can be further completely scrapped.

[0040] Meanwhile, the viscid mixture attached to the crushing plates 22 and 23 are scrapped by the scraper member attached to the front side of the crushing plates

22 and 23 and thus completely separated from the crushing plates 22 and 23.

[0041] As shown in FIG. 4 and FIG. 5, the scraper member 40 is extended along the shaft direction of the rotation rotors 20 and 21 in the housing 12 and thus lateral front ends thereof are fixed to the housing 12. Two scraper members 40 are provided corresponding to the crushing plates 22 and 23 provided in the respective rotation rotors 20 and 21.

[0042] Each scraper member 40 includes an upper end portion 41 extended toward the crushing plates 22 and 23 and where grooves 42 through which the crushing plates 22 and 23 pass are formed at corresponding locations of the crushing plates 22 and 23 of the rotation rotors 20 and 21 to scrap coal attached to the crushing plates 22 and 23 and a lower end portion 44 connected to a lower end of the upper end 41 and extended downward, passing through the front ends of the crushing plates 22 and 23 to guide coals. The lower end portion 44 of the scraper member 40 is integrally formed with the upper end portion 41.

[0043] The grooves 42 formed in the upper end portion 41 of the scraper 40 may correspond to the thickness of the crushing plates 22 and 23 in size. As shown in FIG. 4, the upper end portion 41 of the scraper member 40 contacts both sides of the crushing plates 22 and 23 by being inserted between the crushing plates 22 and 23. Thus, as the crushing plates 22 and 23 relatively rotate with respect to the scraper member 40 fixed in the housing 12, the mixture attached to the crushing plates 22 and 23 is scrapped and detached by the scraper member 40.

[0044] In the present exemplary embodiment, the upper end portion 41 of the scraper member 40 is inclined opposite to the rotation direction of the rotation rotors 20 and 21. For example, as shown in FIG. 5, when the rotation rotor 20 rotates in the counterclockwise direction, the upper end portion 41 of the scraper member 40 forms an inclined surface that is inclined to the left side. When the rotation rotor rotates in the clockwise direction, the upper end portion 41 of the scraper 41 also forms an inclined surface that is inclined to the right side.

[0045] As described, the upper end portion 41 of the scraper member 40 that contacts the crushing plates 22 and 23 is inclined and thus forms an inclined surface, and thus when the crushing plates 22 and 23 rotate, the weight of the mixture attached to the crushing plates 22 and 23 is applied to the upper end portion 41 in a perpendicular direction. That is, as shown in FIG. 5, the mixture attached to the crushing plate 22 is extruded by the upper end portion 41 of the scraper member 40 and thus detached from the crushing plate 22, and since the upper end portion 41 forms the inclined surface, the mixture attached to the crushing plate 22 is applied with a force in the perpendicular direction of the upper end portion 41. Thus, the scraper member 40 can more easily remove the mixture attached to the crushing plate 22. The mixture detached from the crushing plate 22 by the upper end

portion 41 is introduced to the lower end portion 44 along the upper end portion 41 and then dropped down through the lower end portion 44.

[0046] Hereinafter, an effect of the coal briquette manufacturing apparatus according to the present exemplary embodiment will be described.

[0047] The viscid mixture of the binder and coal is flown into the crusher 10 through a transfer screw. The mixture flown into the crusher 10 passes through the two rotation rotors 20 and 21 that rotate in the opposite direction and thus lumped coals included in the mixture are crushed by the crushing plates 22 and 23 provided in the rotation rotors 20 and 21.

[0048] The two rotation rotors 20 and 21 continuously crush the mixture and move the crushed mixture downward. Through such a process, attachment of the viscid mixture to the crushing plates 22 and 23 can be minimized by the crushing plates 22 and 23 that rotate while being alternately overlapped with each other. Since the two rotation rotors 20 and 21 rotate with different rotation speed, the crushing plates 22 and 23 provided in each of the rotation rotors 20 and 21 also rotate with relatively different speed. Thus, crushing plates 22 and 23 of rotation rotor 20 and 21 that are being overlapped with respect to crushing plates 22 and 23 of other rotation rotors 20 and 21 rotate with relatively slow or rapid speed such that mixtures attached to the respective crushing plates 22 and 23 are scrapped and detached.

[0049] In addition, the viscid mixture attached to the crushing plates 22 and 23 is scrapped by the scraper member 40 attached to the front surfaces of the crushing plates 22 and 23 while the crushing plates 22 and 23 rotate such that the mixture is detached from the crushing plates 22 and 23. In the scraper member 40, since the upper end portion 41 is extended between the respective crushing plates 22 and 23 provided in each rotation rotors 20 and 21, the mixtures attached to the respective crushing plates 22 and 23 can be completely removed.

[0050] As described, the crusher 10 can prevent attachment of a viscid mixture to the crushing plates 22 and 23 and continuously perform a sufficient crushing work with relative rotation movement of the crushing plates 22 and 23 provided in the two rotation rotors 20 and 21 and the scraper member 40.

[0051] While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Claims

1. A coal briquette manufacturing apparatus comprising a mixer forming a mixture of powered coal and a binder, a gravity feeder connected to a lower end

of the mixer and feeding the mixture, a molding device connected to a lower end of the gravity feeder and molding the mixture fed from the gravity feeder, and a crusher provided in an upper end of the gravity feeder and crushing the mixture flown into the gravity feeder, 5
 wherein the crusher comprises rotation rotors rotatably provided in a housing and having crushing plates disposed at a distance from each other along the shaft direction, a driver rotating the rotation rotors, and a scraper member provided in the housing and disposed in front surfaces of the crushing plates to scrape mixtures attached to the crushing plates. 10

2. The coal briquette manufacturing apparatus of claim 1, wherein the rotation rotors comprises at least two rotation rotors and arranged in parallel with each other in the housing, and crushing plates provided in each of neighboring rotation rotors are alternately arranged. 15 20
3. The coal briquette manufacturing apparatus of claim 2, wherein the two neighboring rotation rotors have different rotation speed. 25
4. The coal briquette manufacturing apparatus of claim 3, further comprising a reduction gear provided between the two neighboring rotation rotors and differentiating relative rotation speed of the two rotation rotors. 30
5. The coal briquette manufacturing apparatus of claim 4, wherein the two neighboring rotation rotors have different rotation directions. 35
6. The coal briquette manufacturing apparatus of any one of claim 1 to claim 5, wherein the scraper member comprises an upper end portion extended toward the crushing plates and having a groove through which the crushing plate passes formed at location corresponding to each crushing plate of the rotation rotor and a lower end portion connected to a lower end of the upper end portion and extended downward while passing through the crushing plates of the rotation rotor to guide a mixture. 40 45
7. The coal briquette manufacturing apparatus of claim 6, wherein the scraper member formed with a structure in which the upper end portion located in the crushing plate is inclined with respect to a rotation direction of the rotation rotor. 50
8. The coal briquette manufacturing apparatus of claim 7, wherein crushing plates provided in one rotation rotor among the two neighboring rotation rotors are formed in the shape of a round plate, and crushing plates of the other rotation rotor have a structure in which a plurality of wings extended in a radial direc- 55

tion are arranged while respectively having an angle along a circumference direction.

FIG. 1

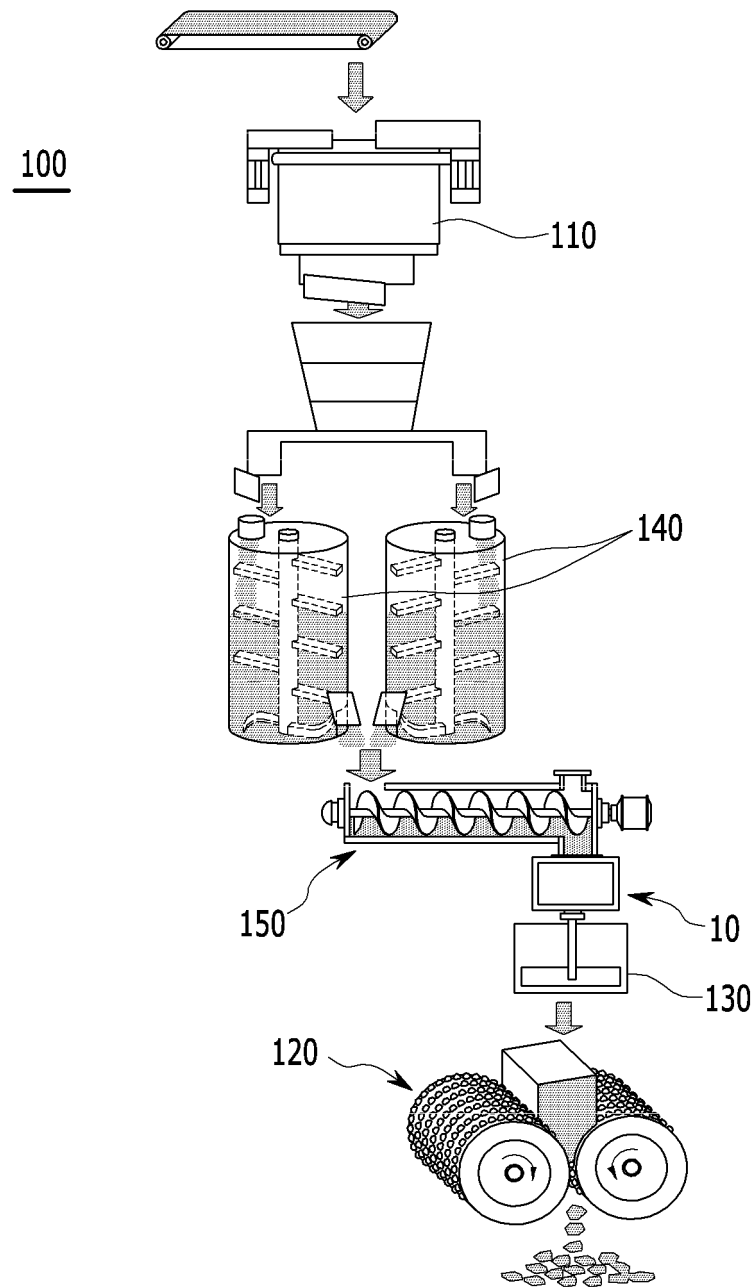


FIG. 2

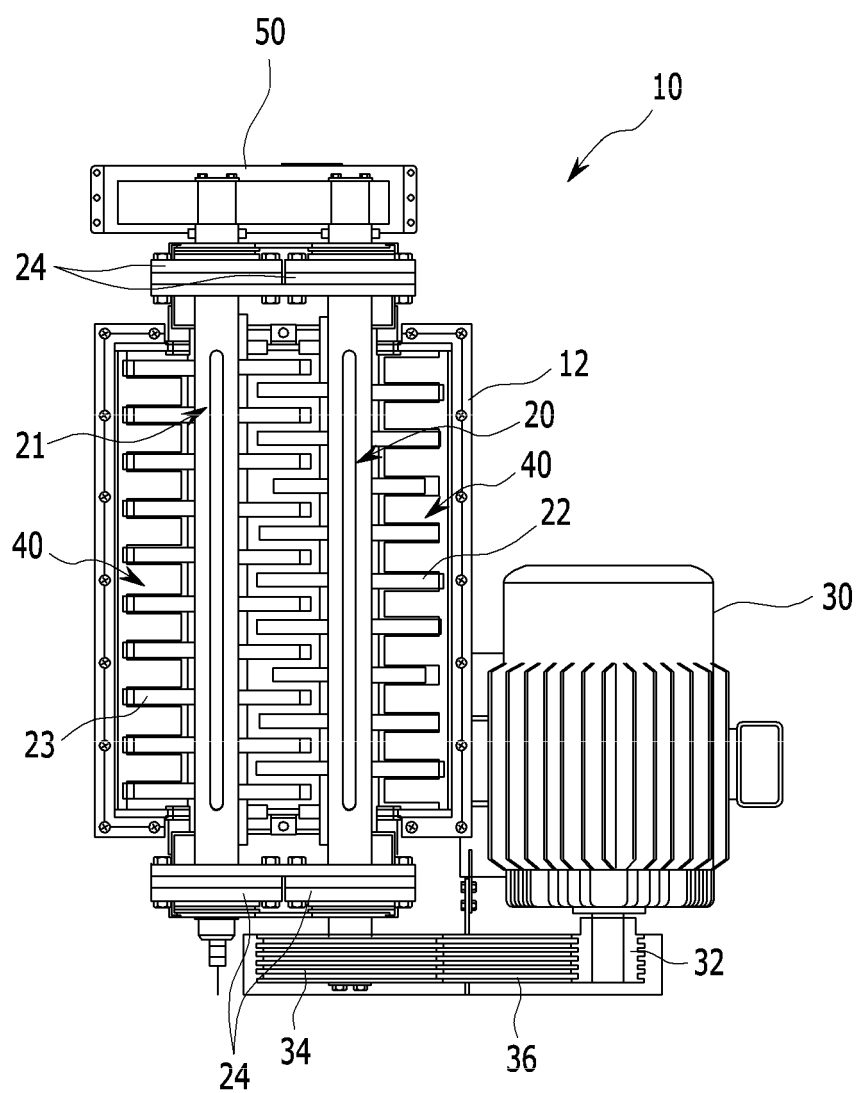


FIG. 3

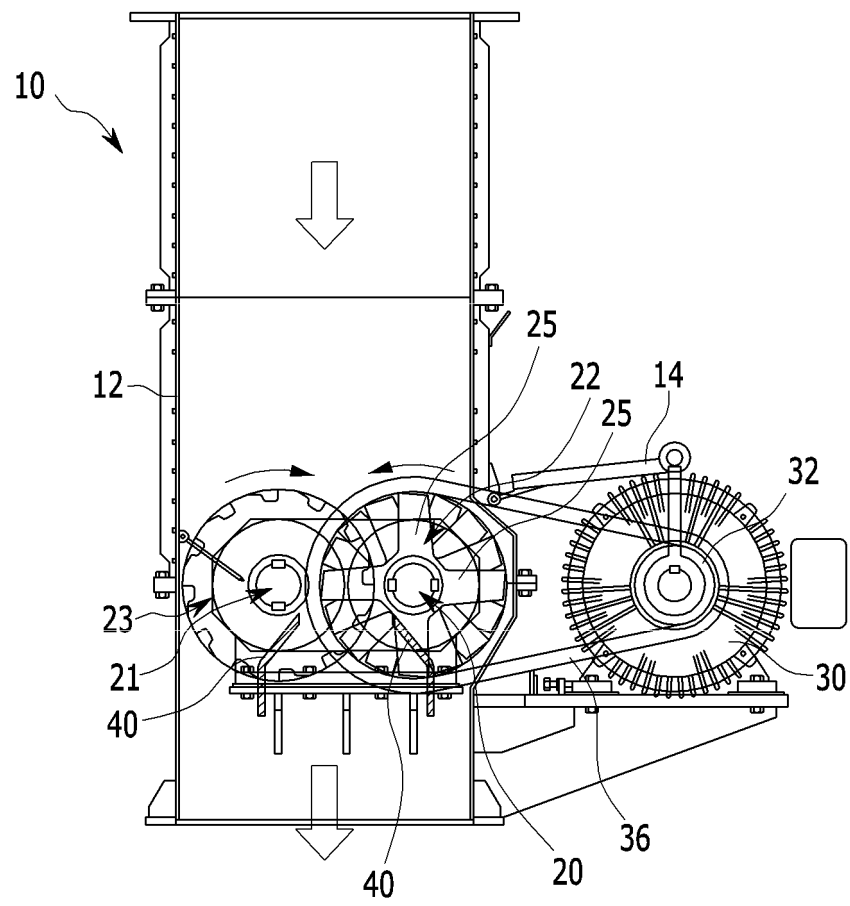


FIG. 4

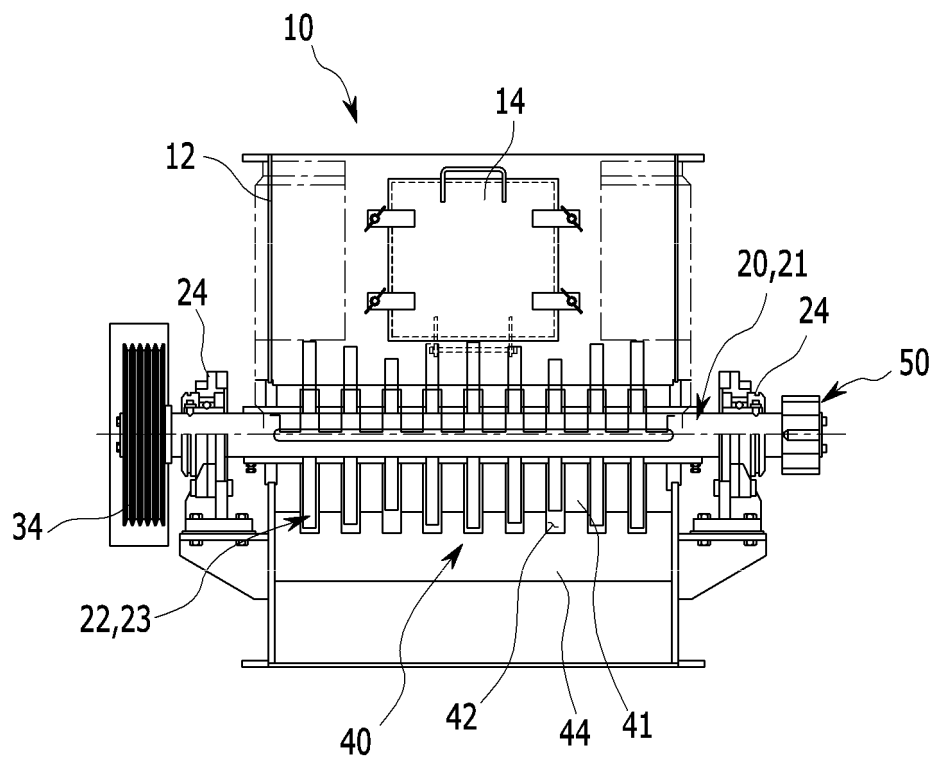
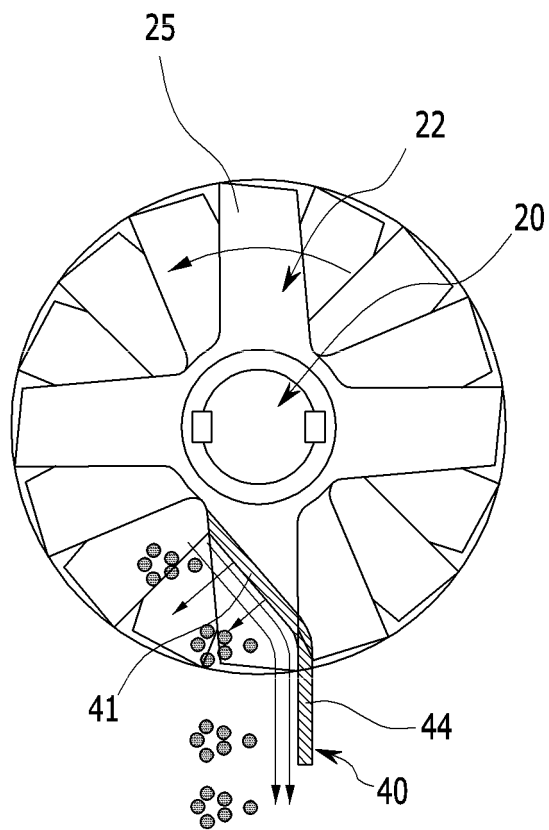


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2014/006345

A. CLASSIFICATION OF SUBJECT MATTER

C10L 5/10(2006.01)i

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)

C10L 5/10; C10B 57/06; C10B 47/02; C10B 57/10; C10B 53/04; C10L 5/48; C10B 53/00

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

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

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

eKOMPASS (KIPO internal) & Keywords: charcoal, fine coal, binder; crushing, molding, feeder and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2011-0039928 A (PARK, Sang Woo) 20 April 2011 See paragraphs [0035]-[0052]; figures 2-4 and claims 1-4.	1-8
A	KR 10-2012-0075179 A (POSCO) 06 July 2012 See paragraphs [0081]-[0101] and figures 1-14.	1-8
A	KR 10-0340333 B1 (LJM, Nam Gi) 12 June 2002 See line 28 of page 2-line 7 of page 4; figures 1-4 and claims 1-4.	1-8
A	JP 2003-342586 A (JFE STEEL KK) 03 December 2003 See paragraphs [0025]-[0048]; figures 1-3 and claims 1-6.	1-8
A	KR 10-0856271 B1 (POSCO) 03 September 2008 See paragraphs [0019]-[0054]; figures 1-6 and claims 1-4.	1-8

☐ 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

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Date of the actual completion of the international search

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Date of mailing of the international search report

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Name and mailing address of the ISA/KR

 Korean Intellectual Property Office
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International application No.

PCT/KR2014/006345

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Patent document
cited in search reportPublication
datePatent family
memberPublication
date

10

KR 10-2011-0039928 A

20/04/2011

NONE

KR 10-2012-0075179 A

06/07/2012

CN103547656 A

29/01/2014

JP 2014-502655A

03/02/2014

WO 2012-091335 A2

05/07/2012

WO 2012-091335 A3

13/09/2012

15

KR 10-0340333 B1

12/06/2002

NONE

JP 2003-342586 A

03/12/2003

NONE

KR 10-0856271 B1

03/09/2008

NONE

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Form PCT/ISA/210 (patent family annex) (July 2009)