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(54) Improved machine for loading coke ovens.

(57) An improved apparatus for loading coke ovens arranged in parallel row gangs and provided with loading mouths, having:

a) a portal shaped welded and bolted bearing structure (2) provided with two-wheel (3,3') driving carriages (1), one said wheel (3) being a driving wheel;

b) loading hoppers (4) of number corresponding to that of the oven loading mouths (11) and provided with a loading shutter element (7);

c) vertically movable oleodynamically driven loading funnels (9), each said loading funnel (9) being located at the lower portion of each said hopper (4), and being provided with an oleodynamically driven closure ball valve (12) and with a ring (10) [illegible] and tightly engage against the corresponding [illegible];

d) [illegible] a bridge connecting tube (15), located at the side lower portion of said bearing structure, at the side thereof therefrom the coke is discharged, said bridge connecting tube (16) being effective to be vertically moved by means of an automatic type of hydraulic driving means, and effective to connect a mouth (17) of the oven to be loaded, as suitably formed at the coke discharging side, to a like mouth (18) formed in the adjacent oven, this latter being preferably in an advanced distilling step, and

e) electric and hydrodynamic devices, for automatically carrying out the overall loading cycle, and a photoelectric cell device for automatically aligning said hoppers with the corresponding loading mouths.

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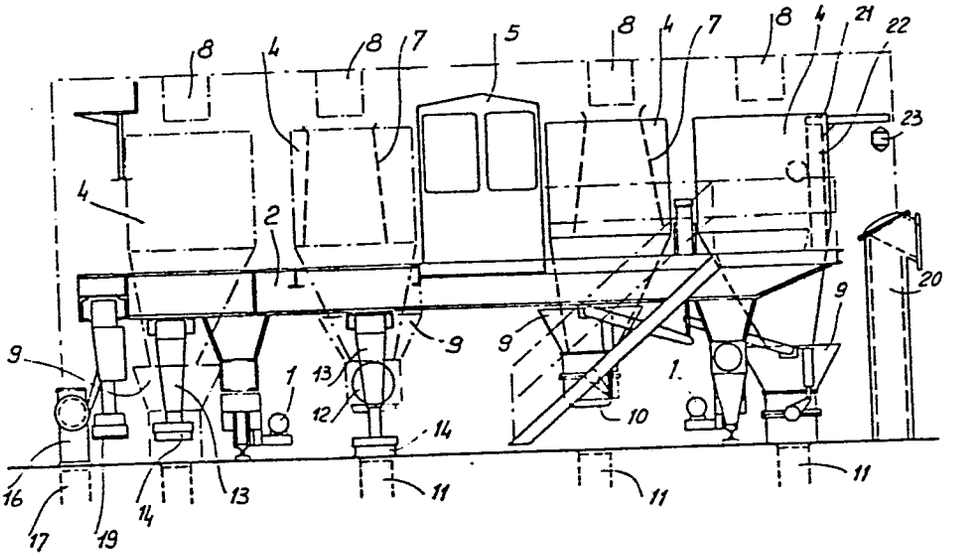
Fig. 2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IMPROVED MACHINE FOR LOADING COKE OVENS

The present invention relates to an improved machine for loading coke ovens.

More specifically, the invention relates to an improved apparatus effective to carry out the loading of coke ovens by finely subdivided sea coal having a moisture contents up to 15%, under extremely safe conditions with respect to the enviromental protection.

As it is known, in the industrial systems, the coke ovens are arranged according to parallel rows and for loading said ovens sea coal loading apparatuses are used substantially consisting of a series of hoppers, in number corresponding to the oven mouth number, as mounted on a rail movable carriage. Said hoppers are aligned with respect to the individual oven loading mouths, and upon removing, either automatically or not, the individual plus element from the oven mouths and having lowered a lug, each hopper being provided with, in order to form a continuous path between the hopper and oven, the coal is directly discharged by gravity or any suitable systems, into the inside of the oven at a very high speed and in a continuous even manner.

The main drawbacks involved in the coke oven loading operations by the known loading apparatuses, consist of the high atmospheric pollution and bad working conditions due to the releasing of gases and powders during said operations.

In fact the coal, which is quickly introduced in the heated oven, causes a displacement of an equivalent heated air volume from the oven, which air, upon exiting, also entrains a some amount of coal powder.

Furthermore, the introduced coal, upon contacting the heated oven walls, immediately releases a great amount of gases exiting from the loading mouths and evolving columns thereby entraining a further amount of coal powder.

Several methods have been studied and tested in order to eliminate or at least reduce this gas and powder emission, during the oven loading operation, but none of said methods has been able of providing satisfactory results.

Thus, for example, a method has been tested consisting of creating a certain tightness between the loading hopper and oven introducing mouths, sucking, by means of sucking devices and through provided ducts nearly the complete amount of gases evolved from the chamber, burning said gases and finally settling, by means of a nebulized water yet, the fumes and ashes originated by said burning step.

This method, however, has the drawback that, under determined conditions, the so-called fire-dumping gas forms which, by exploding may damage the system and, in any way, constitutes a danger for the loading operators.

Moreover, the treating by water causes acid liquid suspensions to form because of the presence of sulphur dioxide in the discharging fumes; these aqueous acid suspensions corrode the system structures they inevitably contact.

Another known method which has had a certain practical interest, consists of using loading apparatuses with a tight closure of the loading mouths and extracting gases and powders directly from the barrel, by means of sucking. This sucking is obtained by super-heated steam injected at a pressure of 12-14 ate by means of a barrel connected injector.

The adoption of this method requires a balancing and adjusting system for balancing and adjusting the pressures in all the ovens, adjacent to that being loaded and in the barrel. In fact, due to an anomalous pressure increase in the barrel during the superheated steam injection, gases leak from the so-called "weak points" of all the other ovens of the gang, in the different distillation stages.

This problem is particularly felt in the case of pre-existing coke oven gangs, where the auxiliary systems have not been predisposed for the carrying out of this method and where the barrel volume and the tightness of the doors and evolvement columns are rather poor.

Accordingly, in the existing oven gangs, the atmospheric pollution, by gases or powders during the loading operations, negatively affect the working environment

of the loading operators.

Thus, the main object of the present invention is to provide an improved apparatus for loading sea coal into coke ovens, which permits to solve the atmospheric pollution problem, especially in the case of pre-existing ovens. This object is achieved by an improved apparatus for loading coke ovens, as arranged in parallel rows and provided with loading mouths, comprising:

a) a portal shaped welded and bolted bearing structure provided with two-wheel driving carriages, one said wheel being a driving wheel;

b) loading hoppers, the number of said loading hoppers being equal to that of the oven loading mouths and being provided with a loading shutter element;

c) loading funnels said loading funnels being effective to be vertically moved by oleodynamic driving means, each said loading funnel being located at the lower portion of each said hopper and being provided with a closure oleodynamically driven ball valve, and a ring effective to fit and tightly engage against the corresponding loading mouth frame;

d) a ridge collecting tube, located at the side lower portion of said bearing structure, at the coke discharging side, and effective to be vertically moved by automatic hydraulic driving means, and effective to connect a mouth of the oven to be loaded, as suitably formed at the coke discharging side,

to a like mouth formed at the adjacent oven, preferably in an advanced distillating step;

e) electric and oleodynamic apparatuses, for automatically carrying out the loading operation complete cycle, such as magnetic devices for raising the oven-mouth covers, moving the apparatus at an adjustable speed, an automatic device for cleaning said loading mouths, an automatic device for cleaning the uprights, emergency and safety systems, an infrared ray device for automatically aligning said hoppers with the corresponding loading mouths, an electronic system for automatically carrying out all the possible desired process sequences, and so on.

The improved apparatus according to the present invention is furthermore provided with a driving cab, located on the main floor of the bearing or carrying structure. Said driving cab preferably extends all along the length of the apparatus, and is provided with a pressurizing system effective to prevent powder from entering, and an air conditioning system.

During the overall loading step, carried out by the instant improved apparatus, the conveying of the evolved gases towards the uprights is facilitated by a negative pressure condition, as that occurring in the top portion of the two ovens, and by the connection thereof through said bridge connecting pipe or tube.

The aforesaid negative pressure condition may be obtained by a fluid injecting device, which fluid may

consist of steam or ammonia water, said fluid injecting device being mounted at the top of said uprights.

The movable bridge connector, effective to provide a connection to the adjacent oven, is formed by an inverted "U" shaped tube, made of steel effective to resist against corrosion and a temperature of 1200°C. Said movable bridge connecting tube or manifold is furthermore provided with an electromagnet for raising the covers of the related loading mouths.

The presence of the aforesaid bridge collector or connecting tube permits to obtain a greater equilibrium and a better distribution of the pressures of the gases evolved during the loading step and in addition it assures, in any case, the connection between the oven upper portion and the negative pressure duct up to said upright columns or uprights.

The possibility of connecting the adjacent oven to that being loaded, by means of said bridge connecting tube, permits to greatly reduce the drawbacks due to the loading operation, without emissions. For example the increase of the coal powder in the produced tar is prevented from occurring. In fact, the slow passing of the gases and powders from the oven being loaded, through the top of the adjacent oven, this latter being generally at the distillation end, permits a powder settling to be obtained.

The loading hoppers are made of stainless steel, have a frustum - cone cross-section and preferably rest on rubber pads, in order to insulate the apparatus from possible vibrations as produced by vibrating means. Each hopper is provided with a loading shutter, consisting of a frustum-cone shaped element, effective to fit to the coal containing silo mouth, the height dimension thereof may be adjusted at will depending on the desired volume of sea coal to be loaded in the hopper. This fitting operation is obtained by varying the height locating of the lower base of said frustum-cone shaped element. The loading funnels are provided with joint connections, effective to provide a perfect fitting of said funnels to the loading mouth seats, with a good tolerance range, in order to compensate for possible settlements of said mouths. The ball valve, each loading funnel is provided with, is for containing the sea coal within the hopper, before the loading step, and for assuring tightness with respect to the fumes, upon carrying out the loading. The closure of said ball valve is driven by level probes effective to monitor the sea coal level in each said hopper.

The improved apparatus according to the present invention permits to solve almost all the atmospheric pollution problems, which occur during the loading step, and in addition the several problems connected to the coke oven working environment.

In fact, the possibility of having variable capacity hoppers, carrying out a differentiated loading operation and gradually sucking the gases emitted through the

columns of two adjacent ovens, connected by the said bridge connecting tube, permits to eliminate the occurring of super-pressures in the barrel which super-pressures, otherwise, would negatively affect other ovens of the gang, by indirectly increasing the gas leaks through the so-called weak points such as doors, mouths, columns and so on.

The emissions of gases are furthermore eliminated or at least reduced due to the fact that all the loading operations are carried out without having the necessity of moving the apparatus and with a tight closure between oven and loading hopper.

Furthermore the instant apparatus permits to improve the volume distribution of the coal through the oven, by means of the differentiated load. Moreover the possibility of being able of settling or decanting the gas—powder mixture during the exiting, permits to reduce the entrainment of coal powder by said gases, and accordingly the produced tar quality is not deteriorated.

In order to better understand the constructional and operative characteristics of the improved apparatus for loading coke ovens, arranged in a gang, according to the present invention, said apparatus will be thereinbelow described referring to the figures of the accompanying drawings illustrating a preferred exemplary and not limitative embodiment of the present invention and where:

Fig. 1 is a top schematic view of the apparatus for loading coke ovens according to the invention;

Fig. 2 is a front schematic view of the apparatus illustrated in fig.1 as sectioned by a plane passing through the line A—B;

Fig. 3 is a side schematic view of the apparatus represented in the preceding figures 1 and 2.

Referring specifically to the figures of the accompanying drawings, the improved apparatus for loading gang arranged coke ovens consists of four translation carriages (1).

Each said carriage is formed by a rocking element, connected to the bearing or carrying structure (2) by means of coil springs. Each said carriage (1) is provided with two wheels (3) and (3'), whereof a wheel is an idle one and the other is a driving one. This latter is driven by a variable speed motor, provided with eddy current braking equipment, and with a speedometer dynamo for synchronizating said carriages (1).

Said bearing or carrying structure (2) consists of a welded and bolted construction having a portal shape. At the top, with respect to said structure (2), is located a floor carrying the hoppers (4), the operating cab (5) and a cab (6) effective to house the electric devices or equipment.

The hoppers (4) which generally are four in number, are preferably made of stainless steel and have a frustum-cone shaped cross-section each thereof being provided, at the top thereof, with a loading shutter-element (7) effective to adjust the sea coal amount to obtain a weight and distribution variable loading in the loading chamber. Each said loading shutter element (7) consists of a frustum-cone shaped element, of variable height, fitted to the door or gate (8) of the coal containing silo and effective to permit the useful volume in the inside of the hopper to be varied.

The lower portion of each said hopper (4) communicates to a corresponding loading funnel (9) effective to be vertically moved by means of an oleodynamic drive. Each funnel (9) is provided, at one end thereof, with an articulated tightness ring (10) which permits a perfect fitting to the seats of the loading mouths (11) to be obtained. Furthermore each funnel (9) is provided, in the inside thereof, with a closure ball valve (12) for containing the coal in the inside of the hopper before the loading and for providing a fume tightness upon carrying out the loading step.

The closure of said ball valve (12) is obtained by coal level detecting probes located in each said hopper which operate an oleodynamic device.

The instant loading apparatus is furthermore provided with four devices (13) for raising the covers of the loading mouths (11) and four devices (15) for cleaning and degraphitizing said loading mouths (11) before the

coal loading step.

The raising up of said covers is obtained by means of a magnetic plate (14) located at the end of each said device (13). Each cleaning device (15) consists of an oleodynamic cylinder which drives a suitable cleaning counter-weight preferably of the vibrating type (15').

At the side thereinto the coke is discharged, the loading apparatus according to the invention is provided with a bridge collecting tube (16), of inverted U-shape, which permits the connection between a suitable mouth (17), as formed on the top of an oven, and another suitable mouth (18) formed on the top or roof of the adjacent oven performing the distillation.

In order to raise the covers of said mouths (17) and (18), an electromagnetic device (19) is used also provided, at the end thereof, with magnetic plates as the devices (13).

Said bridge connecting tube (16) is made of special steel effective to resist against high temperatures (1200°C) and is located on the respective openings or mouths (17) and (18) by means of an automatic hydraulic drive.

In order to prevent interferences between the connecting tube (16) and the coal powder from occurring, during the movement of the loading apparatus, the assembly for raising said tube (16) and the cover

raising device (19) may be moved towards the apparatus inside. Furthermore, the overall assembly may be longitudinally moved for a length corresponding to the oven pitches in order to permit to be used also with the end ovens of each gang.

During the overall loading step, the conveying of the evolved gases is facilitated by a negative pressure condition at the top of the two ovens connected by means of said connecting bridge tube (16). Said negative pressure is obtained by a fluid injecting device mounted on the top of each upright column (20). The loading apparatus according to the invention is furthermore provided, at the side corresponding to the upright column (20), with a divice (21) for automatically cleaning the upright columns, consisting of a member (22) effective to vertically reciprocate the cleaning swab.

The instant loading apparatus is also provided with an electric power system, emergency and safety systems, electric and oleodynamic systems for automatically carrying out all the operations according to all of the possible desired and predetermined sequences, and with a photoelectric cell system for the centering on the loading mouth.

In order to achieve the optimal loading condition without practically causing powder and gas emissions, the instant loading apparatus provides for varying the weight and the volume of the coal in each hopper (4), and an automatic programming of a broad range

of different operative sequences for the falling down of said coal on the loading mouth (11). Accordingly, depending on the inherent characteristics of each mixture, the instant apparatus permits to carry out, even automatically, the loading operation of the four mouths (11), simultaneously, one at a time, two by two, or two individually and a double one and so on. The cab (5) extends all along the length of the loading apparatus and is provided with large windows having athermic glasses, a pressurizing system, for preventing powder from entering, and with an air conditioning system for the operator.

The apparatus for loading coke ovens according to the invention has been thereinabove described only as a non limitative example referring to the figures of the accompanying drawings illustrating an exemplary and not limitative preferred embodiment of the invention.

Accordingly, in the practical construction of the instant apparatus several shape, size and structure changes may be carried out without departing from the spirit and scope of the invention.

List of drawing positions

1	carriages
2	carrying structure
3, 3'	wheels
4	hoppers
5	cab
6	"
7	shutter element
8	gate
9	funnel
10	tightness ring
11	loading mouths
12	ball valve
13	devices for cover raising
14	magnetic plate
15	cleaning devices 15' of vibrating type
16	collecting tube
17	mouth
18	"
19	electromagnetic device
20	column
21	cleaning device
22	reciprocating device

Claims:

1. An improved apparatus for loading coke ovens arranged in parallel row gangs and provided with loading mouths, characterized in that it comprises:

a) a portal shaped welded and bolted bearing structure (2) provided with two-wheel (3,3') driving carriages (1), one said wheel (3) being a driving wheel;

b) loading hoppers (4) of number corresponding to that of the oven loading mouths (11) and provided with a loading shutter element (7);

c) vertically movable oleodynamically driven loading funnels (9), each said loading funnel (9) being located at the lower portion of each said hopper (4), and being provided with an oleodynamically driven closure ball valve (12) and with a ring (10) effective to fit and tightly engage against the corresponding frame of said loading mouths (11);

d) a bridge collecting or connecting tube (16), located at the side lower portion of said bearing structure, at the side thereof thereinto the coke is discharged, said bridge connecting tube (16) being effective to be vertically moved by means of an automatic type of hydraulic driving means, and effective to connect a

mouth (17) of the oven to be loaded, as suitably formed at the coke discharging side, to a like mouth (18) formed in the adjacent oven, this latter being preferably in an advanced distilling step, and

e) electric and oleodynamic devices, for automatically carrying out the overall loading cycle, and a photoelectric cell device for automatically aligning said hoppers with the corresponding loading mouths.

2. An improved apparatus according to claim 1, c h a r a c t e r i z e d in that it is provided with a driving cab, located on the main floor of said hearing structure and provided with a pressurizing system, in order to prevent powder from entering, and with an air conditioning system.

3. An improved apparatus according to claims 1 or 2, c h a r a c t e r i z e d in that said driving carriages are four in number, each thereof being provided with two wheels, whereof one is idle and the other a driving wheel; this latter being driven by a variable speed motor, provided with an eddy current bracking equipment, and having a speedometer dynamo for synchronizating said carriages.

4. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that said hoppers are four in number, being made of

stainless steel, having a frustum-cone shaped cross-section and being provided with an articulated tightness ring, for a perfect fitting to the seats of the loading mouths.

5. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that each loading shutter element consists of a frustum-cone shaped element, of variable height, fitting to the sea coal containing silo door, and effective to permit the useful volume of the hopper to be varied.

6. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that the closure ball valve each hopper is provided with, is driven by an oleodynamic device, in turn controlled by level probes located in each said hopper and effective to detect the sea coal level.

7. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that said bridge connecting tube has an inverted U-shape, is made of steel effective to resist against corrosion and high temperatures, and is located on the loading mouth of two adjacent ovens by means of an automatic type of hydraulic drive.

8. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that it furthermore comprises:

- four devices for raising the covers of said loading mouths;

- four devices, preferably of the vibrating type, for cleaning and degraphitizing said loading mouths;

- a device for raising the covers of the loading mouths corresponding to said bridge connecting tube;

- a device for cleaning the upright columns;

- emergency and safety systems;

- an electric and oleodynamic system for automatically carrying out all the operations, and

- a photoelectric cell device for centering said hopper on the corresponding loading mouths.

9. An improved apparatus according to claim 8, c h a r a c t e r i z e d in that each said device for raising said covers is provided, at one end thereof, with a magnetic plate.

10. An improved apparatus according to claim 8, c h a r a c t e r i z e d in that each said cleaning and degraphitizing device consists of a counter-weight driving oleodynamic cleaning cylinder, preferably of the vibrating type.

11. An improved apparatus according to claim 8, c h a r a c t e r i z e d in that said device for cleaning said upright columns consists of a member effective to vertically reciprocate a cleaning swab.

12. An improved apparatus according to any preceding claims, c h a r a c t e r i z e d in that the bridge connecting tube and corresponding cover raising device assembly is effective to be shifted towards the inside of said apparatus and longitudinally moved for a length corresponding to the oven pitch.

13. An improved apparatus for loading coke ovens, under perfect antipollution and working conditions, as broadly described and illustrated in the preceding description and figures of the accompanying drawings.

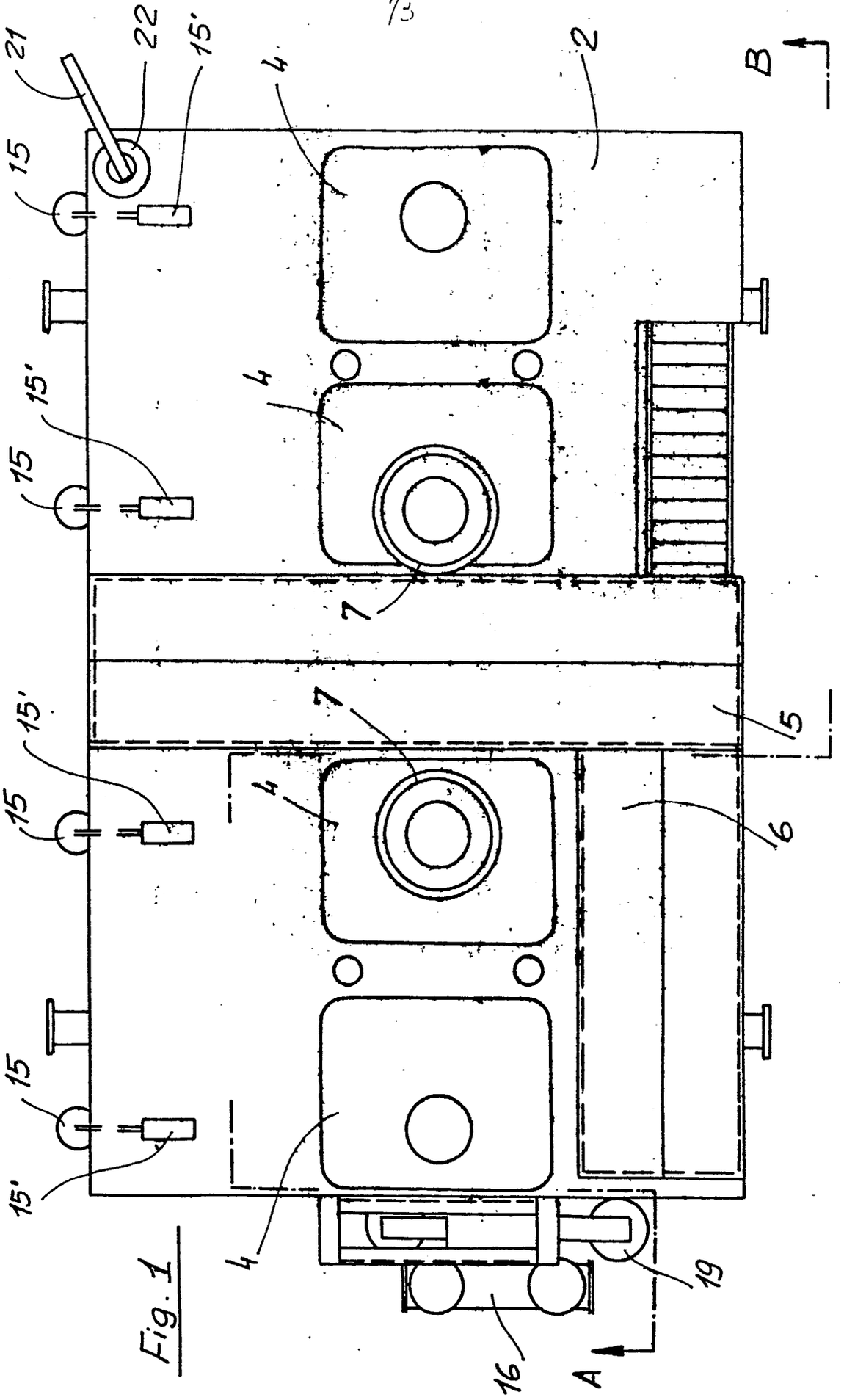

Fig. 1

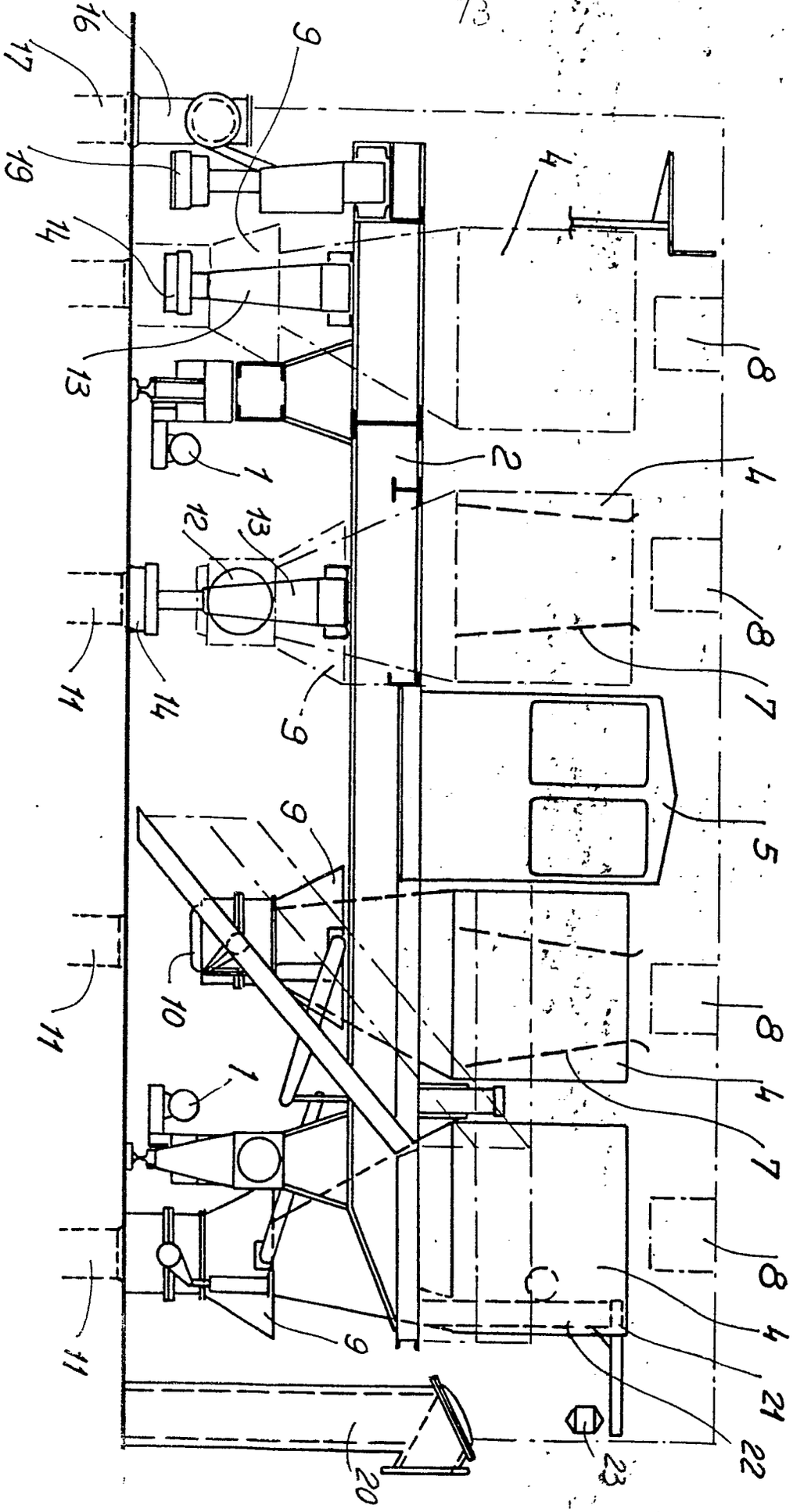

Fig. 2

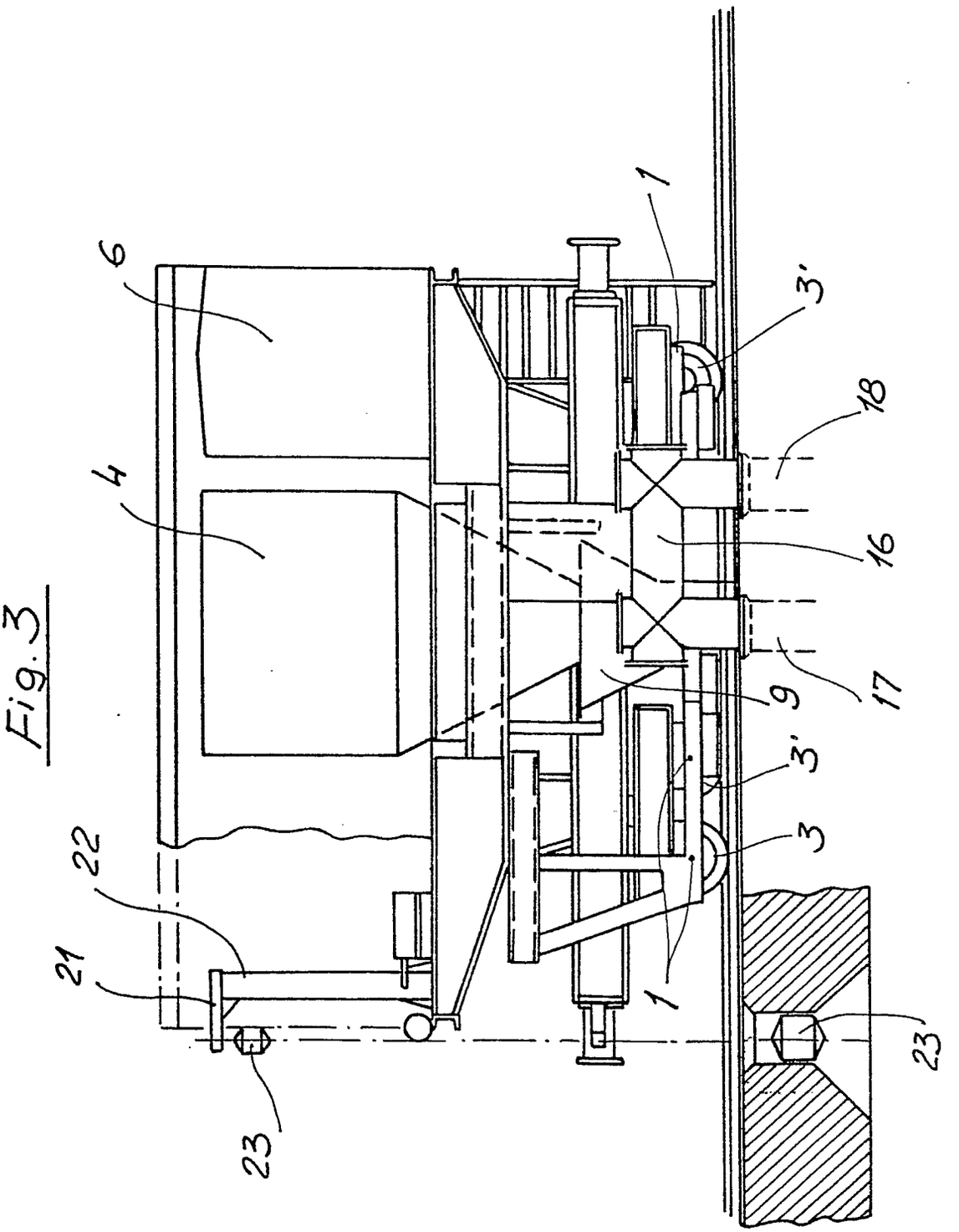

Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

0011673
Application number
EP 79 10 212.

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 1 855 191 (KING) * Claim 1; figure 3 *	1,7
	GB - A - 163 245 (WIL PUTTE) * Claims 1-3; figures 1-3 *	1,5
	US - A - 3 576 263 (ABENDROTH) * Claim 1; figures 1,2 *	1,4-13
	DE - C - 693 043 (KOPPERS) * Claim 1; figures *	8-10
	US - A - 3 400 052 (OLSEN) * Claim 1; figures *	8,11

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

C 10 B 31/04
27/04

TECHNICAL FIELDS SEARCHED (Int.Cl.³)

C 10 B 31/04
27/04
43/06
25/20

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21-02-1980	MEERTENS

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