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(54) **Improvements to hoods for aspiration of secondary fumes in steel mills and foundries.**

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## Description

This invention concerns improvements to hoods for aspiration of secondary fumes in steel mills and foundries.

The invention also concerns hoods for aspiration of secondary fumes in steel mills and foundries which adopt such improvements.

The invention concerns, in particular, hoods for aspiration of secondary fumes which are of the type described in European Patent Application published under No. 0063669 (priority: IT 83366 A/81) in the name of the present applicant.

Many attempts to overcome the problem of the collection of secondary fumes produced in steel mills are known. Some of these attempts have been developed to the stage of configuration of embodiments comprising actual chambers within which the furnaces, and arc furnaces in particular, are disposed

U.S. 3,806,622 discloses an installation cooperating with an arc furnace and enclosing it completely. This installation, however, envisages the arc furnace as being positioned on wheels and being movable but does not visualise the possibility of acting with a bridge crane except for moving the furnace itself.

U.S. 3,938,788 discloses an installation enclosing an arc furnace but cooperating with a crane at the same time. The lengthwise trolleys of the crane cooperate with movable panels which serve to close and plug appropriate openings made in the installation itself. This type of crane is substantially stationary and has its trolleys able to move along the crane itself.

DT-OS 2.511.387 discloses once more substantially the teaching of U.S. 3,938,788.

U.S. 4,088,824 discloses an integral installation which, however, envisages a movable ladle beneath it.

FR 2.381.107 discloses a box-like embodiment of a complex type, which, like the other cited installations, concerns only the furnace.

EP—A—0006084 discloses an embodiment in which a hood is solidly fixed to the trolley of a bridge crane and can move together with that trolley. This hood can cooperate with a stationary aspiration duct. The invention is restricted to applications to metallurgical vessels such as crucibles, ladles, etc., since the trolley mentioned cannot bear hoods of great sizes, such as those needed to collect fumes produced by electric arc furnaces.

EP—A—0003357 teaches a system in which the furnace is shut within an enclosure formed with two casings which can be opened. These casings are opened for the entry and exit of the charging or casting vessel. The collection of fumes while these casings are opened is entrusted to a hood solidly fixed to the bridge crane, and this hood can be placed so as to correspond and cooperate with a stationary aspiration duct. This system, however, entails various drawbacks and shortcomings. A first drawback lies in the fact that owing to the great distance between the vessel, or

furnace, and the hood the flow of air aspirated is of necessity considerable. Another drawback consists of the absence of sealing elements, in the lower part of the hood, which would be able to prevent the exit of fumes from the side of entry of the cables. Moreover, the cited patent has a system of closure of the hood by means of a movable portion solidly fixed to the trolley.

This system cannot ensure a proper seal on the closure side owing to the requirements for positioning the trolley. As a result a considerable flow of aspirated air is needed to obtain good efficiency of collection of fumes.

Patent DE—B—1.228.287 teaches a system with a hood of modest dimensions positioned immediately above a vessel, such as a ladle or crucible, and able to move with that vessel. Owing to its dimensions and positioning this hood cannot be very efficient, bearing in mind the fact that the flow of fumes to be aspirated has a high upwards speed owing to the high temperature. As a result the flow to be aspirated is very great. Moreover, the invention cannot be applied to the collection of fumes produced by a smelting furnace.

DE—B—1.217.028 discloses an embodiment suitable only for vessels of small sizes, the embodiment not being applicable to smelting furnaces.

European Patent Application No. 0063669 (priority: IT 83366 A/81) in the name of the present applicant which we cited earlier discloses hoods solidly fixed to the bridge crane charging the furnace, the hoods being capable of being connected to a lengthwise duct by preferential inlet means which can be closed.

The fact that the duct is positioned lengthwise allows the duct to be located in the middle between two bays of a shed so as to serve two hoods or sets of hoods placed on opposite sides of the duct. In this way it is possible to serve plants located on the two sides of the duct in one and the other bays respectively, the plants being served by two separate bridge cranes.

In the cited patent application the hoods can move with their bridge crane and comprise means to close the openings for the movement of the trolley and the cables bearing the charging or casting vessels. Moreover, these hoods comprise specific means suitable for connection, possibly with the interposition of sealing means, to the stationary inlets in the lengthwise aspiration duct.

It is a purpose of the present invention to improve the efficiency of the hoods described earlier by the present applicant in the cited patent application.

Another purpose of the invention is to provide means which enable a certain collection of fumes to be carried out even when the movable hoods together with the relative bridge crane are not positioned in correspondence with their working zone.

It is a further purpose of the invention to improve the efficiency of collection of fumes by providing possibly movable curtain means and/or directional screen means suitable for achieving

better channelling of the fumes from the zone of their production to the hoods.

Furthermore, the improvements of the invention can be applied not only in the case of hoods serving furnaces not shut within a soundproof enclosure but also in the case of furnaces shut within a soundproof enclosure.

According to the invention the hood consists of two parts, of which one can move together with a bridge crane, whereas the other part, also called the "hood roof", is positioned above and is stationary and solidly fixed to the lengthwise aspiration duct.

When the hood is in its working position, the exhaust collector forms the plurality of the upper part of the hood.

When the hood is absent from its working position, the collector stays in position above the zone producing the fumes and thus ensures a given collection of fumes at all times. The purpose of this is to ensure better conditions within the production sheds where the furnaces or other metallurgical vessels are located.

Moreover, with the embodiment according to the improvements of the invention the extra weight burdening the bridge crane and due to the hoods is reduced, while the load on the structures bearing the roof of the shed is much less than the load with a traditional hood.

Shutter means or their equivalent may be positioned between the hood roof and the aspirator duct so as to regulate the flow aspirated or to shut off the aspiration.

In the lower zone of the movable part of the hoods the invention envisages the ability to employ curtains or other flexible systems or systems which can be lowered. The purpose of such curtains is to extend the edge for the starting of collection of fumes as far downwards as possible and therefore as near as possible to the source of fumes.

In an embodiment entailing an enclosure of the metallurgical vessel it is possible to visualize means to collect or deflect fumes which are positioned substantially on the centre line of such enclosure. These fume collectors have the purpose of directing the fumes towards that particular one of the two hoods or sets of hoods, positioned respectively on one and the other sides of the lengthwise duct conveying the fumes, which is actually above the source of the fumes, the purpose being to improve the collection of fumes still further.

Where curtains or other means which can be lowered or, in any event, adjusted to determine the height for the beginning of fume collection are employed, it is possible for the functioning of such means to be automated, for instance in such a way that they are lowered only when the hood is in the aspiration position.

Advantageously, the provision of curtain means or screen means which can be lowered and raised achieves the purpose of a reduced overall vertical size of the hood when the latter is not in its working position.

Such reduced overall size obviates collisions with other structures which may be located in the sheds, such as the transformer supplying an arc furnace, for instance, when the hoods are moved.

The invention is therefore obtained with an assembly for aspiration of secondary fumes in steel mills and foundries, which assembly is suitable to cooperate with smelting furnaces, converters, crucibles, etc. for the aspiration of fumes emitted by the same and comprises:

—hood sidewalls fitted to and solidly fixed to a movable crane or bridge crane,

—stationary aspiration duct,

—means for moving said crane or bridge crane which are operative to bring said hood sidewalls into connection with the stationary aspiration duct,

—at least one opening in the hood sidewalls, which allows the passage of a trolley of the bridge crane, and

—means for the closure of such opening,

wherein: a) the connection means include a fixed hood roof for independent collection of fumes when the movable hood sidewalls move away, b) the fixed hood roof comprises an opening having a plan section at least equal in area to that enclosed by the movable hood sidewalls in the connected position and cooperates in the connected position with the latter, c) the fixed hood roof constitutes the major area of the top portion of the hood which aspirates secondary fumes.

We shall describe hereinafter a preferred embodiment of the invention as a non-restrictive example with the help of the attached figures, in which:

Figs. 1 give two views, a front view and a side view respectively, of an application of the invention to a furnace not surrounded by an enclosure;

Figs. 2 shows the application of the invention to a furnace within a soundproof enclosure.

In the figures the same parts or parts having the same functions bear the same reference numbers.

In Figs. 1 improved hoods 10 according to the invention comprise hood sidewalls 11 which are solidly fixed to a bridge crane and within which a charging trolley 15 can enter.

The hood sidewalls 11 comprise doors or other means 16—17 to close the openings required for the passage of the charging trolley 15 and of cables bearing a charging skip 18 or ladle 19.

The upper portion of the hoods consists, instead, of a stationary hood roof 12 communicating with a lengthwise duct 13 positioned in this instance on the center line between two bays of a shed 20.

Thus a collection surface provided by the plan section of the hood roof 12 itself is always positioned above a furnace 21 or vessel from which the fumes are emitted.

Thus collection is ensured for the fumes, which are gathered by the hood roof 12 and aspirated by the duct 13 even when the sidewalls 11 of the hood 10, solidly fixed to a bridge crane 14, are not

located in correspondence with the furnace 21 or, in any event, with the position of collection of fumes.

In the working position there is a small space between the sidewalls 11 and hood roof 12, but this space can be closed by providing possible seal means. Such seal means can be of various types and can consist, for instance, of flexible skirts or other equivalent means which can be provided on the hood roof 12 or on the movable sidewalls 11 of the hood 10.

One or more movable curtains 22 arranged on one or more sides of the hood 10 can be envisaged in the lower part of the movable sidewalls 11 of the hood 10 (see the lines of dashes in Fig. 1a).

Movement of the curtains 22 may possibly be controlled automatically, for instance by being governed by the position of the movable sidewalls 11 and therefore of the bridge crane 14 in relation to a charging zone 23 or casting zone 24.

The curtains 22 can be raised advantageously in this way when the sidewalls 11 of the hood 10 are not situated in correspondence with such charging zone 23 or casting zone 24, so that the curtains 22 will not come into contact with other structures inside the shed 20.

According to a variant which is not shown here, the curtains 22 can be embodied so as to cooperate with stationary structures of the shed 20, such as the upright columns 29, for example. In this way it will not be necessary for the curtains 22 to be movable or adjustable, for they will be cooperating with the sidewalls 11 of the hood 10 only in the working position of the hoods 10 themselves.

Figs. 2 show a variant relating to the application of the improvements of the invention to a furnace 21 provided with a soundproof enclosure. The enclosure consists of a surrounding structure 25 which encloses the furnace 21 wholly. This structure 25 contains also the charging skip 18 or ladle 19.

In this instance the enclosure 25 has an upper opening 27 through which the fumes can be collected by the hood 10. This opening 27 may possibly comprise closure means 30 such as doors, shutters or other equivalent means.

In this example, therefore, the sidewalls 11 of the hoods 10, which are solidly fixed to the bridge crane 14, will have smaller dimensions than those shown in Figs. 1 since these sidewalls 11 only need to collect fumes from the opening 27 in the top of the enclosure 25.

According to the improvements of the invention the enclosure 25 comprises closure means 26, such as doors or other equivalent means, which can be opened momentarily to allow the ladle 19 or charging skip 18 and relative cables to pass through. In contrast with known embodiments, the improvements of the invention envisage the doors 26 alone as being the only movable parts. In this way the movable parts have a much lower weight than in known solutions. As a result the relative controls are simpler, faster and more reliable.

Fig. 2a also shows conveyor or deflector means 28. In this case the conveyor means 28 are

conformed as a substantially V-shaped sector located in correspondence with the division between the charging zone 23 and casting zone 24. These conveyor means 28 have the purpose of assisting the conveying of fumes which are produced in the casting zone 24 or charging zone 23 respectively, towards the hood 10 positioned respectively above one or the other of those zones. In this way the conveying of the fumes is assisted.

We have described here some preferred embodiments of the invention, but variants are possible for a person skilled in this field without departing thereby from the scope of the invention itself.

Thus the shapes and proportions can be changed. The invention can be applied to only one bay of a shed 20, in which case the lengthwise duct 13 will serve only one set of hood sidewalls 11 and relative hood roof 12 located on only one side of the duct 13.

It is also possible to employ a soundproof enclosure 25 in a case where casting takes place in the same bay as that in which the furnace 21, or furnaces, is charged.

It is also possible to envisage the employment, in cooperation with the hoods 10 of the invention, of air curtain means which ensure a good seal between the sidewalls 11 and the hood roof 12 and/or between the enclosure 25 and the sidewalls 11 of the hoods 10.

Moreover, regulation means, such as shutters or other means, can be envisaged which are intended to regulate the flow aspirated by the individual hood roofs 12 whenever several hood roofs 12 are included and are served by the same aspiration duct 13.

According to another variant the aspiration duct 13 can also be visualized as having any required disposition other than a lengthwise disposition.

These and other variants are all possible without departing thereby from the scope of the invention.

## Claims

1. Assembly (10) for aspiration of secondary fumes in steel mills and foundries, which assembly (10) is suitable to cooperate with smelting furnaces, converters, crucibles, etc. for the aspiration of fumes emitted by the same and comprises:

—hood sidewalls (11) fitted to and solidly fixed to a movable crane or bridge crane (14),

—stationary aspiration duct (13),

—means for moving said crane or bridge crane which are operative to bring said hood sidewalls (11) into connection with the stationary aspiration duct (13),

—at least one opening in the hood sidewalls (11), which allows the passage of a trolley (15) of the bridge crane (14), and

—means (16—17) for the closure of such opening,

wherein a) the connection means include a fixed hood roof (12) for independent collection of fumes when the movable hood sidewalls (11) move

away, b) the fixed hood roof (12) comprises an opening having a plan section at least equal in area to that enclosed by the movable hood sidewalls in the connected position and cooperates in the connected position with the latter (11), c) the fixed hood roof (12) constitutes the major area of the top portion of the hood (10) which aspirates secondary fumes.

2. Assembly as claimed in Claim 1, comprising means to regulate the aspirated flow which are located between the hood roof (12) and the duct (13).

3. Assembly as claimed in Claim 1 or 2, which comprise at least momentary seal means between the hood roof (12) and the movable hood sidewalls (11).

4. Assembly as claimed in any claim hereinbefore, which comprise auxiliary means (22—28) to convey fumes that cooperate at least momentarily with the movable sidewalls (11) of the hood (10).

5. Assembly as claimed in Claim 1 or 4, by which the conveyor means (22) are solidly fixed to the movable hood sidewalls (11).

6. Assembly as claimed in Claim 4 or 5, by which the conveyor means (22) can be regulated in relation to the ground.

7. Assembly as claimed in Claim 4 or 5, by which the conveyor means (22) are stationary.

8. Assembly as claimed in any claim hereinbefore applied to a smelting furnace (21) not contained within an enclosure (25).

9. Assembly as claimed in any of Claims 1 to 7 inclusive applied to a smelting furnace (21) contained within an enclosure (25), which comprises at least one upper opening (27) for the passage of fumes.

10. Assembly as claimed in Claim 1 and 9, by which the enclosure (25) of the furnace (21) comprises doors (26) for the passage of a charging skip (18) or ladle (19), the plurality of the enclosure (25) being stationary.

11. Assembly as claimed in Claims 9 and 10, which comprise means to provide at least a momentary seal between the enclosure (25) and the movable hood sidewalls (11).

12. Assembly as claimed in any of Claims 9 to 11 inclusive, which comprise means (30) to close the upper opening (27) to the passage of fumes.

#### Patentansprüche

1. Anordnung (10) zum Absaugen von Sekundärabgasen in Stahlwerken und Gießereien, welche Anordnung (10) zum Zusammenwirken mit Schmelzöfen, Konvertern, Schmelztiegeln etc. zum Zwecke des Absaugens der von diesen abgegebenen Abgase geeignet ist und enthält:

—Haubenseitenwände (11), die an einem bewegbaren Kran oder Brückenkran (14) angeordnet und mit diesem fest verbunden sind,

—Einrichtungen zum Bewegen dieses Krans oder Brückenkrans, die bewirken können, daß die Haubenseitenwände (11) in Verbindung mit dem feststehenden Absaugkanal (13) kommen,

—zumindest eine Öffnung in den Haubenseitenwänden (11), welche den Durchtritt einer Laufkatze (15) des Brückenkrans (14) ermöglicht und

—Einrichtungen (16—17) zum Verschließen einer solchen Öffnung,

wobei a) die Verbindungseinrichtungen ein ortsfestes Haubendach (12) aufweisen, das ein unabhängiges Auffangen der Abgase ermöglicht, wenn sich die bewegbaren Haubenseitenwände (11) wegbewegen, b) das ortsfeste Haubendach (12) eine Öffnung aufweist, dessen Grundrißquerschnitt zumindest die gleiche Fläche aufweist, sodaß es in der verbundenen Position von den bewegbaren Haubenseitenwänden umschlossen ist und in der verbundenen Position mit letzteren (11) zusammenwirkt, c) das ortsfeste Haubendach (12) den größeren Bereich des Oberteils der Haube (10) bildet, welche die Sekundärabgase absaugt.

2. Anordnung nach Anspruch 1, mit zwischen dem Haubendach (12) und dem Absaugkanal (13) gelegenen Einrichtungen zum Regulieren des abgesaugten Flusses.

3. Anordnung nach Anspruch 1 oder 2, mit zumindest vorübergehend wirksamen Dichtungseinrichtungen zwischen dem Haubendach (12) und den bewegbaren Seitenwänden (11).

4. Anordnung nach irgendeinem der vorhergehenden Ansprüche, mit zusätzlichen Einrichtungen (22—28) zur Führung der Abgase, die zumindest vorübergehend mit den bewegbaren Seitenwänden (11) der Haube (10) zusammenwirken.

5. Anordnung nach Anspruch 1 oder 4, bei welcher die Führungseinrichtungen (22) fest an den bewegbaren Haubenseitenwänden (11) befestigt sind.

6. Anordnung nach Anspruch 4 oder 5, bei welcher die Führungseinrichtungen (22) bezüglich des Bodens einstellbar sind.

7. Anordnung nach Anspruch 4 oder 5, bei welcher die Führungseinrichtungen (22) ortsfest sind.

8. Anordnung nach irgendeinem der vorhergehenden Ansprüche, angewendet auf einen Schmelzofen (21), der nicht in einer Umhüllung (25) eingeschlossen ist.

9. Anordnung nach einem der Ansprüche 1 bis 7, angewendet auf einen Schmelzofen (21), der in einer Umhüllung (25) angeordnet ist, welche zumindest eine obere Öffnung (27) zum Durchtritt von Abgasen besitzt.

10. Anordnung nach Anspruch 1 und 9, bei welcher die Umhüllung (25) des Ofens (21) Türen (26) zum Durchtritt eines Kippkübels (18) oder einer Gießpfanne (19) besitzt, wobei der Großteil der Umhüllung (25) unbeweglich ist.

11. Anordnung nach Anspruch 9 und 10, mit Einrichtungen, die ein zumindest vorübergehendes Abdichten zwischen der Umhüllung (25) und den bewegbaren Haubenseitenwänden (11) ermöglichen.

12. Anordnung nach einem der Ansprüche 9 bis 11, welche eine Einrichtung (30) zum Verschließen der oberen Öffnung (27) zum Durchtritt der Abgase besitzt.

## Revendications

1. Système de hotte (10) destiné à aspirer des fumées secondaires dans des aciéries et des fonderies, propre à coopérer avec des fours de fusion, des convertisseurs, des creusets, etc., pour aspirer les fumées émises par ceux-ci, comprenant:

—des parois latérales de hotte (11) montées sur une grue ou un pont-grue mobile (14) et fixées rigidement à celui-ci;

—un conduit d'aspiration fixe (13);

—des moyens pour déplacer la grue ou le pont-grue, qui sont à même de raccorder les parois latérales (11) de la hotte au conduit d'aspiration fixe (13);

—au moins une ouverture dans les parois latérales (11) de la hotte qui permet le passage d'un chariot (15) du pont-grue (14), et

—des moyens (16—17) pour fermer cette ouverture,

dans lequel a) les moyens de raccordement comprennent une calotte de hotte fixe (12) destinée à capter les fumées de manière indépendante lorsque les parois latérales mobiles (11) s'écartent, b) la calotte de hotte fixe (12) comprend une ouverture présentant une section à plat au moins égale à celle délimitée par les parois latérales mobiles de la hotte en position raccordée et coopère dans la position raccordée avec ces parois latérales (11), c) la calotte de hotte fixe (12) constitue la majeure partie de l'aire de la partie supérieure de la hotte (10) qui aspire les fumées secondaires.

2. Système suivant la revendication 1, comprenant des moyens pour régler le flux aspiré, qui sont installés entre la calotte de hotte (12) et le conduit (13).

3. Système suivant la revendication 1 ou 2, qui

comprend des moyens d'étanchéité au moins momentanés entre la calotte de hotte (12) et les parois latérales de hotte mobiles (11).

4. Système suivant l'une quelconque des revendications précédentes, qui comprend des moyens auxiliaires (22 à 28) pour guider les fumées coopérant au moins momentanément avec les parois latérales mobiles (11) de la hotte (10).

5. Système suivant la revendication 1 ou 4, dans lequel les moyens déflecteurs (22) sont fixés rigidement aux parois latérales de hotte mobiles (11).

6. Système suivant la revendication 4 ou 5, dans lequel les moyens déflecteurs (22) peuvent être réglés par rapport au sol.

7. Système suivant la revendication 4 ou 5, dans lequel les moyens déflecteurs (22) sont fixes.

8. Système suivant l'une quelconque des revendications précédentes, appliqué à un four de fusion (21) non contenu dans une enceinte (25).

9. Système suivant l'une quelconque des revendications 1 à 7 incluse, appliqué à un four de fusion (21) contenu dans une enceinte (25) qui comprend au moins une ouverture supérieure (27) pour le passage de fumées.

10. Système suivant les revendications 1 et 9, dans lequel l'enceinte (25) du four (21) comprend des portes (26) livrant passage à une benne de chargement (18) ou à une poche de coulée (19), la majeure partie de l'enceinte (25) étant fixe.

11. Système suivant les revendications 9 et 10, qui comprend des moyens pour assurer au moins une étanchéité momentanée entre l'enceinte (25) et les parois latérales de hotte mobiles (11).

12. Système suivant l'une quelconque des revendications 9 à 11 incluse, qui comprend des moyens (30) pour fermer l'ouverture supérieure (27) aux fumées.

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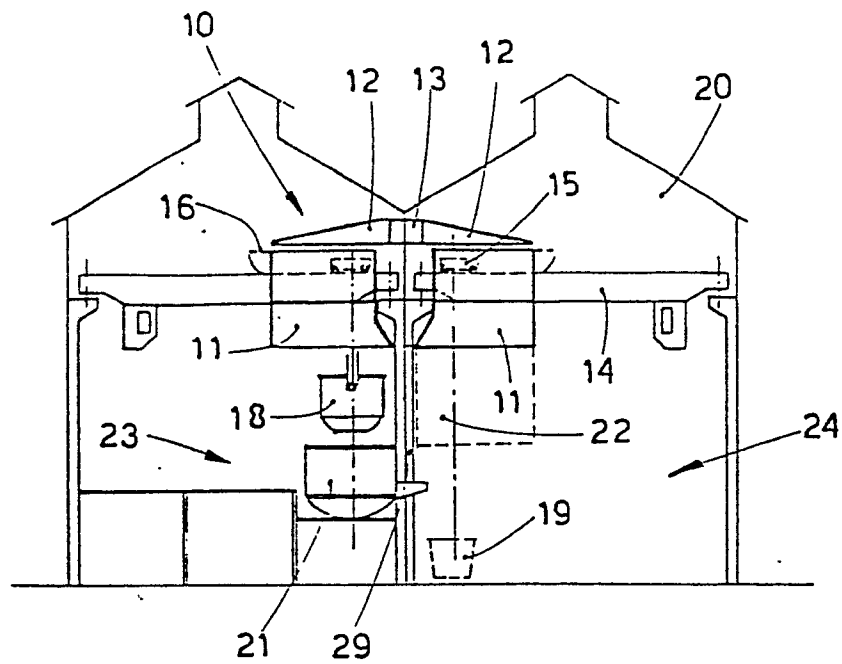


fig.1a

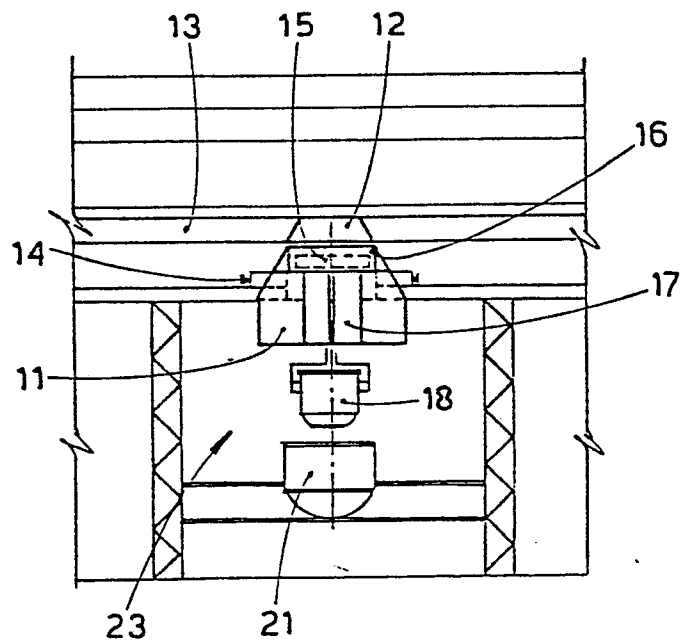


fig.1b

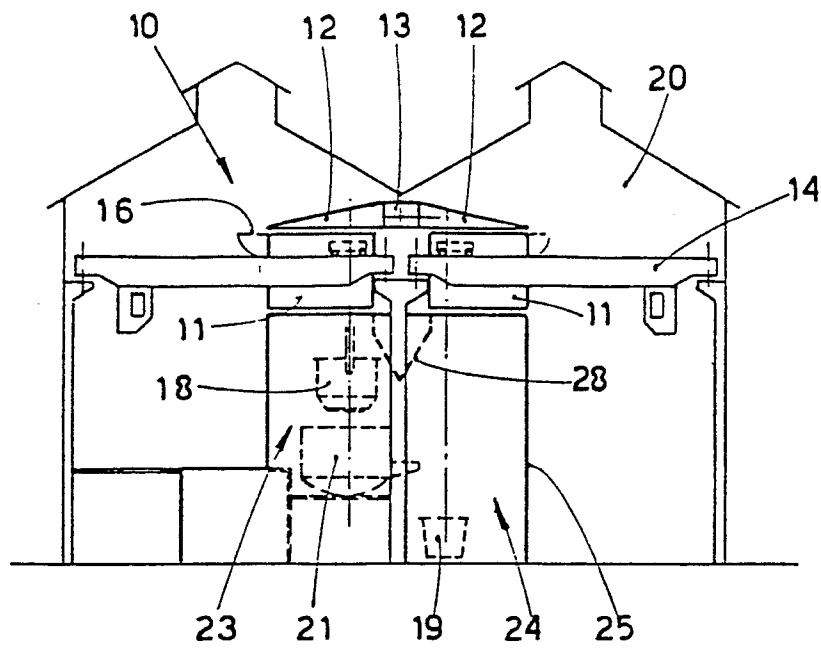


fig.2 a

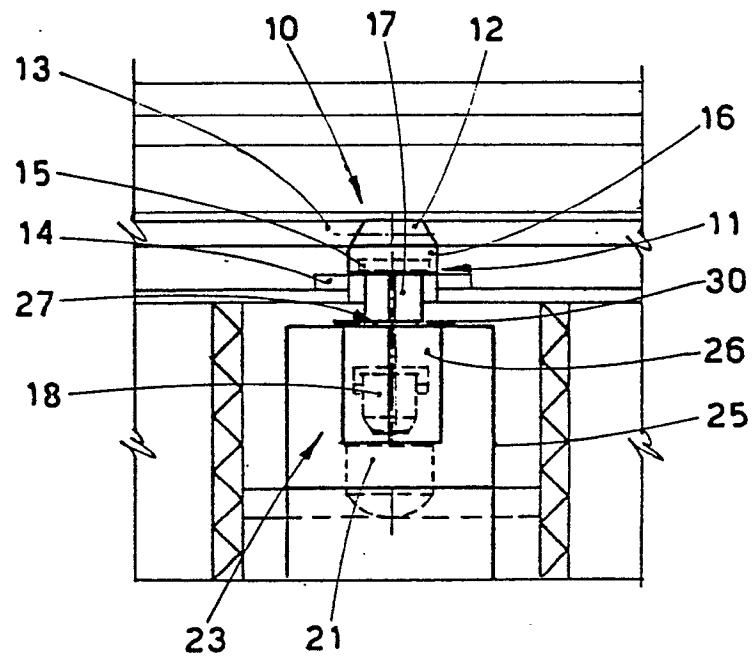


fig.2 b