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(54) **HYDROMECHANICAL MIXING APPARATUS**

HYDROMECHANISCHE MISCHVORRICHTUNG

APPAREIL DE MÉLANGE HYDROMÉCANIQUE

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Description

TECHNICAL FIELD

[0001] The invention relates to a hydromechanical mixing apparatus for producing a mixture of powder or granular state material and liquid.

BACKGROUND ART

[0002] In industry, it is frequently necessary to produce a mixture consisting of powder or granular state material and liquid. Such an application is the producing of a mixture - a so-called thick slurry - consisting of a solid phase combustion residue and water generated in a coal or oil-fired power station.

[0003] The hydromechanical mixing apparatuses utilise the kinetic energy of flows generated gravitationally and/or by pressure. In the case of gravitational flows, the mixing of liquid and solid phases is carried out in the gravitation space by means of baffle elements installed in a fixed way in the gravitation space, while in the case of applying pressure generated flows, the energy required for agitation is created by the pumping of the liquid. By way of example, Hungarian patent No. 172 922 and DE 26 02 858 A1, which discloses an apparatus in accordance with the preamble of claim 1, describe a gravitational hydromechanical mixing apparatus, known by those skilled in the art as 'hydromix', and used for producing thick slurry.

[0004] It is a general characteristic of well-known hydromechanical mixing apparatuses that they have at least one mixing space into which a hopper member feeds from above the powder or granular state material. On the inner wall of the feeding hopper member, a slurry-type deposit is inevitably generated during agitation. This deposit on the one hand prevents the regulated intake of an appropriate material volume and on the other reduces the efficiency of agitation. A further risk related to the deposit is that it may even block the whole cross section of the hopper member, and by solidifying there, it may hinder the technological process. A further risk is represented by the fact that the deposit may collapse under the weight of powder or granular state material arriving from above, which may cause impulsive or, as the case may be, destructive damage of the structures in the mixing space.

[0005] A further disadvantage of the prior art mixing apparatuses is that the pipe member or pipe head generally fitted on the top of the mixing tank and designed to extract the gases and/or air from the mixing space is also prone to being blocked. pipe cleaning device is described in WO 2005/049240.

DISCLOSURE OF INVENTION

[0006] The object of the invention is to create a hydromechanical mixing apparatus for producing a mixture of

powder or granular state material and liquid, in which the disadvantages of prior art solutions are eliminated. A further objective is the creation of a mixing apparatus which has a means designed to clean the feeding mechanism. A further objective is the creation of such a mixing apparatus which enables the efficient removal of deposits in members for the feeding of the material and also in those applied for extracting the air.

[0007] The invention thus relates to a hydromechanical mixing apparatus for producing a mixture of powder or granular state material and liquid. The apparatus has at least one mixing space and an inlet pipe member for feeding the powder or granular state material from above into the mixing space. The apparatus is characterised by comprising means for cleaning an inner wall of the inlet pipe member. Said means comprise:

- a cleaning member bidirectionally movable in parallel with the inlet direction, along the inner wall of the inlet pipe member, said cleaning member being a pipe insert inserted into the inlet pipe member, wherein the outer wall of the pipe insert is spaced apart from the inner wall of the pipe member, and
- an actuating member for moving the cleaning member, the actuating member being connected to the pipe insert's end protruding from the inlet pipe member.

By means of the pipe insert according to the invention, the removal of the deposit created on the inner wall of the inlet pipe member can be carried out very advantageously.

[0008] A preferred embodiment is **characterised in that** a flange is connected to an upper edge of the pipe insert and a plurality of bidirectionally movable work cylinder pistons are connected to the flange arranged with equal spacing around the periphery. Preferably, a pipeline feeding the powder or granular state material is inserted from above into the pipe insert and compensating cover is provided between the pipeline and the pipe insert and between the pipe insert and the pipe member, respectively, for preventing dusting and flexibly allowing the movement of the pipe insert. As a result of the beneficial movement and covering, the solution according to the invention can be implemented very simply and efficiently. Preferably, at a bottom edge of the pipe insert a cleaning edge is provided for facilitating cleaning.

[0009] A particularly preferred embodiment is **characterised in that** it comprises a pipe head for discharging the gaseous materials therefrom, and the pipe head also comprises means for cleaning its inner wall. The means for cleaning the inner wall of the pipe head comprises a pipe head cleaner made of spiral flat steel, and an actuating member - preferably a handle - protruding in a sealed manner from the pipe head. Thus, the pipe head cleaner according to the invention can be operated manually, because the dust slurry blocking the air outlet is a relatively rare occurrence as shown by experience.

Therefore, the preferred embodiment outlined is the most cost efficient way to clean the inner wall of the pipe head provided for discharging air.

[0010] The pipe head is preferably arranged with a substantially vertical axis, and a discharging pipeline is laterally connected thereto. The discharging pipeline is connected to a dust separator preferably via a safety air inlet valve and the separated dust is returned from the dust separator to the mixing space, preferably via the pipe head, in the form of dust slurry.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will hereinafter be described by way of preferred exemplary embodiments with reference to the drawings, where

Fig. 1 is a partial cross sectional view of the assembly provided for the feeding of the powder or granular state material with the cleaning means according to the invention,

Fig. 2 is a partial cross sectional view of the air outlet assembly comprising a cleaning means for the mixing apparatus shown in Fig. 1, and

Fig. 3 is a schematic view of a further technological arrangement associated with the assembly shown in Fig. 2.

MODES FOR CARRYING OUT THE INVENTION

[0012] Fig. 1 is a partial cross sectional schematic view of the assembly provided for feeding the powder or granular state material. The feeding assembly is preferably fitted on the lid 11 covering the upper part of a mixing space 10. The feeding of the powder or granular state material through the lid 11 is provided for by the pipe member 12, which enables feeding from above.

[0013] The hydromechanical mixing apparatus according to the invention has means for cleaning the inner wall of the inlet pipe member 12. The means according to the invention comprises a cleaning member 14, which can be moved bidirectionally in parallel with the feeding direction of the powder or granular state material along the inner wall of the inlet pipe member 12, as well as an actuating member 16 provided for displacing the cleaning member 14.

[0014] According to the preferred embodiment shown in the figure, the cleaning member 14 is formed as a pipe insert 14, which is fitted into the inlet pipe member 12, and the outer wall of the said pipe insert 14 is spaced apart from the inner wall of the pipe member 12. The appropriate spacing is ensured by sliding protrusions provided on the outer wall of the pipe insert 14 as shown in the figure. The at least one actuating member 16 is connected to the end of the pipe insert 14 protruding from the inlet pipe member 12.

[0015] According to the depicted exemplary embodiment, a flange 18 is connected to an upper edge of the

pipe insert 14. With equal spacing around the periphery of the flange 18, several - in the example three - work cylinder pistons are connected thereto as actuating members.

[0016] A pipeline or hopper 20 feeding the powder or granular state material - for example dry ash or flyash - from above is inserted into the pipe insert 14. A compensating cover 22 is provided for preventing dusting between the pipeline 20 and pipe insert 14 and pipe insert 14 and pipe member 12, respectively. Moving in a bellows fashion, the compensating cover 22 makes sure that the pipe insert 14 can be moved in two directions, maintaining the vacuum eventually needed in the mixing apparatus. Preferably, a buffer made of fabric can be applied. Preferably, the compensating cover has a thermal resistance of around 180°C and has a coating for facilitating sliding and cleaning on their inner surface.

[0017] In the embodiment shown by way of example, flushing air can be introduced into the mixing apparatus by means of an air inlet 24.

[0018] On the bottom edge of the pipe insert 14, a cleaning edge facilitating the removal of deposit is preferably provided. Preferably, the cleaning edge is formed by conical milling of the inner wall of the pipe insert 14.

[0019] On the inner surface of the pipe member 12, a smudge-like deposit is generated during agitation, which can be removed by moving the pipe insert 14 cyclically up and down. The cleaning process may eventually be supplemented by cyclically introducing compressed air, where the air is blown in preferably in a tangential manner.

[0020] The pipe member 12 and the cleaning member 14 are preferably made from stainless steel to make sure that the deposits can be easily slid and removed from the surfaces.

[0021] Fig. 2 is a partial cross sectional view of the air outlet assembly of the mixing apparatus fitted with a cleaning means as shown in Fig. 1. For extracting the gaseous materials from the mixing space 10', there is a pipe head 30 which is preferably fitted on the pipe stub located in the lid 11 a which covers the mixing space 10' from above. In a preferred embodiment, the pipe head 30 also has a means for cleaning its inner wall. Preferably, this means includes a pipe head cleaner 32 made from spiral flat steel and an actuating member 34 - preferably a handle - connected to the pipe head cleaner 32 and protruding in a sealed manner from the pipe head 30. The pipe head 30 is arranged with a substantially vertical axis, and a discharging pipeline 36 is laterally connected thereto.

[0022] The dusty air comprising thick slurry drops exits the mixing reservoir through the pipe head 30. The sludge consisting of the dust and thick slurry drops deposited in the pipe head 30 is removed by the pipe head cleaner 32. By the repeated operation of the pipe head cleaner 32, the vacuum can be maintained continuously in the mixing reservoir, while avoiding a sludge deposit. Both the pipe to be cleaned and the cleaner may be made of

stainless steel to facilitate cleaning. The pipe head cleaner 32 for the air extraction of the mixing reservoir is movably affixed to the closing lid of the pipe head 30. By removing the lid, the pipe head cleaner 32 can be taken out for maintenance.

[0023] A schematic view of a further technological arrangement in association with the assembly of Fig. 2 is shown in Fig. 3. As shown in the figure, the discharging pipeline 36 is connected to the dust separator 40 preferably via the safety air inlet valve 38. The dust separator 40 may also be preferably a bag type powder filter. In case the pipe head 30 is blocked as a result of a breakdown of the pipe head cleaner 32, the vacuum increases in the dust separator 40. The safety air inlet valve 38, also called the draught interrupter, protects the dust separator 40 and prevents the generation of an undesirably strong vacuum.

[0024] From the dust separator 40, the dust is delivered to the scrubber 44, where it is mixed into a dust slurry with water introduced through the scrubber water intake 46. The dust scrubber 44 may be made of carbon steel plate and is provided with appropriate surface protection. Depending on the dust to be treated, the dust slurry can have an alkaline or acidic reaction. The powder slurry is returned to the mixing space 10' via the powder slurry line 48. The return path can lead preferably via the pipe head 30. The required exhaustion for the dust separator 40 is provided by a fan 42 discharging the clean air through the air outlet 43 into the environment.

[0025] The following objectives are achieved by discharging the air: vacuum is created in the mixing apparatus during operation, the air introduced into the mixing apparatus is quickly removed, any carbonation as a result of the CO₂ content of the air is prevented, and furthermore the slurry generated as a result of the agitation is free of bubbles.

[0026] Consequently, the hydromechanical mixing apparatus according to the invention has means for cleaning the feeding member to prevent a deposit of the powder or granular state material, and preferably means for cleaning the air outlet. Through these measures, the hydromechanical mixing apparatus will work continuously, and the mixing process will not be interrupted by disadvantageous effects caused by the deposits.

[0027] It is to be appreciated that the invention is not limited to the preferred embodiments shown by way of example in the figures, but further modifications are possible within the scope of protection defined by the claims. The mixing apparatus according to the invention may have a single mixing space when the two types of cleaning means shown are provided for cleaning the openings of the same mixing space. At the same time it is also conceivable that the invention is used in an apparatus having several mixing spaces, in which case the means designed to clean the inlet pipe member is preferably connected to a so-called premixing apparatus sub-assembly, and the means designed for cleaning the air outlet is connected to a main mixing space.

[0028] The cleaning means also depicted in the figures may be constructed in other ways as well. For improving the efficiency of cleaning, preferably and by way of example an appropriately designed air injection may also be applied.

[0029] It is to be appreciated that the system and procedure according to the invention is not limited to the embodiments and methods described in detail, but further modifications and changes are possible within the scope of protection defined by the claims.

Claims

1. A hydromechanical mixing apparatus for producing a mixture of powder or granular state material and liquid, having at least one mixing space (10) and an inlet pipe member (12) for feeding the powder or granular state material from above into the mixing space, **characterised in that** it comprises means for cleaning an inner wall of the inlet pipe member (12), said means comprising:
 - a cleaning member (14) bidirectionally movable in parallel with the inlet direction, along the inner wall of the inlet pipe member (12), said cleaning member (14) being a pipe insert (14) inserted into the inlet pipe member (12), wherein the outer wall of the pipe insert (14) is spaced apart from the inner wall of the pipe member (12), and
 - an actuating member (16) for moving the cleaning member (14), the actuating member (16) being connected to the pipe insert's (14) end protruding from the inlet pipe member (12).
2. The mixing apparatus according to claim 1, **characterised in that** a flange (18) is connected to an upper edge of the pipe insert (14) and a plurality of bidirectionally movable work cylinder pistons are connected to the flange (18) arranged with equal spacing around the periphery.
3. The mixing apparatus according to claim 2, **characterised in that** a pipeline (20) feeding the powder or granular state material is inserted from above into the pipe insert (14) and a compensating cover (22) is provided between the pipeline (20) and the pipe insert (14) and between the pipe insert (14) and the pipe member (12), respectively, for preventing dusting and flexibly allowing the movement of the pipe insert (14).
4. The mixing apparatus according to claim 1, **characterised in that** at a bottom edge of the pipe insert (14) a cleaning edge is provided for facilitating cleaning.

5. The mixing apparatus according to any of the claims 1 to 4, **characterised by** comprising a pipe head (30) for discharging gaseous materials therefrom, and the pipe head (30) also comprises means for cleaning its inner wall, wherein said pipe head (30) is preferably fitted on a pipe stub located in a lid (11a) covering the mixing space (10') from above.
6. The mixing apparatus according to claim 5, **characterised in that** the means for cleaning the inner wall of the pipe head (30) comprises a pipe head cleaner (32) made of spiral flat steel, and an actuating member (34) - preferably a handle - protruding in a sealed manner from the pipe head (30).
7. The mixing apparatus according to claim 5, **characterised in that** the pipe head (30) is arranged with a substantially vertical axis, and a discharging pipeline, (36) is laterally connected thereto.
8. The mixing apparatus according to claim 7, **characterised in that** the discharging pipeline (36) is connected to a dust separator (40) preferably via a safety air inlet valve (38) and the separated dust is returned from the dust separator (40) to the mixing space (10'), preferably via the pipe head (30), in the form of dust slurry.

Patentansprüche

1. Hydromechanische Mischvorrichtung zum Erzeugen einer Mischung aus Pulver oder Material im Granulatzustand und einer Flüssigkeit, die zumindest einen Mischraum (10) aufweist und ein Einlassrohrelement (12) zum Zuführen des Pulvers oder Materials im Granulatzustand von oben in den Mischraum,
dadurch gekennzeichnet, dass
sie Mittel zum Reinigen einer inneren Wand des Einlassroherelements (12) umfasst, wobei die Mittel umfassen:
 - ein Reinigungselement (14), das bidirektional parallel zu der Einlassrichtung bewegbar ist, entlang der inneren Wand des Einlassroherelements (12), wobei das Reinigungselement (14) ein Rohreinsatz (14) ist, das in das Einlassroherelement (12) eingesetzt ist, wobei die äußere Wand des Rohreinsatzes (14) beabstandet von der inneren Wand des Rohrelements (12) angeordnet ist, und
 - ein Betätigungselement (16) zum Bewegen des Reinigungselements (14), wobei das Betätigungselement (16) mit dem Ende des Rohreinsatzes (14), das von dem Einlassroherelement (12) hervorsticht, verbunden ist.

2. Mischvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** ein Flansch (18) mit einer oberen Kante des Rohreinsatzes (14) verbunden ist und eine Vielzahl von bidirektional bewegbaren Arbeitszylinderkolben mit dem Flansch (18) verbunden sind, angeordnet mit einem gleichen Abstand um den Umfang.
3. Mischvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** eine Rohrleitung (20), die das Pulver oder Material im Granulatzustand zuführt, von oben in den Rohreinsatz (14) eingesetzt ist und eine Ausgleichsabdeckung (22) jeweils zwischen der Rohrleitung (20) und dem Rohreinsatz (14), und dem Rohreinsatz (14) und dem Rohrelement (12) vorgesehen ist, zum Verhindern des Verstaubens und zum flexiblen Ermöglichen der Bewegung des Rohreinsatzes (14).
4. Mischvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** an einer Bodenkante des Rohreinsatzes (14) eine Reinigungskante zum Erleichtern des Reinigens vorgesehen ist.
5. Mischvorrichtung nach einem der Ansprüche 1 bis 4, **gekennzeichnet durch** Umfassen eines Rohrkopfes (30) zum Entladen von Gasmaterial aus diesem, und wobei der Rohrkopf (30) ebenfalls Mittel zum Reinigen der inneren Wand umfasst, wobei der Rohrkopf (30) vorzugsweise an einem Rohrstumpf befestigt ist, der in einem Deckel (11a) lokalisiert ist, der den Mischraum (10') von oben abdeckt.
6. Mischvorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** die Mittel zum Reinigen der inneren Wand des Rohrkopfes (30) einen Rohrkopfreiniger (32) umfassen, der aus einem Spiralfachstahl hergestellt ist, und ein Betätigungselement (34) - vorzugsweise ein Handgriff - steht in einer abgedichteten Weise von dem Rohrkopf (30) hervor.
7. Mischvorrichtung nach Anspruch 5, **dadurch gekennzeichnet, dass** der Rohrkopf (30) mit einer im Wesentlichen vertikalen Achse angeordnet ist und eine Entladungsrohrleitung (36) dazu quer verbunden ist.
8. Mischvorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** die Entladungsrohrleitung (36) mit einem Staubabscheider (40) verbunden ist, mittels eines Sicherheitslufteinlassventils (38), und der abgetrennte Staub von dem Staubabscheider (40) zu der Mischkammer (10'), vorzugsweise mittels dem Rohrkopf (30) in der Form von Staubbrei, zurückgeführt wird.

Revendications

1. Appareil de mélange hydromécanique pour produire un mélange de matériau à l'état de poudre ou granulaire et de liquide, ayant au moins un espace de mélange (10) et un élément de tuyau d'entrée (12) pour alimenter le matériau à l'état de poudre ou granulaire du dessus dans l'espace de mélange, **caractérisé en ce qu'il** comprend des moyens pour nettoyer une paroi interne de l'élément de tuyau d'entrée (12), lesdits moyens comprenant :
 - un élément de nettoyage (14) se déplaçant de manière bidirectionnelle avec la direction d'entrée, le long de la paroi interne de l'élément de tuyau d'entrée (12), ledit élément de nettoyage (14) étant un insert de tuyau (14) inséré dans l'élément de tuyau d'entrée (12), dans lequel la paroi externe de l'insert de tuyau (14) est espacée de la paroi interne de l'élément de tuyau (12), et
 - un élément d'actionnement (16) pour déplacer l'élément de nettoyage (14), l'élément d'actionnement (16) étant raccordé à l'extrémité de l'insert de tuyau (14) saillant depuis l'élément de tuyau d'entrée (12).
2. Appareil de mélange selon la revendication 1, **caractérisé en ce qu'une** bride (18) est raccordée à un bord supérieur de l'insert de tuyau (14) et une pluralité de pistons de cylindre de fonctionnement mobiles de manière bidirectionnelle sont raccordés à la bride (18) disposée selon un espacement égal autour de la périphérie.
3. Appareil de mélange selon la revendication 2, **caractérisé en ce qu'un** conduit (20) alimentant le matériau à l'état de poudre ou granulaire est inséré par le dessus dans l'insert de tuyau (14) et une couverture de compensation (22) est fournie entre le conduit (20) et l'insert de tuyau (14) et entre l'insert de tuyau (14) et l'élément de tuyau (12), respectivement, pour empêcher la poussière et permettre le mouvement flexible de l'insert de tuyau (14).
4. Appareil de mélange selon la revendication 1, **caractérisé en ce qu'un** bord de nettoyage est ménagé sur un bord inférieur de l'insert de tuyau (14), pour faciliter le nettoyage.
5. Appareil de mélange selon l'une quelconque des revendications 1 à 4, **caractérisé en ce qu'il** comprend une tête de tuyau (30) pour décharger des matériaux gazeux de celle-ci, et la tête de tuyau (30) comprend également des moyens pour nettoyer sa paroi interne, dans lequel ladite tête de tuyau (30) est de préférence équipée sur un bras de tuyau situé dans un rebord (11a) couvrant l'espace de mélange (10') depuis le dessus.
6. Appareil de mélange selon la revendication 5, **caractérisé en ce que** les moyens pour nettoyer la paroi interne de la tête de tuyau (30) comprennent un nettoyeur de tête de tuyau (32) constitué d'un acier plat en spirale, et un élément d'actionnement (34) - de préférence une poignée - saillant de manière étanche depuis la tête de tuyau (30).
7. Appareil de mélange selon la revendication 5, **caractérisé en ce que** la tête de tuyau (30) est disposée avec un axe sensiblement vertical, et un conduit de décharge (36) y est latéralement raccordé.
8. Appareil de mélange selon la revendication 7, **caractérisé en ce que** le conduit de décharge (36) est raccordé à un séparateur de poussière (40), de préférence par le biais d'une soupape d'entrée d'air de sécurité (38) et la poussière séparée est renvoyée du séparateur de poussière (40) à l'espace de mélange (10'), de préférence par le biais de la tête de tuyau (30), sous la forme d'une pâte de poussière.

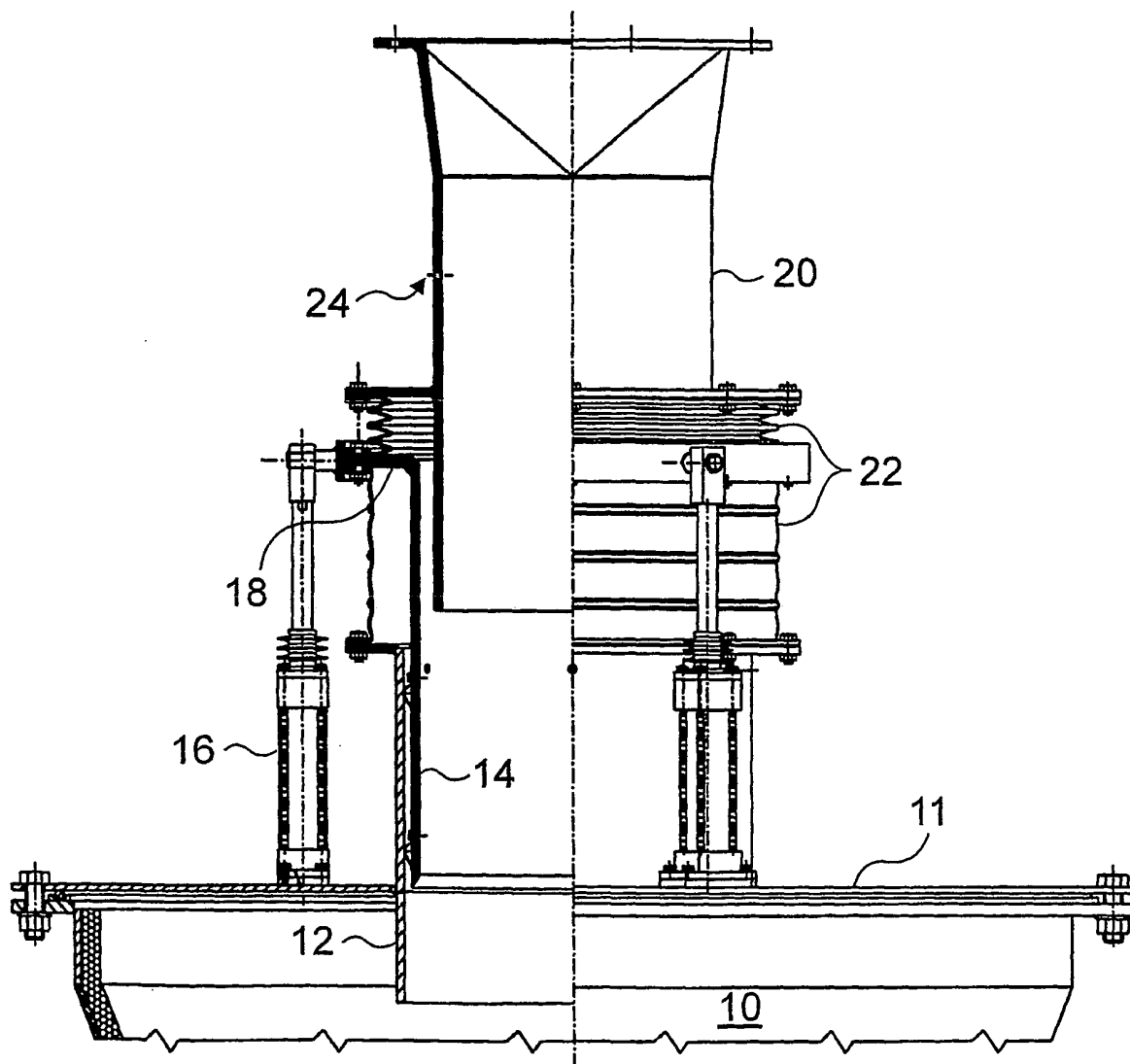


Fig. 1

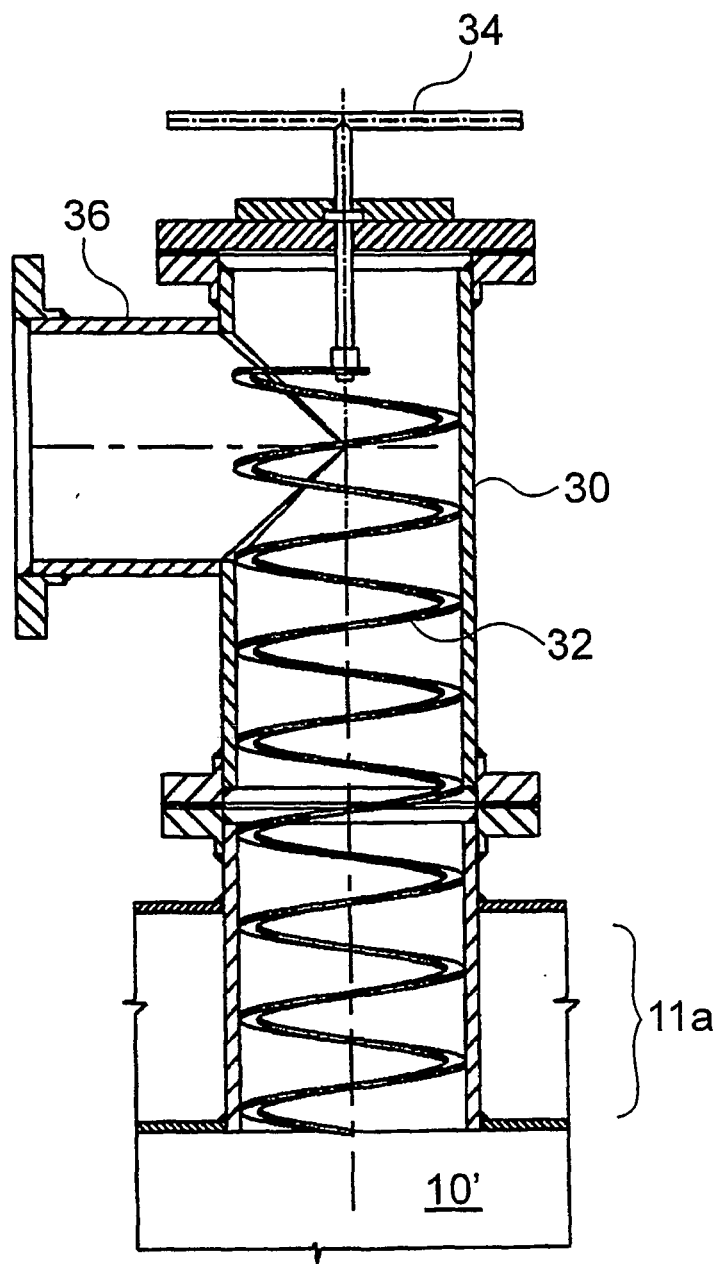


Fig. 2

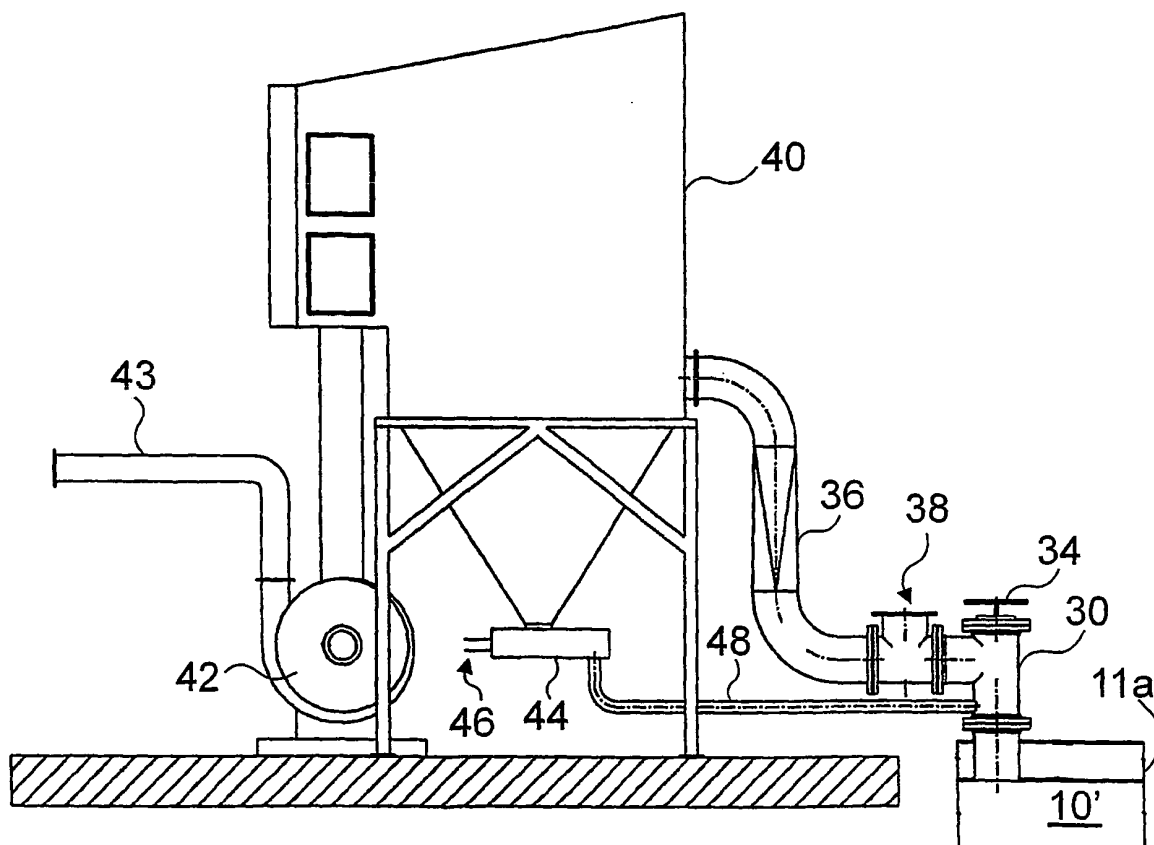


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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