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(54) **Apparatus for heating tubular bodies**

(57) The present invention relates to an apparatus for heating tubular bodies or the like, comprising supply means (20) adapted to convey a combustion fluid toward a distributor, a plurality of ducts (40) connected to said

distributor and adapted to convey said combustion fluid toward a plurality of flame nozzles (50), at least one of said ducts (40) being configured to vary its length automatically.

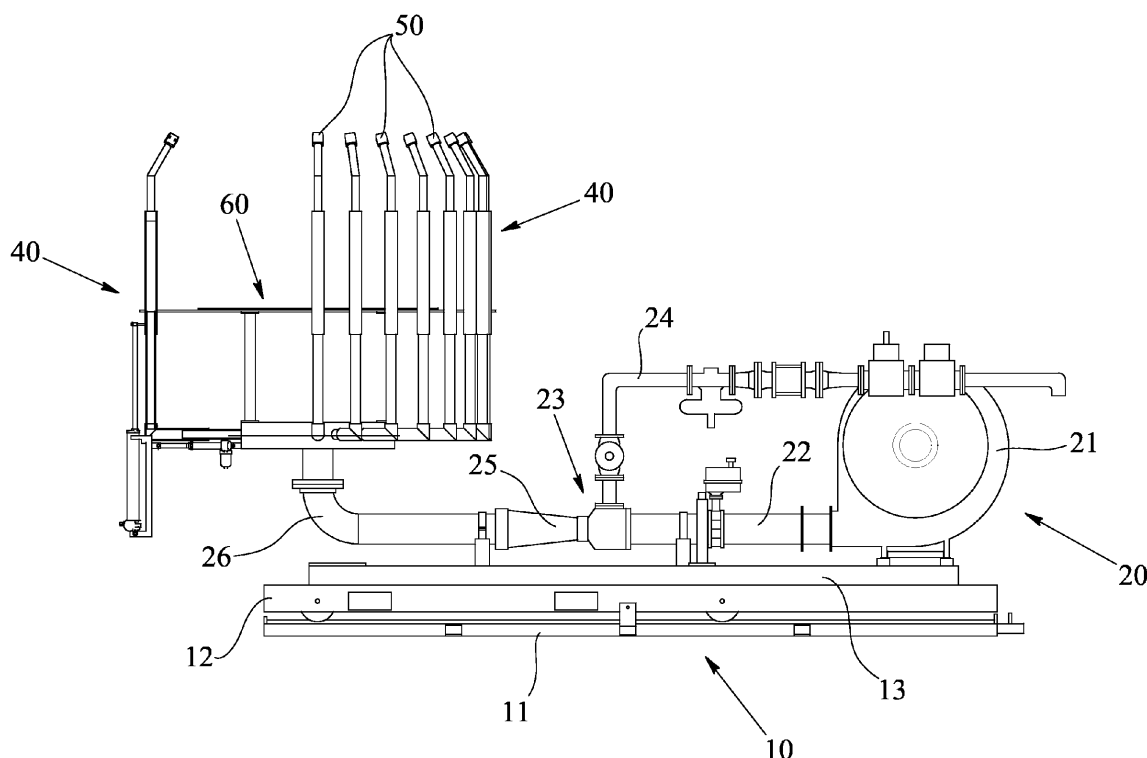


Fig. 1

Description

[0001] The present invention relates to an apparatus for heating substantially tubular bodies and more in particular substantially cylindrical metal bodies such as pipes or unions of medium or large size.

[0002] As is known, in plants in which large quantities of gases or fluids must be transported, such as power stations, off-shore platforms, chemical industries or oil or gas pipelines, a large number of pipes, unions, valves or the like are used, which can have diameters of up to two meters or more.

[0003] Due to the large dimensions, many of these components are often not standardized, but sized and constructed ad hoc, according to the design requirements of the plant.

[0004] Typical processes carried out to obtain a finished component from a semi-finished component include, for example, plastic deformation processes.

[0005] These processes are generally performed hot, i.e. by heating the piece to a temperature equal to or greater than around 60% of the melting temperature, which, in the case of parts made of steel, is around 1000 °C or more.

[0006] This is performed using special furnaces of large dimensions, in which the components to be heated are placed. In other cases, when the dimensions of these components are too large to fit inside a furnace, or when the process only involves a small area of the piece, heating is performed locally only in the area involved.

[0007] One of these cases is, for example, the production of one or more branches (in practice tees) in a pipe with a large diameter.

[0008] To obtain this, the least expensive production process involves plastic deformation of the edge of a hole produced on the surface of the pipe to create an opening for connection of another pipe.

[0009] For this purpose there are known apparatus for heating components thus structured comprising a distributor, supplied with a mixture of gas and air, connected to a plurality of ducts leading to the same number of nozzles adapted to direct a flame against the surface of the piece to be heated.

[0010] More in detail, said nozzles are arranged so as to direct the flame in the vicinity of the edge of the hole made in the pipe to heat the part of material that will then be deformed by means of known systems.

[0011] Generally, the piece to be heated is arranged horizontally over the apparatus with the hole facing downward so that the flame emitted from the nozzles has a substantially vertical or slightly transverse direction.

[0012] However, these known apparatus thus configured have some limits.

[0013] A first problem relates, for example, to non-uniform heating of the area of the piece to be deformed.

[0014] The deformation process in fact can take place in several steps during which the edge of the hole is progressively enlarged and pushed toward the outside of

the pipe using a spherical die, gradually forming a substantially cylindrical wall arranged transverse with respect to the pipe and which must also be subjected to plastic deformation in the subsequent steps to increase its diameter.

[0015] The area to be initially heated may be only the edge of the hole but progressively becomes a wider surface also comprising said wall.

[0016] Known apparatus are generally provided with jointed pipes that allow the nozzles to be positioned manually at the edge of the hole prior to heating, but which remain in said position for the whole of the heating process.

[0017] As the area to be heated becomes progressively larger, the fixed position of said nozzles does not allow uniform heating of the portion of material to be processed, requiring both a longer heating time and an overheating of the areas closest to the nozzles.

[0018] As already mentioned, positioning of the nozzles takes place manually by acting on the ducts, which are generally connected to the distributor by means of flexible pipes or the like.

[0019] Besides requiring a certain amount of time to position the nozzles at a more or less uniform distance from the area to be processed, this operation is also particularly difficult when the apparatus is hot, for example during heating or between one step and the next of the deformation process.

[0020] Problems similar to those described above can also occur in the case in which a plastic deformation process must be carried out at the end or head of a pipe. According to the length of the section to be processed, it may be necessary to continuously vary the relative position between the heating nozzles and the piece to obtain uniform heating.

[0021] Both in this case and in the one described previously, this does not generally occur due to the difficulty of accurately moving (a number of times) parts with large dimensions and weight heated to high temperatures.

[0022] In this context, the object of the present invention is to provide an apparatus for heating tubular bodies, which overcomes the problems of the prior art described above.

[0023] In particular, the object of the present invention is to produce an apparatus for heating substantially cylindrical bodies such as metal pipes or the like, which allows uniform heating of a surface with a substantially circular profile with a given extension.

[0024] More in detail, the object of the present invention is to produce an apparatus for heating tubular bodies that allows the extension of the area to be heated to be varied automatically and continuously.

[0025] A further object of the present invention is to provide an apparatus for heating tubular bodies that allows optimization of the heating time of a piece reducing the energy consumed to a minimum.

[0026] These objects are substantially achieved by an apparatus for heating tubular bodies or the like, compris-

ing supply means adapted to convey a combustion fluid toward a distributor, a plurality of ducts connected to said distributor adapted to convey said combustion fluid toward a plurality of flame nozzles, characterized in that at least one of said ducts is configured to vary its length automatically.

[0027] In this way, it is possible to move the flame nozzles connected to the ducts to heat wider surfaces in less time and in a uniform manner, or to heat the edge of a hole by positioning said flame nozzles at the most appropriate distance from it in a simple and rapid manner.

[0028] Advantageously, said at least one duct comprises at least a first and at least a second portion sliding relative to each other in a telescoping manner, which can be moved by specific actuator means.

[0029] The flame nozzles can therefore be moved independently with respect to the piece according to processing requirements.

[0030] According to a preferred variant, said ducts can comprise at least a first section that extends in a substantially radial direction with respect to the distributor and a second section that extends in a substantially vertical direction, wherein the first and second portion of the duct are comprised in said second substantially vertical section.

[0031] Again according to a preferred variant, said ducts can comprise a third portion and a fourth portion, sliding relative to each other in a telescoping manner, which are comprised in the first section of duct that extends in a substantially radial direction with respect to the distributor.

[0032] In practice, the flame nozzles can be translated both vertically and radially so as to be moved toward or away from one another and arranged along a larger or smaller substantially circular perimeter.

[0033] This allows the same apparatus to be used for heating tubular bodies of different dimensions and shapes, always maintaining the flame at a correct distance from the surface of the piece.

[0034] Advantageously, the apparatus comprises a control unit that controls movement of the actuator means and which can be used to memorize an automatic movement program specific for the shape and dimensions of the piece to be heated.

[0035] Further characteristics and advantages will become more apparent from the indicative and therefore non-limiting description of an example of preferred but not exclusive embodiment of the invention, illustrated in the accompanying figures, wherein:

- Fig. 1 is a side view of the apparatus for heating tubular bodies according to the invention;
- Fig. 2 is a sectional side view of a detail of the apparatus of Fig. 1;
- Fig. 3 is a top view of a detail of the apparatus of Fig. 1.

[0036] With reference to the accompanying figures, the

apparatus according to the invention comprises a base, indicated as a whole with 10, on which there are installed supply means 20 adapted to convey a combustion fluid, preferably a mixture of gas and air, toward a distributor 30.

[0037] According to a preferred embodiment, said supply means 20 comprise a fan 21 adapted to convey an air flow, through a pipe 22, toward a mixer 23 to which a flow of combustion gas (such as methane, butane or the like) is also supplied by means of a pipe 24, in turn connected to a tank or to a gas distribution network.

[0038] In detail, said mixer 23 can, for example, comprise a pipe 25 with a convergent-divergent section that, making use of the Venturi effect, regulates and mixes the quantity of air and gas sent toward the distributor 30, according to the velocity (and consequently the flow rate) of the air supplied by the fan 21.

[0039] The distributor 30 instead comprises a hollow body 31 preferably with a circular section, and more preferably cylindrical in shape, defining an inner chamber 32.

[0040] According to the embodiment shown, a pipe 26 coming from the mixer 23 is in connection with said chamber 32 through the lower face of the body 31 to supply the flow of combustion fluid, and more specifically the mixture of gas and air.

[0041] From the distributor 30, and in particular from the lateral face 33, a plurality of ducts 40 extend, adapted to convey said combustion fluid toward a plurality of flame nozzles 50; preferably, but not exclusively, each duct 40 supplies a single flame nozzle 50.

[0042] More in detail, said ducts 40 extend in a prevalently vertical, or substantially vertical, direction and are arranged so that the respective flame nozzles 50 placed at the ends are aligned along a substantially circular perimeter.

[0043] In this way, the flames emitted from said nozzles can heat cylindrical, or substantially cylindrical, tubular bodies arranged inside said perimeter, or the edge of a hole produced on a flat or curved wall, in a uniform manner.

[0044] A characteristic of the invention is to provide at least one of said ducts 40 configured so as to be able to vary its length automatically, in other words be able to vary the position of the flame nozzle 50 with respect to the piece to be heated, which, being of large dimensions, is generally maintained in a fixed position.

[0045] More in detail, said at least one duct 40 is configured to vary its length along at least one direction and, in particular, along at least one substantially vertical direction, i.e. parallel to the main direction of extension of said duct.

[0046] This makes it possible, for example, to heat a substantially cylindrical surface in a uniform manner along a section of a given length, or to heat the edge of a hole produced on a curved surface maintaining the flame nozzles 50 at a desired distance from said edge.

[0047] For this purpose, advantageously, several ducts 40 can be configured so as to vary their length,

thus being able to position the flame nozzles 50 independently with respect to the piece.

[0048] According to an embodiment, said ducts 40 with variable length can comprise at least a first portion 41 and at least a second portion 42 sliding relative to each other in a telescoping manner along a substantially vertical direction. More in detail the first portion 41 can be fixed with respect to the distributor 30 and the second portion 42, on which the flame nozzle 50 is placed, can slide from a position of minimum height to a position of maximum height of the flame nozzle 50.

[0049] Movement of the two portions of duct 41, 42 can be implemented by means of specific actuators 43 adapted to move, independently or in a coordinated manner, said first and second portion 41, 42 of one or more of said ducts 40.

[0050] Said actuator means 43 can comprise, for example, a linear actuator moved by an electric motor or equivalent devices.

[0051] A control unit (not shown in the figure) allows an operator to control and manage movement of the actuators 43 in real time to arrange the flame nozzles 50 in a position chosen with respect to the piece or to memorize an automatic program for continuous or discontinuous movement of the flame nozzles 50.

[0052] For this purpose, the actuators 43 can be provided with a device for controlling sliding of the second portion of the duct 42, such as an encoder or the like. Advantageously, end of stroke sensors can also be provided to detect the position of minimum or maximum height of the nozzles, or both.

[0053] According to a preferred variant, said ducts 40 comprise at least a first section 40a that extends in a substantially radial direction with respect to the distributor and a second section 40b that extends in a substantially vertical direction; in the duct thus structured, the first and the second sliding portions 41, 42 are comprised in said second substantially vertical section 40b.

[0054] To also vary the extension of the perimeter along which the flame nozzles 50 are arranged, the ducts 40 can also comprise a third portion 44 and a fourth portion 45, also sliding relative to each other in a telescoping manner, comprised in the first section of duct 40a that extends in a substantially radial direction with respect to the distributor 30.

[0055] Said third and fourth portion of duct 44, 45, being able to slide from a position of minimum extension to a position of maximum extension of the flame nozzle 50, allow the flame to be positioned at the correct distance from tubular bodies of different dimensions and shapes (for example not perfectly cylindrical).

[0056] Similarly, also said third 44 and said fourth 45 portion of the duct 40 are moved by means of actuators 46, also connected to the control unit, which can control their simultaneous or independent extension for each duct according to requirements.

[0057] In the embodiment illustrated, the first portion 41 of the duct and the fourth portion 45 of the duct are

coupled integral with each other but alternatively they could be produced as a single elbow element.

[0058] To limit excessive heating of the ducts, i.e. to prevent deformations that could compromise the sliding and tightness thereof, at least one part thereof is clad with a heat insulating material, such as rock wool or the like.

[0059] In a preferred variant, at least a second portion 42, i.e. the portion closest to the heat source, is shrouded by a layer of insulating material 48 in turn protected by a casing 49 preferably made of a metal material.

[0060] To prevent rotation of the second portion 42 of the duct, which would cause incorrect orientation of the flame nozzle 50, the apparatus is provided with a guide comprising a plate 60 substantially circular in shape, arranged between the ducts 40, and in particular between the second portions 42, in which there are produced a plurality of slots 61 that enable radial extension of the ducts 40, i.e. when the third and the fourth portion 44, 45 slide relative to each other.

[0061] Advantageously, the casing 49 that surrounds the second portion 42 can be produced with a quadrilateral profile with a slightly smaller dimension than the dimension of said slots 61 so as to slide therein without being able to rotate.

[0062] To further limit the thermal energy radiated from the piece at high temperature toward more delicate components of the apparatus, such as the actuators and other control components, said plate 60 can be coated on the top or bottom with a layer of insulating material 62.

[0063] Moreover, according to the invention the base 10 can be configured to move the whole apparatus, therefore all the nozzles simultaneously, along a horizontal and/or vertical direction.

[0064] This is particularly useful to take the apparatus to an idle position, in which it remains outside the operating area in which the piece to be heated is positioned, to an operating position where, with the aid of actuator means, it can be aligned and centered with the piece.

[0065] In this way it is possible to limit movements of the piece and in particular to limit accurate positioning with respect to the apparatus, which are somewhat complicated to perform given the large weight and dimensions typical of these components.

[0066] More in detail, said base 10 can comprise at least one pair of tracks or guides 11 on which a slide 12 slides along a substantially horizontal direction, moved by hydraulic actuators or the like, on which the various components of the apparatus (distributor, ducts, nozzles, etc.) are in turn installed. The horizontal movement of the slide 12 allows the nozzles 50 to be easily and accurately centered with the tubular element or the edge of the hole to be heated.

[0067] Preferably, said base can also comprise a frame 13 supported by the slide 12, and sliding vertically with respect thereto by means of actuators, on which the components of the apparatus are connected integral.

[0068] In practice, the components of the apparatus,

and in particular the group of ducts 40 and nozzles 50, are movable along at least one horizontal and one vertical axis to allow optimal positioning of the nozzles with respect to the piece without requiring to move the latter.

[0069] Once the apparatus has been positioned and centered, the nozzles 50 can be moved in an accurate and programmed manner, with the aid of the linear actuators controlled according to the heating operation to be performed, to the shape of the piece, etc.

[0070] The present invention, as described and illustrated, may be subject to various modifications and variants, all of which fall within the scope of the invention; furthermore, all the details may be replaced with other technically equivalent elements.

Claims

1. Apparatus for heating tubular bodies or the like, comprising supply means (20) adapted to convey a mixture of a combustion fluid toward a distributor (30), a plurality of ducts (40) connected to said distributor (30) adapted to convey said combustion fluid toward a plurality of flame nozzles (50), **characterized in that** at least one of said ducts (40) is configured to vary its length automatically.
2. Apparatus for heating tubular bodies or the like according to claim 1, **characterized in that** said at least one duct (40) comprises at least a first portion (41) and at least a second portion (42) sliding relative to each other in a telescoping manner.
3. Apparatus for heating tubular bodies or the like according to claim 2, **characterized in that** it is provided with actuator means (43) adapted to respectively move the first and the second portion (41, 42) of said at least one duct (40).
4. Apparatus for heating tubular bodies or the like according to claim 2 or 3, **characterized in that** said ducts (40) comprise at least a first section (40a) that extends in a substantially radial direction with respect to the distributor (30) and a second section (40b) that extends in a substantially vertical direction, said first and second portion of the duct (41, 42) being comprised in said second substantially vertical section (40b).
5. Apparatus for heating tubular bodies or the like according to claim 4, **characterized in that** said ducts (40) comprise a third portion (44) and a fourth portion (45) sliding relative to each other in a telescoping manner, said portions being comprised in the first section of duct (40a) that extends in a substantially radial direction with respect to the distributor (30).
6. Apparatus for heating tubular bodies or the like according to claim 5, **characterized in that** it is provided with actuator means (46) adapted to respectively move said third and said fourth portion (44, 45) of the duct (40).
7. Apparatus for heating tubular bodies or the like according to any one of claims 3 to 6, **characterized in that** it comprises a control unit adapted to selectively control said actuator means.
8. Apparatus for heating tubular bodies or the like according to any one of the preceding claims, **characterized in that** at least one portion of the duct (40) is clad with an insulating material.
9. Apparatus for heating tubular bodies or the like according to claim 8, **characterized in that** at least the second portion (42) of the duct (40) is shrouded by a layer of insulating material (48), in turn covered by a casing (49).
10. Apparatus for heating tubular bodies or the like according to any one of the preceding claims, **characterized in that** it is provided with a guide comprising a plate (60) substantially circular in shape, arranged between the ducts (40), on said plate there being produced a plurality of slots (61) that enable sliding of the ducts (40) during extension in radial direction.
11. Apparatus for heating tubular bodies or the like according to claims 9 and 10, **characterized in that** said casing (49) is configured so as to be able to translate inside said guide slots (61) without rotating.
12. Apparatus for heating tubular bodies or the like according to any one of the preceding claims, **characterized in that** said base (10) comprises a pair or tracks (11) on which a slide (12) slides along a substantially horizontal direction moved by hydraulic actuators or the like, and a frame (13), supported by said slide (12), sliding vertically with respect thereto by means of actuators, on which the components of the apparatus are connected.

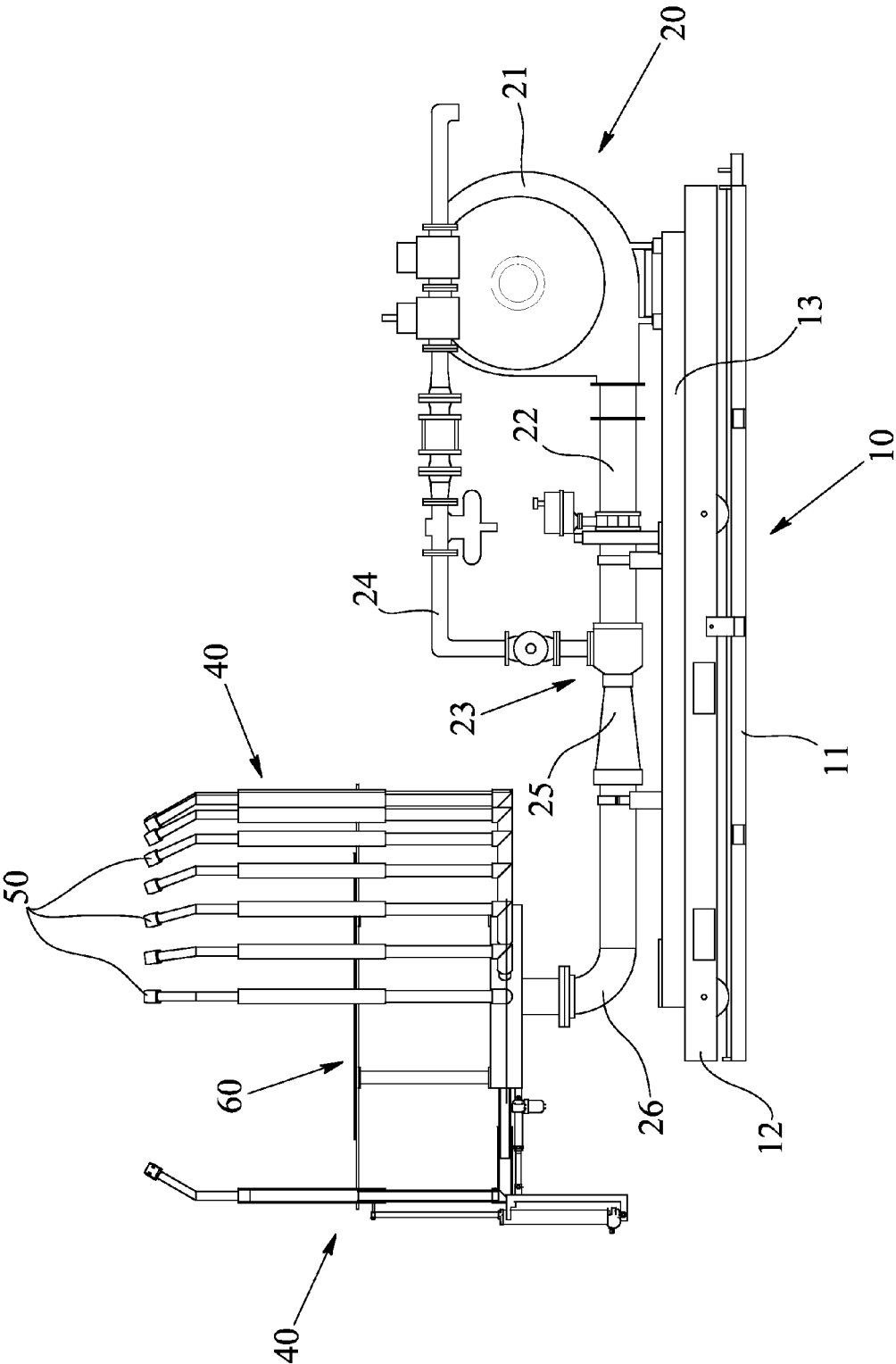


Fig. 1

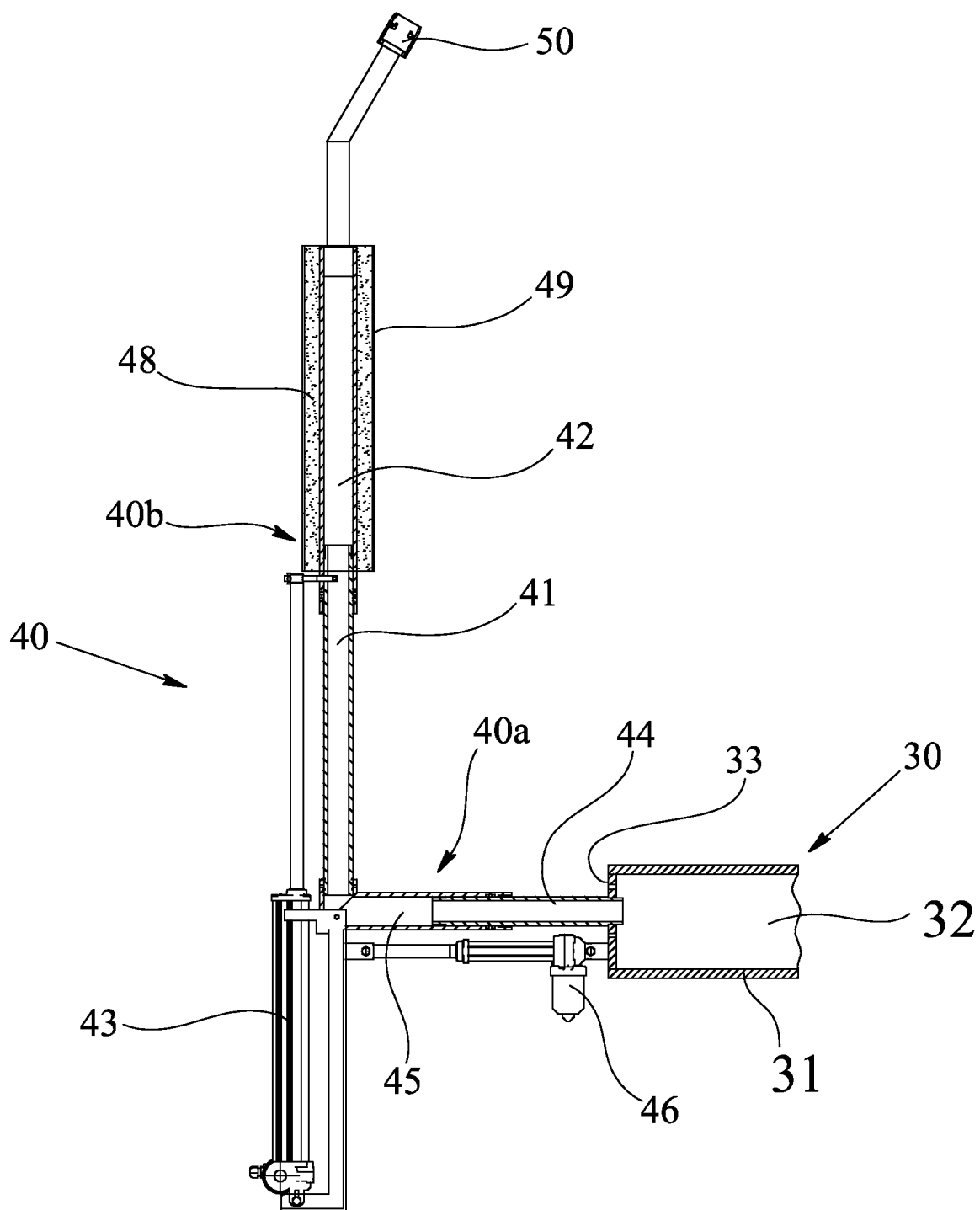


Fig. 2

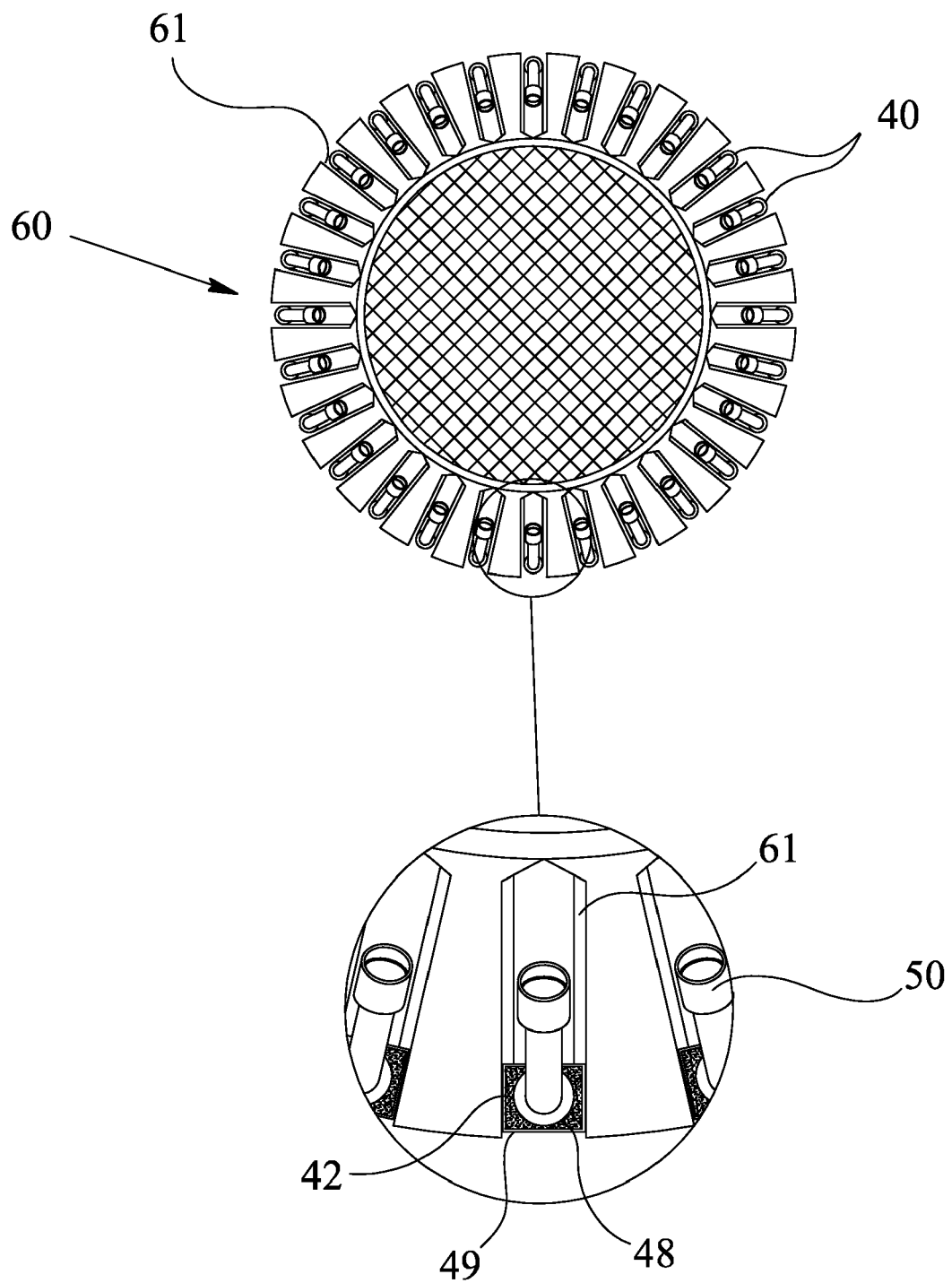


Fig. 3



EUROPEAN SEARCH REPORT

 Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 April 2014	Examiner Coli, Enrico
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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