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DESCRIPTION

[0001] The present invention relates to a food cooking installation.

[0002] Industrial cooking installations are known comprising a tunnel traversed from one end to the other by a continuously driven conveyor belt, on which the foods to be cooked are positioned. This type of installation is particularly bulky and hardly suitable for use where the available space is limited.

[0003] Each food is known to be characterised by its own cooking curve, i.e. by a specific variation which the temperature has to follow during the entire cooking cycle; for example the cooking cycle for bread requires greater heat during the initial stage and a lesser heat during the final stage, whereas that for panettone is exactly the opposite; in contrast, meat requires a constant temperature during the entire cooking cycle.

[0004] In order to match the cooking curves for the various foods, traditional cooking installations comprise different temperature zones along the tunnel. The temperature values for each zone are hence initially set according to the type of food to be cooked, and once set must be maintained constant to enable the foods driven by the endless conveyor belt to be cooked. As generally it is not possible to instantaneously vary the temperature values in the various tunnel zones, traditional installations are able to simultaneously cook only foods having the same cooking curve.

[0005] US 2005/092730 describes a spiral oven wherein, inside a cooking chamber, it is positioned a helical run of a food-carrying conveyor belt in combination with a helical assembly of heat-delivery elements. The driving element of the conveyor belt comprises a large turning barrel that is positioned inside the helical run of the conveyor belt and rotates around a vertical axis. In particular, said turning barrel has a plurality of paddles on its cylindrical surface that contact inboard overhangs extending from flights of conveyor, thus causing the latter to move forward.

[0006] The main object of the invention is to propose an improved food cooking installation which is able to simultaneously handle internally products having mutually different cooking curves.

[0007] Another object of the invention is to propose an improved food cooking installation of low energy consumption.

[0008] Another object of the invention is to propose a food cooking installation which operates within a healthy and clean environment.

[0009] Another object of the invention is to propose an improved food cooking installation which improves food cooking, while reducing and optimizing the cooking times

required thereby.

[0010] Another object of the invention is to propose an improved food installation in which cooking can take place either directly on the conveyor belt or by using baking-pans for containing the food.

[0011] Another object of the invention is to propose an improved cooking installation which is simple and quick to produce and at low cost.

[0012] All these and other objects which will be apparent from the ensuing description are attained, according to the invention, by an improved cooking installation with the characteristics indicated in claim 1.

[0013] The present invention is further clarified hereinafter in a preferred embodiment described with reference to the accompanying drawings in which:

Figure 1 is a perspective view of an improved cooking installation according to the invention,

Figure 2 shows it without the heat exchange circuit,

Figure 3 shows it without the conveyor belt,

Figure 4 shows a detail of the heat exchange circuit in perspective view.

[0014] As can be seen from the figures, the improved food cooking installation 2, according to the invention, comprises a spiral structure 4 intended to be housed within a closed cooking chamber; this chamber is not shown in the figures, however it is similar to a container which has its lower surface coinciding with the base 6 on which the spiral structure 4 is rested, and which is provided with two openings to enable the foods to enter the cooking chamber and exit therefrom respectively.

[0015] In particular, the spiral structure 4 comprises a plurality of vertical columns 8 arranged relative to each other such as to define two coaxial cylindrical surfaces for supporting the superposed spiral turns of a conveyor belt 10. In particular, said vertical columns 8 are provided with a plurality of support and guide members suitably spaced apart vertically and defining the various planes 12 of the spiral path followed by the conveyor belt 10.

[0016] The installation 2 comprises an entry section 14 and an exit section 16 which can be connected to treatment stations positioned respectively downstream and upstream of the installation 2. Suitably, at the exit section 16 a linkage section 18 is provided, necessary to return the conveyor belt to the entry section 14.

[0017] To the sides of the spiral structure 4, two vertical frames 20 are provided, connected together by a horizontal frame 22; this latter is provided with an actuator 24 which, by suitable

transmission means, drives the vertical shafts 26 housed in the two vertical frames 20. Moreover, a series of toothed wheels 28 are keyed along the shafts 26, such that their teeth can engage appendices emerging laterally from the facing links of a chain applied to the outer edge of the conveyor belt 10, such that on rotating each shaft 26 by means of the actuator 24, the toothed wheels 28 are made to rotate and drag the conveyor belt 10 into movement.

[0018] The installation 2 also comprises a heat exchange circuit 30 through which the fluid used as the thermal vector circulates in order to heat by radiation the products to be cooked. This fluid is preferably diathermic oil.

[0019] The circuit 30 comprises a heat control unit 32 positioned outside the chamber housing the spiral structure 4, and provided with a tank 34, a boiler 36 and a plurality of pipes 38. The circuit 30 also comprises an inlet conduit 40, which emerges from the boiler 36 to carry the high temperature fluid to the structure 4, specifically to the lower spiral turn and to an intermediate spiral turn of the circuit, and two outlet conduits 42 which withdraw the cooled fluid from an intermediate spiral turn and from the upper spiral turn, to transfer it to the boiler 36.

[0020] In greater detail, the heat exchange circuit 30 is formed from a plurality of pipes 44 wound side-by-side to form a spiral. The pipes 44 are not continuous, but for constructional and installation reasons are divided into portions of length equal to one half of a spiral turn and have their ends connected to radial headers 46, each of which is connected to the adjacent header by a connection portion 48. Again for constructional reasons, the pipes 44 can also consist of lengths of less than one half of a spiral turn, for example equal to one quarter or to one eighth of a spiral turn.

[0021] In particular, the inlet conduit 40 is connected to the lower header 52 of the spiral and to an intermediate header 54, while the two outlet conduits 42 are connected to the intermediate header 56, adjacent to the header 54 connected to the inlet conduit 40, and to the upper header 58 of the spiral. In this manner, the heat exchange circuit 30 is divided into two parallel portions 60, 62 (half-circuits), which feed the lower zone and the upper zone of the cooking chamber and can be controlled independent of each other by modulating valves positioned in the two conduits 42, between the spiral structure and the heat control unit 32.

[0022] The heat exchange circuit 30 can evidently also be divided into a greater number of parallel portions intended to act on different overlying zones of the cooking chamber.

[0023] In any event, the spiral portion of the heat exchange circuit 30 is inserted within the spiral forming the conveyor belt 10, such that each spiral turn thereof is upperly and lowerly faced by a spiral turn defined by the pipes 44 of the heat exchange circuit 30.

[0024] The installation 2 is also provided with an electronic management and control unit, not represented in the drawings, for coordination and control of the valves which regulate the flow of the heating fluid in the two portions 60, 62 which form the heat exchange circuit 30 and for controlling the means for driving said conveyor belt.

[0025] The installation 2 can also comprise two or more conveyor belts 10, which define a spiral path in which the spiral turns of each conveyor 10 alternate with those of the others.

[0026] The operation of the installation according to the invention is apparent from its description. In particular, the food products to be cooked, originating from the treatment station upstream of the installation, are transferred to the entry section 14 of the conveyor belt 10, which then conveys them towards the spiral structure 4.

[0027] Then, by following the ascending spiral path of the conveyor belt 10, the heat of the heated fluid contained in the bundle of pipes 44 positioned below and above the spiral turns of the conveyor belt, is transmitted by radiation to the food products, which are hence cooked. Finally, when the conveyor belt 10 reaches the exit section 16, the cooked products are passed from the conveyor belt 10 to a treatment station provided downstream of the cooking installation 2.

[0028] If the foods to be cooked require particular cooking cycles, the electronic unit, on the basis of predefined programs, controls the modulating valves in such a manner as to achieve a differentiated temperature in the two zones of the cooking chamber. In particular, if a greater heating fluid velocity is commanded for the upper portion 62 of the bundle of pipes 44, the temperature reached in the upper zone of the cooking chamber is greater than that reached in the lower zone, and vice versa.

[0029] From the foregoing it is apparent that the installation according to the invention is particularly advantageous, in that:

- the use of diathermic oil as heating vector enables stable temperature control and is also particularly suitable for use in the food sector,
- in contrast to air-ventilated traditional installations, it enables a lesser heat dispersion to be achieved, and consequently a greater energy saving; the fact that fan-fed air is no longer used as the environmental heating medium enables humidity to remain unchanged, and also prevents any dust or foreign bodies from being circulated by ventilation,
- the fact that heating takes place by radiation reduces the formation of convection movements inside the cooking chamber,
- the fact that no ventilation or forced air circulation is provided means that product moisture losses are reduced, with consequent better cooking,
- the use of a spiral conveyor enables the overall installation size to be considerably reduced,
- the cooking within the installation can take place without modification either directly on the conveyor belt or in baking-pans, according to requirements, and hence does not require either upstream or downstream any device for transferring products between the conveyor belt and the installation.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US2005092730A [0005]

Patentkrav

1. Madlavningsinstallation (2), som omfatter:

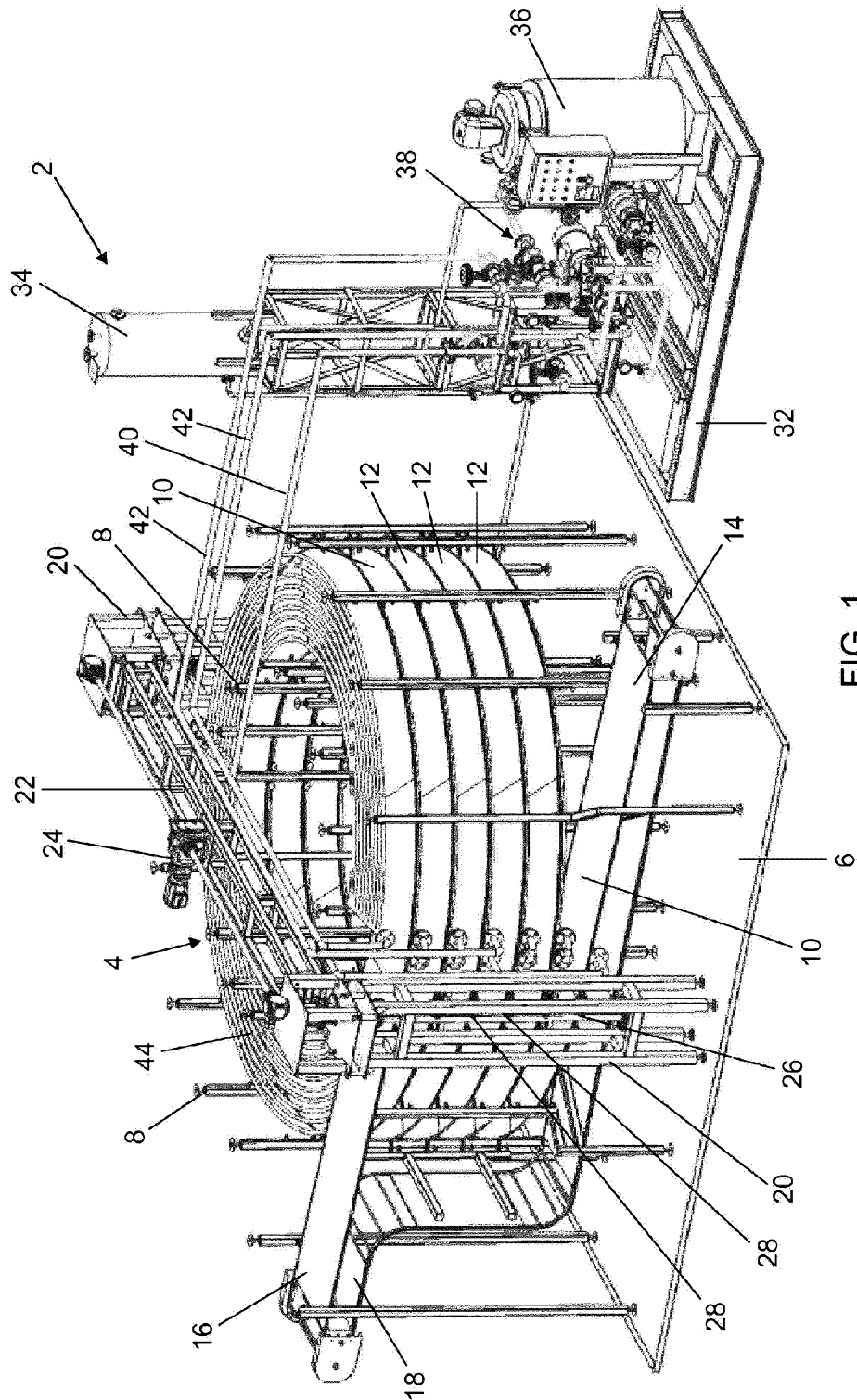
- 5 - et kogerum,
 - mindst et transportbånd (10), som er anbragt i kogerummet, og som følger en skruelinjeagtig bane med lodret akse, og som kan modtage madvarer og føre dem fra en indgangsåbning (14) til en udgangsåbning (16) i nævnte rum,
- 10 - et varmevekslingskredsløb (30), som omfatter et bundt rør (44), der er anbragt, så at det følger en skruelinje og er indskudt i transportbåndet (10) og delt i flere dele, hvilket indebærer flere oven på hinanden anbragte zoner i nævnte kogerum og anbragt parallelt, og en varmestystem (32) til frembringelse af et varmende fluidum,
- 15 - organer til uafhængig regulering af strømningshastigheden af det varmende fluidum inden for de nævnte dele (60, 62) af varmevekslingskredsløbet (30),
 - en administrations- og styreenhed til varmevekslingskredsløbet (30) og til organer til drift af transportbåndet, **kendetegnet ved**, at organerne til drift af
- 20 transportbåndet omfatter tandhjul (28), som er kilet fast langs aksler (26), og som ligger an mod fortsættelsesdele, som udgår sideværts fra modstående led i en kæde, der er anvendt ved den ydre kant af transportbåndet (10), så at - når man bringer hver aksel (26) til at rotere ved hjælp af et aktiveringsorgan (24) - tandhjulene (28) vil bringes til at rotere og trække transportbåndet (10) i bevægelse langs en skruelinjeformet struktur (4), der omfatter et
- 25 antal lodrette søjler (8), som er således anbragt i forhold til hinanden, at de fastlægger to koaksiale cylinderflader til at bære de oven på hinanden anbragte skruelinjeformede vindinger i nævnte transportbånd (10).
- 30 2. Installation ifølge krav 1, **kendetegnet ved**, at varmevekslingskredsløbet omfatter mindst en indløbsledning (40), som kan lede fluidum fra nævnte varmesystem (32) til indløbet for hver af de nævnte dele (60, 62) af varmevekslingskredsløbet (30), og mindst en udløbsledning (42), som kan lede fluidum fra

udløbet af hver af de nævnte dele (60, 62) i varmevekslingskredsløbet (30) til varmestyreenheden (32).

3. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at rørene
5 (44) i det nævnte rørbundt er opdelt i portioner med en længde svarende til en brøkdel af en skruelinje-vinding.
4. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at en-
derne af de portioner, i hvilke rørene (44) i bundtet er opdelt, er forbundet ved
10 hjælp af radiale samleorganer (46), som er forbundet med et nærliggende samleorgan ved hjælp af en forbindelsesdel (48).
5. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at orga-
ner til uafhængig regulering af strømningshastigheden af nævnte opvarmede
15 fluidum omfatter modulationsventiler, som er styret ved hjælp af temperaturregulatorer.
6. Installation ifølge ethvert af kravene 3 til 5, **kendetegnet ved**, at organerne
til uafhængig regulering af strømningshastigheden af nævnte opvarmede fluidum
20 er anbragt i den mindst ene indløbsledning (40) eller i den mindst ene udløbsledning (42).
7. Installation ifølge krav 5, **kendetegnet ved**, at den elektroniske administra-
tions- og styreenhed kan styre de nævnte modulationsventiler, som regulerer
25 strømmen af varmende fluidum i to dele (60, 62), som danner varmevekslingskredsløbet (30), og dette på en sådan måde, at der opnås forskellige temperaturer mellem de forskellige dele (60, 62) af varmevekslingskredsløbet (30).
8. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at hver
30 skruelinje-vinding på transportbåndet (10) har en overside og en underside vendt mod en skruelinje-vinding i varmevekslingskredsløbet (30).

9. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at det varmende fluidum er diatermisk olie.
10. Installation ifølge ethvert af de foregående krav, **kendetegnet ved**, at den
- 5 omfatter mindst to transportbånd (10), som fastlægger en skruelinjeformet bane, hvor skruelinjevindingerne i hvert transportbånd (10) veksler med skruelinjevindingerne i de andre transportbånd.

DRAWINGS



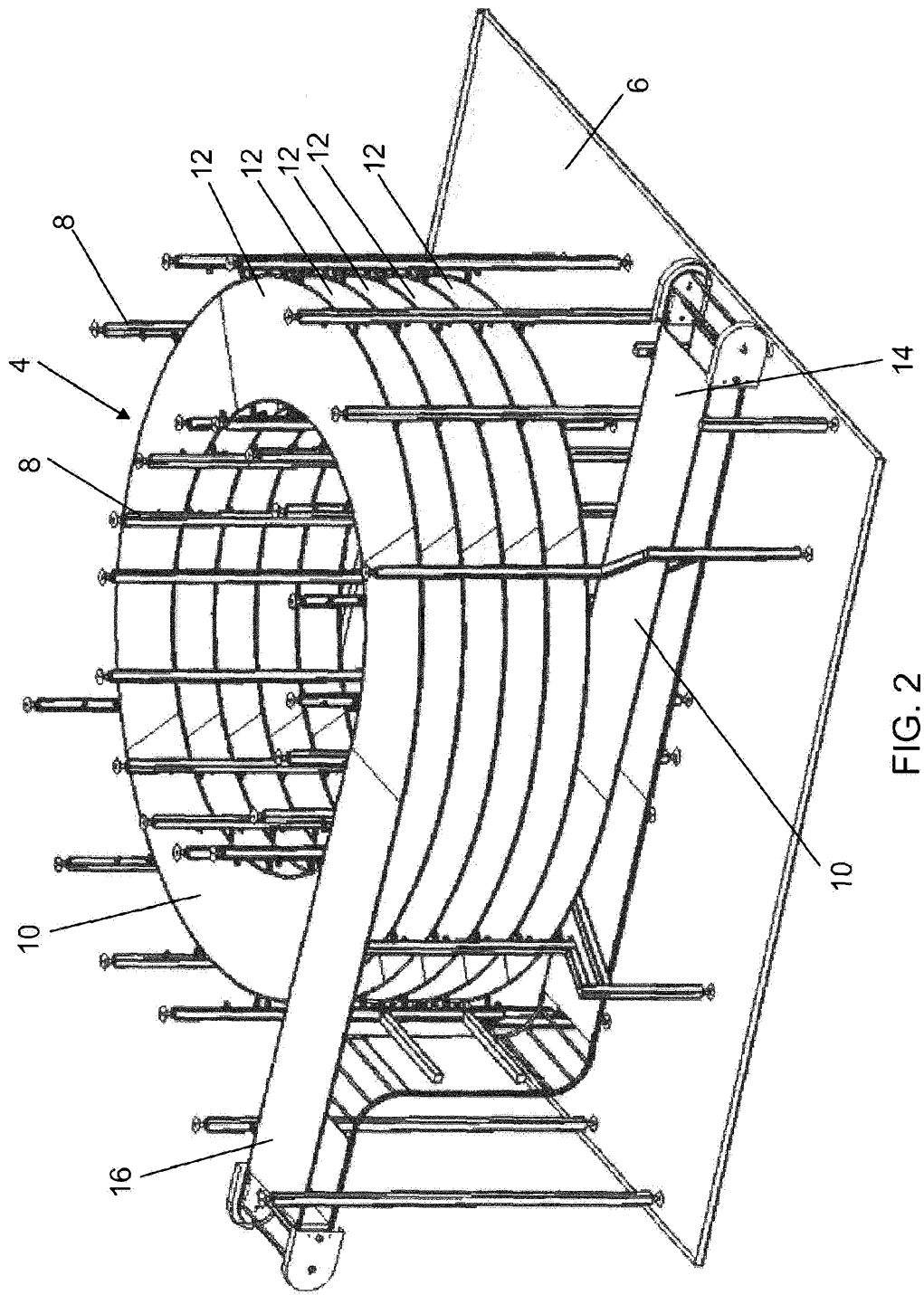


FIG. 2

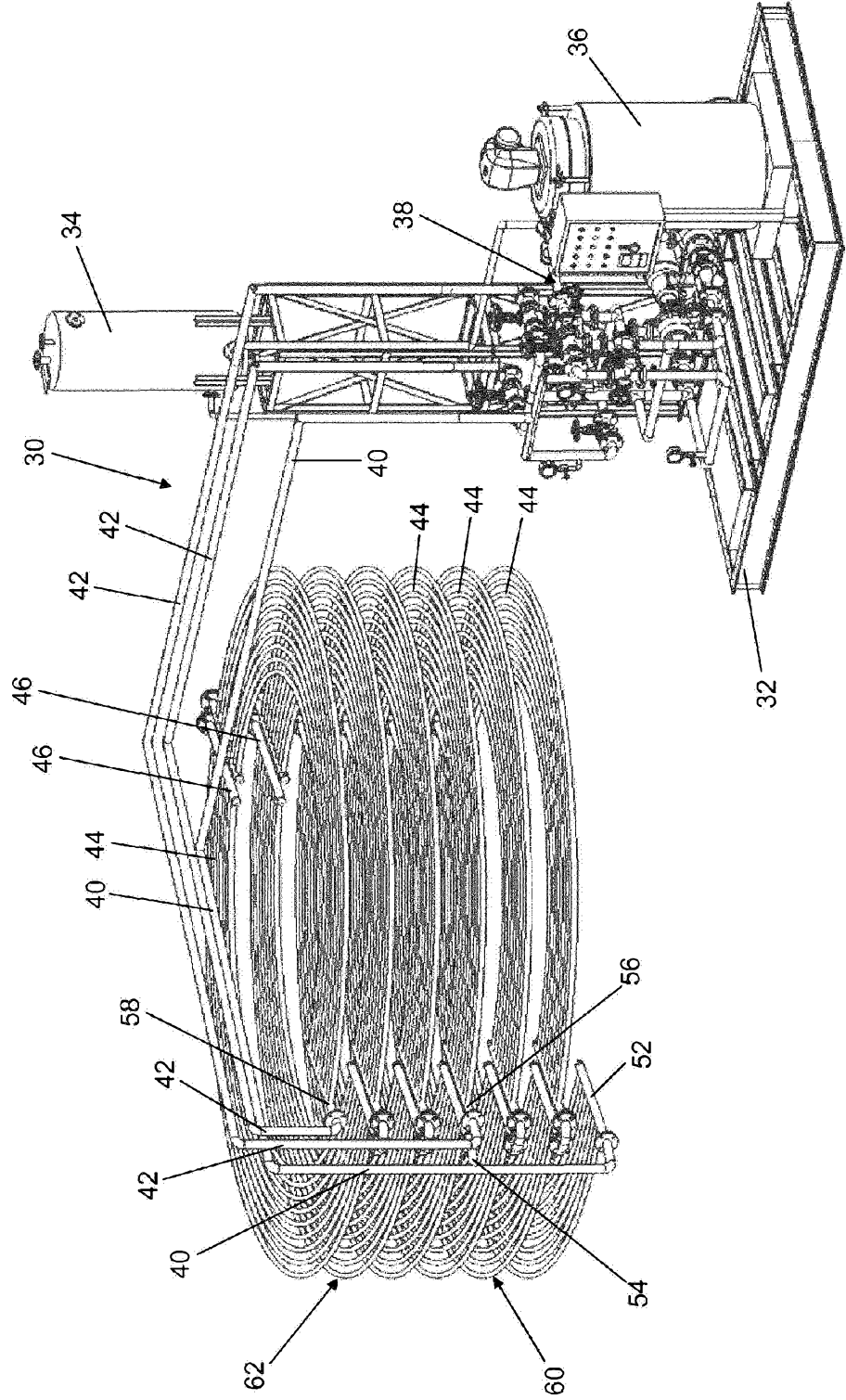


FIG. 3

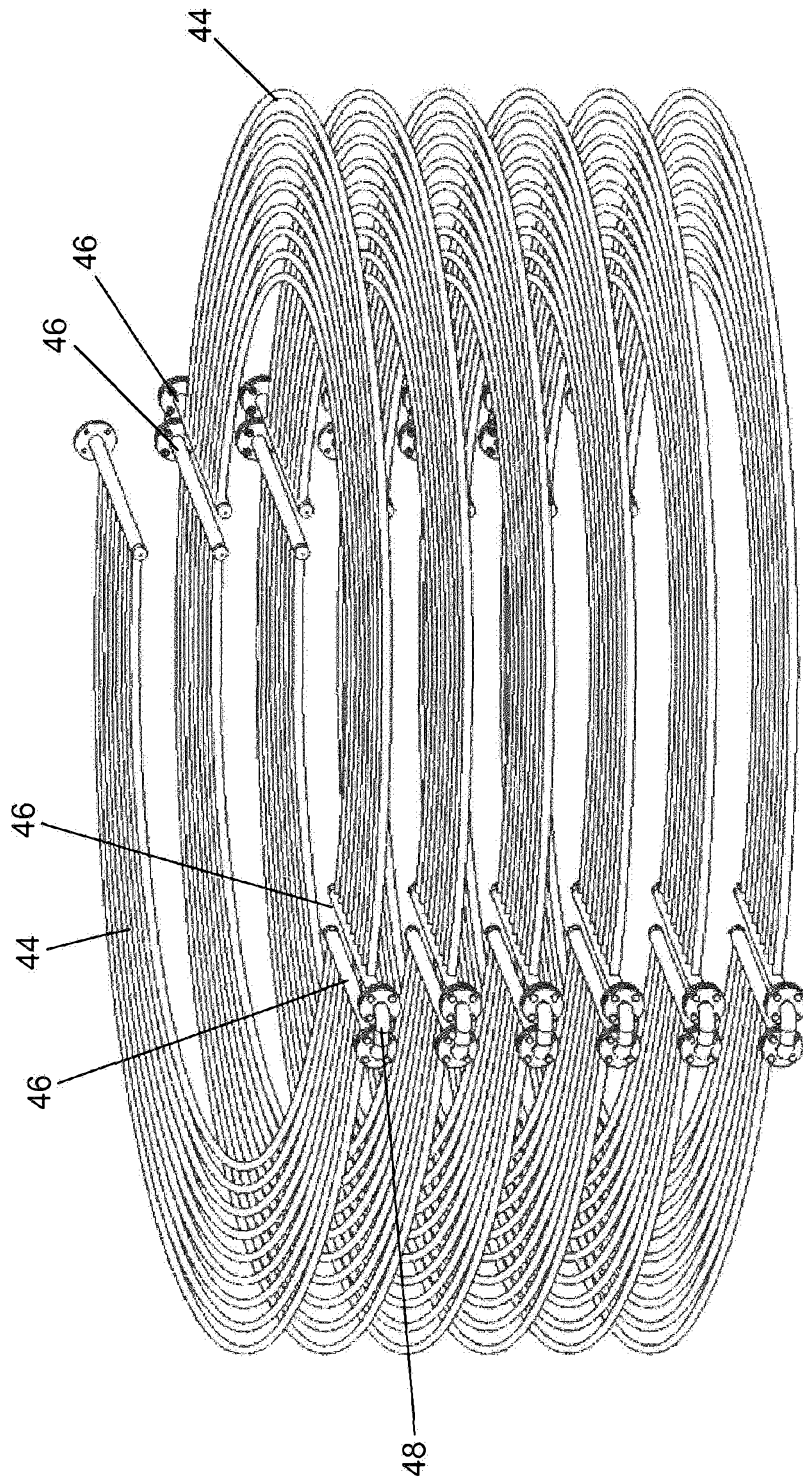


FIG. 4