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Bonnaure

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[54] **INSTALLATION FOR TREATMENT OF MINERALS ON A CONTINUOUS CIRCULAR GRILL**

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[73] Assignee: **Creusot-Loire Entreprises,** Paris, France

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[51] **Int. Cl.**^{2}.... **F27B 9/14;** F27B 9/16; F27B 21/06

[58] **Field of Search** 266/20, 21; 75/3, 5; 432/7, 17, 137, 139, 138, 142, 144, 242, 243, 244, 245

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Assistant Examiner—Paul A. Bell
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[57] **ABSTRACT**

Pelletised ores are treated with hot gases on a continuous circular rotary grid mounted for rotation on a fixed base. Radial beams form cradles supporting the grid. The grid is made up of bars sitting on the radial beams. The grid rotates through various treatment zones with each zone having an upper box and a lower box with respect to the grid with the boxes fixed in position and fluid-tight. The radial beams are cooled and are mounted on concentric rings rotating at the same angular velocity. The mounting of the beams on the concentric rings permits free radial expansion of the beams. The vertical, lateral sides of the radial beams are connected by flexible members allowing tangential expansion of the radial beams.

8 Claims, 6 Drawing Figures

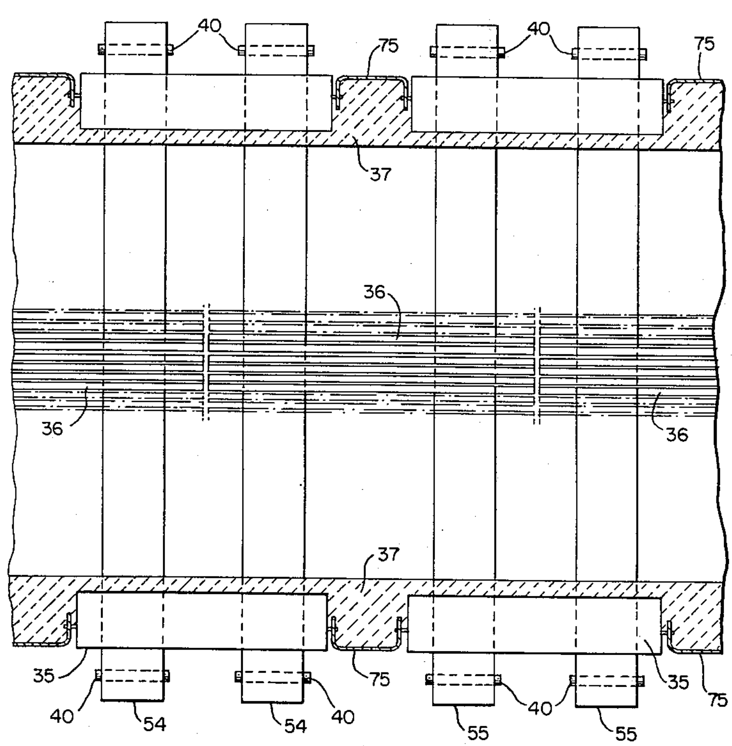

FIG. 1

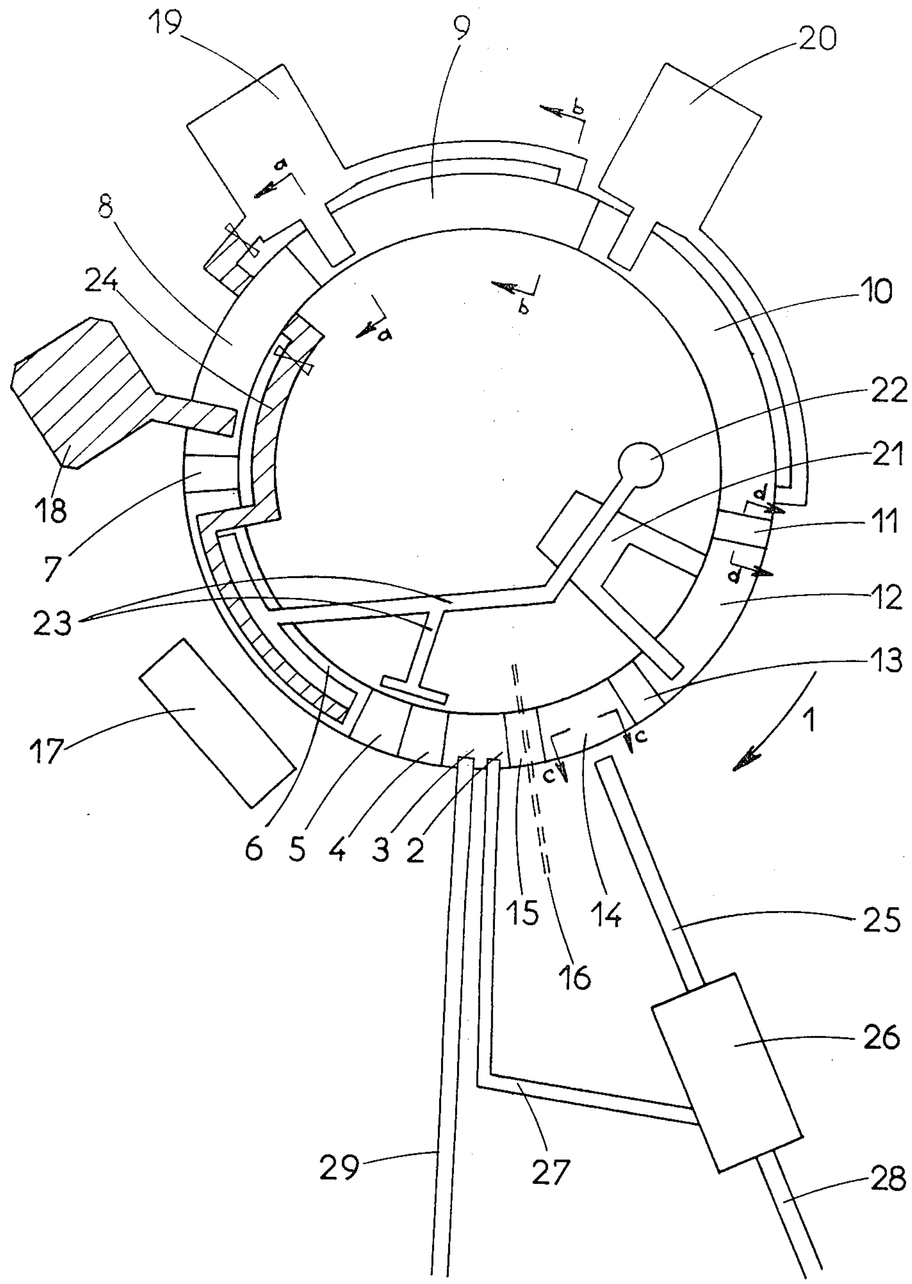
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FIG. 2

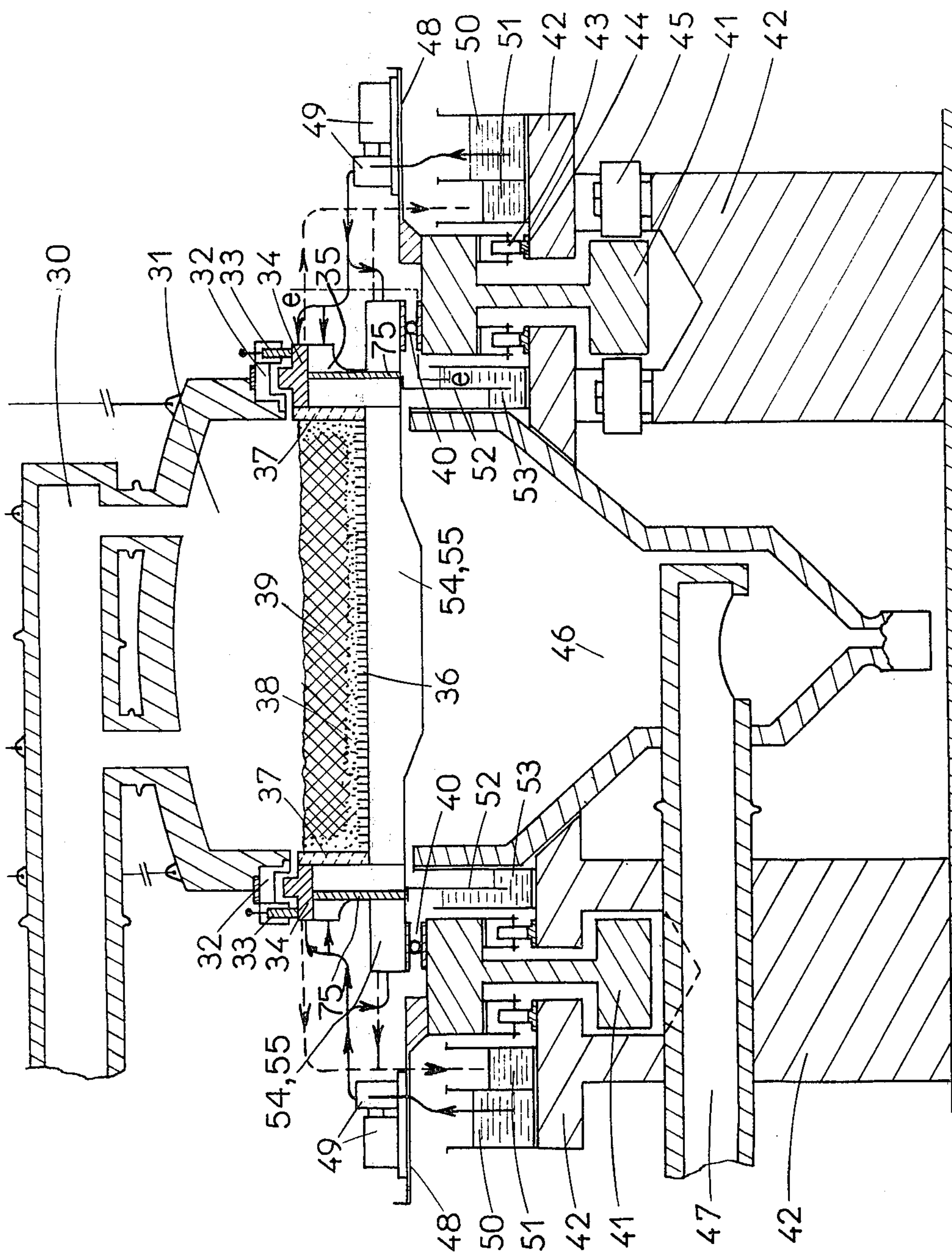
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FIG. 3

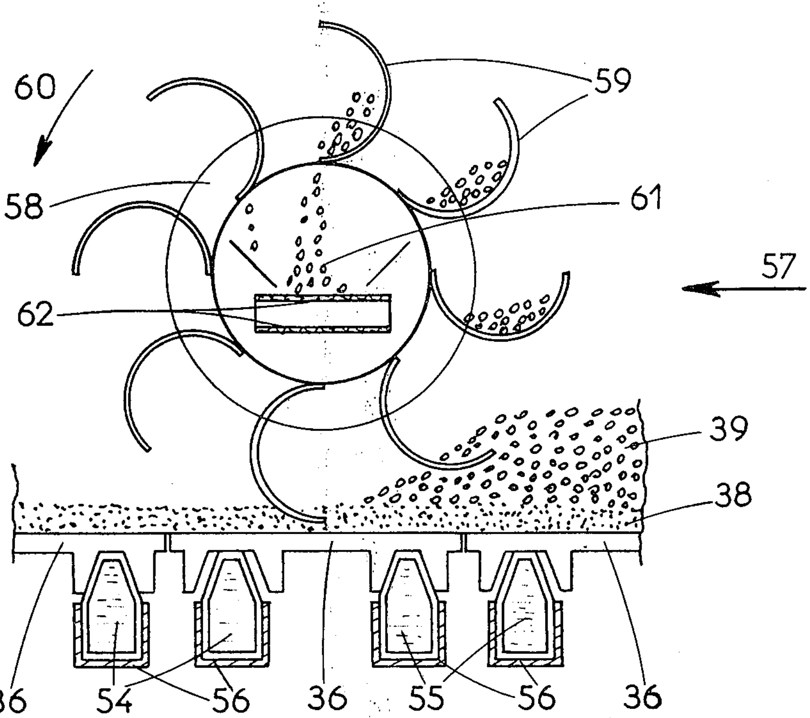
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FIG. 4

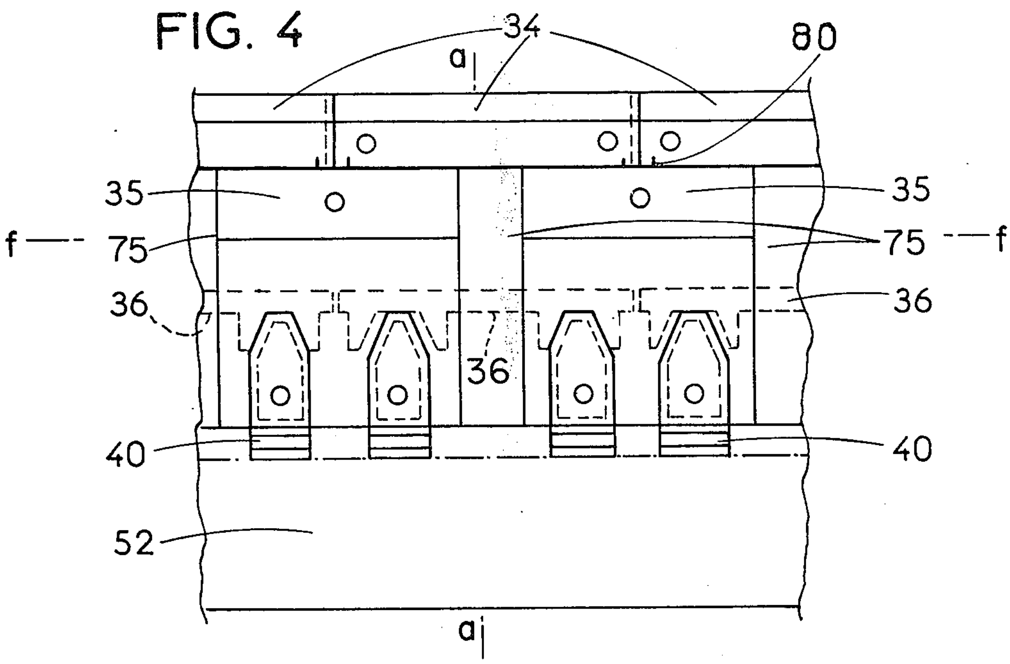
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FIG. 5

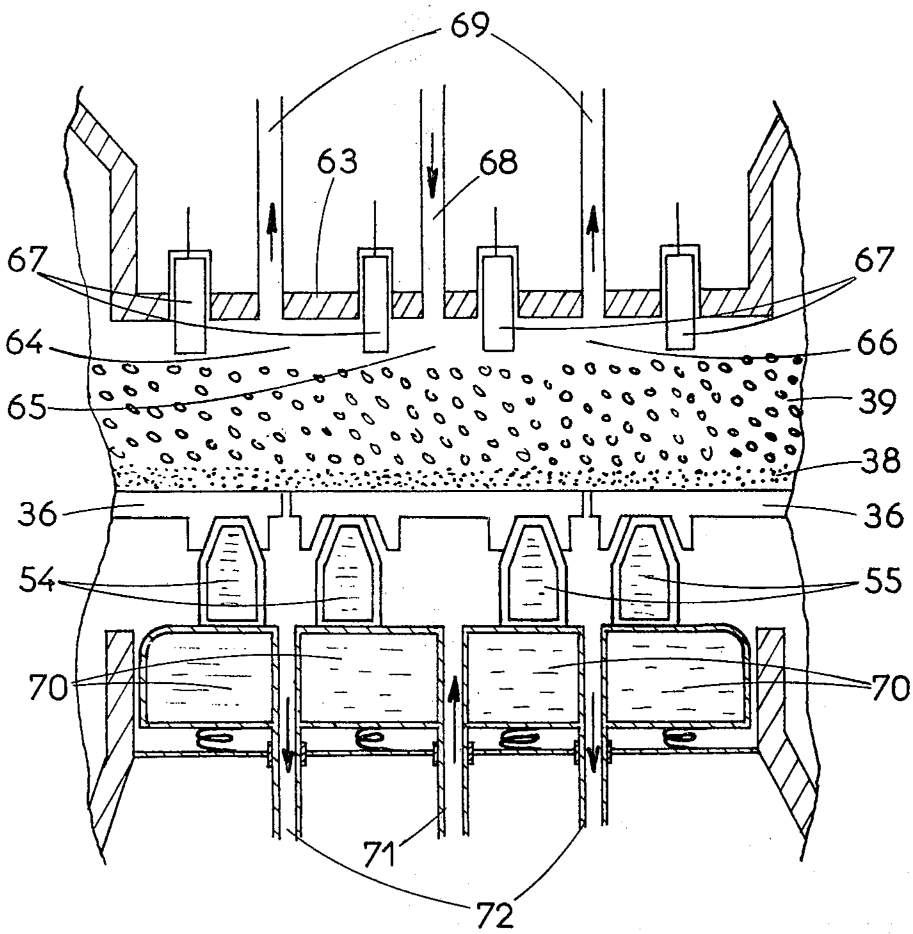
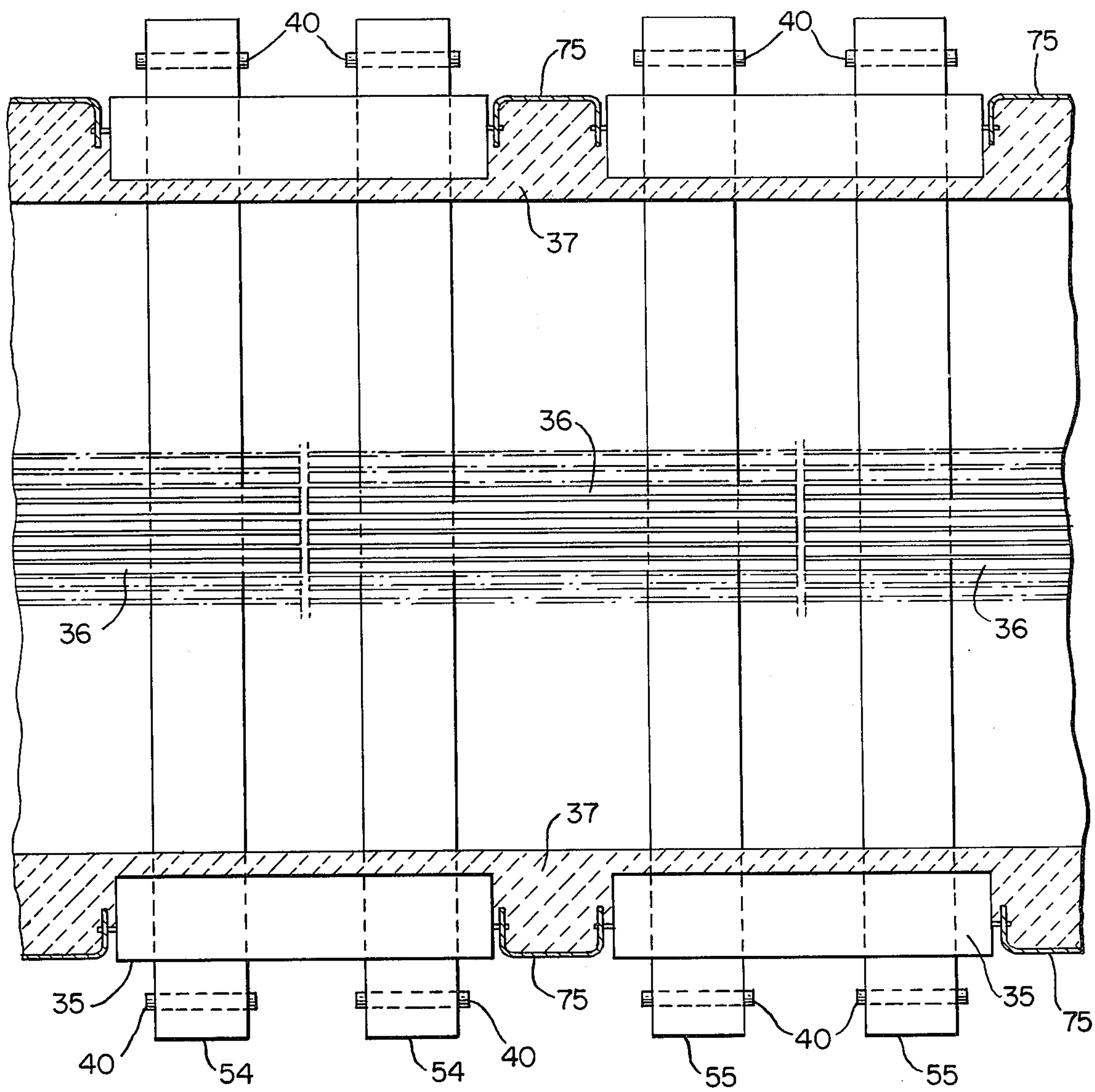


FIG. 6.



INSTALLATION FOR TREATMENT OF MINERALS ON A CONTINUOUS CIRCULAR GRILL

The present invention relates to a plant for heat treatment by gas flows of pelletised ores, using a continuous, circular grid. By way of example, it is more particularly applicable to the reduction of iron ores with pure hydrogen or with a mixture of hydrogen and carbon monoxide, for the production of solid, deoxidized products. This reduction process was the object of French Patent application No. 72-15245 of 28th April 1972 and its Addition No. 72-30196 of 24th August 1972, filed by the same Applicant.

In such a plant for the treatment of ores on a continuous, circular grid, the grid passes successively through zones with different functions of which the zones for treatment by through-passage of a gas flow are generally the longest and the hottest. As a result, the grid in these zones is subject to high thermal stresses which are of long duration and are deleterious to the good condition of its elements. Further, the gases used for the treatment of ore are often expensive and inflammable and it is therefore important to control the leaks which take place, firstly between the fixed boxes and the elements of the grid, secondly between the various elements of the grid and lastly between the various gas circulation boxes.

The present invention provides a solution to these various problems and is applicable to a plant for heat-treatment by gas flows of pelletised ores, using a continuous, circular grid with a fixed base, formed of a series of radial beams forming cradles supporting the bars of the grid, and including a loading zone, at least one treatment zone, a discharge zone and neutral zones, the grid passing in the or each treatment zone, between a fluid-tight upper and a fluid-tight, fixed lower box. The ends of the radial beams forming the grid extend beyond the boxes on either side and rest on two circular, concentric rings rotating at the same angular velocity. In accordance with the invention, the supports for the radial beams on the circular rings permit their free radial expansion and the vertical, lateral sides of the radial beams are connected by flexible, fabricated members which are able to accommodate tangential expansion of the radial beams.

The invention will now be described in more detail, with reference to a particular embodiment given by way of example and illustrated in the attached drawings.

FIG. 1 gives a diagrammatic plan of a plant, in accordance with the invention, where a circular grid is used for the reduction of the ore in two successive stages, firstly with a mixture of carbon monoxide and hydrogen and then with pure hydrogen.

The upper portion of FIG. 2 gives a more detailed view of the plant along a radial section a—a of FIG. 1 and of FIG. 4, i.e., along the axis of the hydrogen supply to a secondary reduction zone. The lower portion of FIG. 2 shows the lower box along a radial section b—b of FIG. 1, along the axis of the outlet for the hydrogen after reduction.

FIG. 3 shows a view of the plant along a section c—c of FIG. 1, in the products evacuation zone.

FIG. 4 shows in principle in lateral view on line e—e of FIG. 2 the assembly of the radial beams, the flexible, fabricated sides and the portions of the seals rigidly attached to the mobile grid.

FIG. 5 shows a vertical view along the section d—d of FIG. 1, through a neutral zone arranged between two zones for treatment with different gases.

FIG. 6 is a plan view of the beams on the line f—f of FIG. 4.

With reference to FIG. 1, the circular, horizontal and continuous grid moves in the direction indicated by arrow 1. At 2 the grid receives the sized and inert products for lining the bottom and the sides to form a protection for the grid. The "green" pellets are brought onto the grid at 3. Zones 4 and 5 are zones for predrying and drying of the pellets, which are then roasted in zone 6. Separated by a first neutral zone at 7, is a primary reduction zone at 8, while secondary reduction is effected in zones 9 and 10. Neutral zone 11 precedes a cooling zone 12, itself followed by another neutral zone 13. Product evacuation is carried out at 14 by means of a shovelling wheel. Zone 15 is a clear zone to enable repairs to be carried out and is served by a handling machine 16 for this purpose.

Assembly 17 groups the fans, scrubbers, combustion chambers, flues and other apparatus linked with the circuit of the drying and roasting gases of zones 4, 5 and 6. At 18 is shown the unit for preparation of the mixture of carbon monoxide and hydrogen which supplies primary reduction zone 8. Conditioning units 19 and 20 supply reduction zones 9 and 10 with hydrogen. At 21 is shown the unit for circulation and cooling of the neutral gas which passes through zone 12. Fan 22, for the cooling air of unit 21, sends back hot air to zones 4, 5 and 6 through conduits 23. The hot gas leaving primary reduction zone 8 can be passed as fuel, through conduits 24, either to roasting zone 6 or to the hydrogen heater of the adjacent conditioning unit 19.

The materials extracted from the grid at 14 are evacuated by conveyer 25 to treatment unit 26, where the recovery takes place of the grid protector, which is returned to the grid at 2 by means of conveyer 27. Conveyer 28 transfers the iron sponges to the treatment storage and shipping assembly. Conveyer 29 brings the "green" pellets onto the grid.

FIG. 1 does not show the ore storage and homogenization depots or the drying, crushing and pelletizing plants, or the attached plants, the positioning of which, relative to the grid itself is relatively unimportant.

With reference now to FIG. 2, the hot reducing gas is passed into upper box 31 by conduit 30. Conduit 30 and box 31 are of fabricated construction and covered inside with an insulating and refractory lining. They are suspended from upper beams not shown in the figure. Fabricated cases 32, with water circulation, are rigidly attached to box 31 and have the triple task of providing thermal insulation for the upper mechanical seal, of providing a lower anchorage for the refractory lining of the box and, lastly, of limiting the empty space between the fixed box and the tops of the sides of the mobile grid. Fluid-tightness between the box and the grid is produced by seals 33 which are applied to the fabricated cases 34 rigidly attached to the mobile grid and cooled by circulation of water. The shape of cases 32 and 34 forms a baffle to shield seals 33 from the radiation of the box and from the materials arranged on the grid.

Each radial beam consists of two hollow, vertical sides 35 at the ends supporting cases 34 and connected by two hollow struts, 54 or 55. The longitudinal bars of grid 36 rest on the struts of two consecutive radial beams. The internal, vertical faces of sides **35** are lined with an insulating and refractory layer **37**. The layer of sized and inert products forming the protection for the grid is arranged at **38** over the bars of the grid.

The radial beams rest freely, by their struts **54** and **55** and through two roller supports **40** which permit expansion, on two large beams **41**, in the form of circular, horizontal and concentric rings which rotate at the same angular velocity, which is adjustable according to the conditions of use. The two circular beams **41** run on rails **44** of fixed frame **42** by means of wheels **43** and are guided radially by centering rollers **45**. So as not to overcrowd the figure, the mechanical apparatus for driving beams **41**, which can be of a quite conventional type, has not been shown.

Lower box **46** and gas outlet conduit **47**, covered internally with an insulating and refractory lining, are also anchored to frame **42**. Two service platforms **48** are rigidly attached to circular beams **41** and, in particular, support motor pump units **49**. Pumps **49** remove cold water from continuous, fixed tanks **50** and pass it into radial beams and cases **34**. After circulation inside the beams and cases, the water is evacuated to continuous, fixed tanks **51**. FIG. **2** shows diagrammatically in solid lines the cold water supply circuit and in broken lines the hot water return circuit.

A seal is formed between lower box **46** and the mobile grid by vertical plates **52**, which are rigidly attached to the radial beam and immersed in fixed waterholders **53**.

FIG. 3 shows, at **54** and **55** respectively, the two radial struts of two consecutive beams. Bars **36** rest freely on water-cooled cross-pieces **54** and **55**. Cross-pieces **54** and **55** are coated with a special layer **56**, which limits gas-metal contact and heat-exchange. With the grid assembly moving in the direction of arrow **57**, the iron-bearing materials **39** and the grid protection materials **38** are removed by a shovelling wheel **58** which is provided with buckets **59** and rotates in the direction of arrow **60** about a horizontal axis **61**; the materials are deposited on a conveyer belt **62** in the centre of the shovelling wheel, and conveyer **62** then tips them onto conveyer **25**, which can be seen in FIG. **1**.

Any metallised pellets which may have escaped discharge shovelling wheel **28** can be evacuated further on by a simple, magnetic apparatus, not shown in the figure; the remaining grid protection layer **38** is then levelled before receiving the further addition necessary to reform the required thickness.

Reference will nextly be made to FIGS. **4** and **6**, which shows the two vertical sides **35** at the ends of two consecutive radial beams. The sides of these beams are connected by flexible, fabricated sides **75**. Fabricated cases **34** rest on the sides **35** of extremities of the radial beams and are connected to the beams by vertical axes **80**. The vertical joints between adjacent cases are cylindrical. Vertical plate **52**, which is immersed in lower hydraulic seal **53**, is fastened to the lower portion of sides **35** and fabricated sides **75**. This arrangement permits easy disassembly of the different elements of the mobile grid, in the zone **15** provided for this purpose. In particular, the beams, which rest directly on double mobile ring **41** can be very rapidly released and replaced in case of need.

With reference, lastly, to FIG. **5**, it will be observed that the upper arch **63** of the neutral zone is lower than those of the adjacent treatment zones. Moreover, the

empty space between the upper level of the iron-bearing materials **39** and the arch **63** is divided into three chambers **64, 65** and **66** by four registers **67**, the lower portions of which are as close as possible to the top of layer **39**. In middle chamber **65**, inert gas is injected by piping **68**, at a pressure very slightly greater than that in the adjacent treatment zones. The mixtures of this inert gas and the other gases escape from chambers **64** and **66** through water-cooled purges **69**; the flow rate, pressure and composition of these gaseous mixtures are controlled to maintain the proper operation of the plant. A similar apparatus is used for the lower portion of the grid, where water-cooled cases **70** are applied at a controlled pressure to the lower faces and struts **54** and **55** of radial beams **35**. Central piping **71** is used for the supply of inert gas, while the gaseous mixtures are exhausted through purges **72**. It will be noted that purges **69** and **72** can also act as possible dispersion purges for the treatment gas circuits running on either side of the neutral zone in question.

Of course, the invention is not strictly limited to the single embodiment described above by way of example, but also covers all its modifications. Thus the plant may have a different number of primary and secondary reduction zones to the one described by way of example.

Similarly, an advantageous modification could be formed by the use of two successive shovelling wheels to evacuate the materials, instead of one, the first removing the upper portion of layer **39** (with a high degree of reduction) and the second removing the lower portion of the layer (with a lower degree of reduction), together with a small proportion of grid protector **38**.

What is claimed is:

1. A plant for heat-treatment of pelletised ores with gas flows comprising a continuous, circular rotary grid, a fixed base for said grid, a series of radial beams in the form of cradles supporting the bars of the grid, a loading zone, at least one treatment zone, a discharge zone and neutral zones for said grid, said grid passing, in each treatment zone, between an upper box and a lower box said boxes being fixed and fluid-tight, said radial grid-support beams extending beyond said boxes on either side, means for cooling said beams by internal water circulation, two circular, concentric rings rotating at the same angular velocity supporting said beams and mounted on said base, roller supports for said radial beams on said circular rings permitting free radial expansion of said beams and flexible, fabricated members flexing to allow tangential expansion of said radial beams connected to vertical, lateral sides of the ends of said beams adjacent said supports.

2. A plant in accordance with claim **1**, wherein the lateral fluid-tightness between each upper box and the mobile grid is created by one or more mechanical seals, and that the fluid-tightness between each lower box and the mobile grid is created by a hydraulic seal, the seals being situated beyond the gas flows.

3. A plant in accordance with claim **1**, wherein the surfaces of the radial beams in contact with the treatment gases are coated with an inert, insulating and refractory protective layer.

4. A plant in accordance with claim **1**, wherein the radial beams are made of special, stainless and refractory steel, without a protective layer.

5. A plant in accordance with claim **1**, wherein discharge of the materials after treatment is effected by a shovel-wheel, the buckets of which sweep the whole width of the grid.

6. A plant in accordance with claim **1,** wherein discharge of the treated materials is effected by means of two successive shovel-wheels, the first picking up the upper layer of the materials, the second picking up the remainder of the materials.

7. A plant in accordance with claim **1,** having neutral zones between different active zones, the ceiling of each neutral zone being lower than the ceiling of adjacent active zones, the space below the ceiling being divided into three transverse chambers by means of four vertically adjustable registers, an inert gas being introduced to the central chamber at a pressure slightly higher than that in the adjacent chambers, the other two transverse chambers being evacuated by continuous purge devices at controlled flow-rate, pressure and analysis.

8. A plant in accordance with claim **1,** wherein the space below the grid is, in each neutral zone, divided into three transverse chambers by water-cooled cases applied with controlled pressure to the lower surfaces of the radial beams, and wherein the transverse chambers are provided with means for supply of inert gas and evacuation means in accordance with claim **7.**

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