FORM 1 646021

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

MANNESMANN AKTIENGESELLSCHAFT

of MANNESMANNUFER 2
D-4000 DUSSELDORF 1
FEDERAL REPUBLIC OF GERMANY

hereby apply for the grant of a standard patent for an invention entitled:

METHOD AND EQUIPMENT FOR OPERATION OF METALLURGICAL FURNACE WITH SELF-BAKING ELECTRODE.

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
P40 10 353.6	DE	28 MAR 90

My/our address for service is care of GRIFFITH HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 05th day of March 1991

MANNESMANN AKTIENGESELLSCHAFT

GRIFFITH HACK & CO.

TO: The Commissioner of Patents.

(Note: This is a comprehensive form, and parts inappropriate to a particular case must be deleted. This declaration must be signed by the applicant(s), if individuals. If applicant is a Company, this declaration must be signed by a person on its behalf and the Company seal or stamp should not be applied.)

Forms 7 and 8

COMMONWEALTH OF AUSTRALIA

Patents Act 1952–1962

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

INSTRUCTIONS

(a) Insert No. if available.
(b) Insert full name(s) of applicant(s).
(c) Insert title of invention.
(d) Insert full name(s) of declarant(s) who must be PERSON or PERSONS, NOT a corporate body. (See head note)
(e) Insert address(es) of declarant(s).
(f) Delete entirely if applicant is corporate body.
(g) Delete entirely if applicant is person or persons.
(h) Delete entirely if Convention pririty NOT claimed.
(i) Insert country in which first basic application was filed.
(j) Insert date of first basic application.
(k) Insert full name(s) of basic applicant(s).
(l) Delete entirely if applicant(s) NOT inventor(s).
(m) Insert full name(s) of actual inventor(s) if applicant(s) NOT inventor(s)
(n) Insert address(es) of actual inventor(s) if applicant(s) NOT inventor(s)
(o) Recite manner in which applicant(s) derive(s) title from actual inventor(s) if applicant(s) NOT inventor(s).
(p) Delete entirely if Convention priority NOT claimed.
(q) Recite manner in which applicant(s) derive(s) title from basic applicant(s) if applicant(s) NOT basic applicant(s).
(r) Signature(s) of declarant(s).
N.B. No seal or stamp impression to be applied.

In support of the application No. (a).....

made by (b) MANNESMANN AKTIENGESELLSCHAFT

.....

for a patent/patent of addition for an invention entitled (c) METHOD AND EQUIPMENT FOR OPERATION OF METALLURGICAL FURNACE WITH SELF-BANKING ELECTRODE.

I, (d) Mario Patek
Dr. Fred Kügler

of (e) Mannesmann Aktiengesellschaft, Mannesmannufer 2
D-4000 Düsseldorf 1, Federal Republic of Germany

do solemnly and sincerely declare as follows:–

1. (f) I am/We are the applicant (s) for the patent/patent of addition.

1. (g) I am authorized by the abovementioned applicant for the patent/patent of addition to make this declaration on its behalf.

2. The basic application (s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date (s) by the following applicant (s) namely:–

(h)
in (i) GERMANY on (j) 28th March 19 90
by (k) MANNESMANN AKTIENGESELLSCHAFT
in (i) ..... on (j) ..... 19.....
by (k) .....
in (i) ..... on (j) ..... 19.....
by (k) .....

3. (~~I~~/We are the actual inventor(s) of the invention.

3. (m) 1) Ing. Heinz STARK
2) Ing. Heribert KÖNIG

of (n) 1) Erftstr. 21, D-4300 Essen 18, GERMANY
2) Kardinal-Galen-Str. 93, D-4100 Duisburg 1, GERMANY

is/are the actual inventor (s) of the invention and the facts upon which the applicant (s) is/are entitled to make the application are as follows:–

–as regards entitlement under Section 34 of the Act:– (o) The said applicant is the assignee of the said inventors.

(p)
–as regards entitlement under Part XVI of the Act:– (q) .....

4. The basic application (s) referred to in paragraph 2 of this Declaration was/were the first application (s) made in a Convention country in respect of the invention the subject of the application.

Declared at Düsseldorf this EIGHTH day of FEBRUARY 1991

(r) MANNESMANN AKTIENGESELLSCHAFT

TO: THE COMMISSIONER OF PATENTS

AU9172610

(12) PATENT ABRIDGMENT (11) Document No. AU-B-72610/91
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 646021

(54) Title
METHOD AND EQUIPMENT FOR OPERATION OF METALLURGICAL FURNACE WITH SELF-BAKING ELECTRODE

(51)[5] International Patent Classification(s)
F27D 011/02

(21) Application No. : **72610/91** (22) Application Date : **05.03.91**

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(43) Publication Date : **03.10.91**

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(57) Claim

1. A metallurgical furnace, including:

a traction tube in the furnace;

a self-baking electrode on the traction tube, the traction tube extending along substantially the entire length of the self-baking electrode;

a moving means for moving the traction tube ~~member~~ and the self-baking electrode in the furnace;

a tubular shaping device having a jacket for encasing the self-baking electrode at least in an unbaked region of the electrode;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

.../2

12. A self-baking electrode arrangement for a metallurgical furnace, including:

a traction tube for location in the furnace;

a tubular shaping device having a jacket for encasing a self-baking electrode at least in an unbaked region of the electrode;

a moving means for moving the traction ~~member~~ tube and the self-baking electrode in the furnace;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

AUSTRALIA

PATENTS ACT 1952

Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE 646021

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant:
MANNESMANN AKTIENGESELLSCHAFT

Address of Applicant: MANNESMANNUFER 2
D-4000 DUSSELDORF 1
FEDERAL REPUBLIC OF GERMANY

Actual Inventor:

Address for Service: GRIFFITH HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
METHOD AND EQUIPMENT FOR OPERATION OF METALLURGICAL FURNACE WITH SELF-BAKING ELECTRODE.

The following statement is a full description of this invention including the best method of performing it known to me:-

The present invention relates to an apparatus of a metallurgical furnace with self-baking electrodes and a self-baking electrode arrangement.

In metallurgical processes with electrothermal heating of the melting furnace, self-baking electrodes, so-called Sodeberg electrodes, are utilised. The burn-up of these electrodes, during their operation is to be followed up accordingly by way of the equipment. Here it is to be ensured that the electrodes remain permanently at the appropriate working distance away from the melt. Electrodes of this type are predominantly restored by lengthening with new jacket components and filling with new electrode mass.

From the German Patent Specification 32 47 41, a method for the manufacture of self-baking electrodes having metal jackets is known, in which the electrodes are restored continually by lengthening with new jacket components and the tamping in of new electrode mass. The forces involved for holding and recharging of the electrodes damage the metal jacket. The disadvantage is that, because of this type of holding and recharging, deformation of the electrode can be caused. To this must be added the fact that, in the case of this type of holding electrodes, the holding jaws must be pressed against the electrodes with geometrically exact large surface-area contact with the necessity of having a special tamping device for the corresponding electrode diameter.

Furthermore, a self-baking electrode with metal jacket is known from the German Auslegeschrift 1 161 652. Here the metal jacket has a cylindrical configuration, in which at least one profiled member, extending longitudinally through

the middle zone of the electrode mass, is embedded. The disadvantage of this is that the profiled member cannot provide sufficiently great bonding forces between the baked and unbaked electrode mass. Furthermore, from this Auslegeschrift, there is no information to be gleaned about the holding and restoring of the electrodes.

The task underlying the present invention is to make proposals regarding the method and equipment by means of which a simple and reliable recharging and lowering of the electrodes in a metallurgical furnace can be effected, and which can be utilised for electrodes of different dimensions, in which circumstances the equipment must simultaneously be small and compact in construction to facilitate handling.

The present invention provides a metallurgical furnace, including:

a traction tube in the furnace;

a self-baking electrode on the traction tube, the traction tube extending along substantially the entire length of the self-baking electrode;

a moving means for moving the traction ~~member~~ tube and the self-baking electrode in the furnace;

a tubular shaping device having a jacket for encasing the self-baking electrode at least in an unbaked region of the electrode;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

The present invention also provides a self-baking electrode arrangement for a metallurgical furnace, including:

a traction tube for location in the furnace;

a tubular shaping device having a jacket for encasing a self-baking electrode at least in an unbaked region of the electrode;

a moving means for moving the traction ~~member~~ tube and the self-baking electrode in the furnace;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

In an advantageous embodiment, the traction member is frictionally locked into position, for example by spring forces. This is implemented on the part of the equipment by a locking clamping device with at least one hydraulic piston working in the horizontal direction against a spring packet. In this way the electrode which is held in a locked manner is lowered in a controlled fashion when the locking is temporarily released for a brief period of time. The controlled lowering of the electrode can be achieve in terms of the equipment, when the lockable clamping device can be moved in the vertical direction by means of hydraulic pistons. If this lockable clamping device has been moved vertically into its end position, then an additional clamping device takes over the short-term holding of the electrode on the traction member, during which time the vertically displaceable lockable clamping device returns to its initial position. The additional clamping device can be either stationary or else it can be designed to move along

with the first clamping device.

Reliable guiding or follow-up can be achieved if the vertically guided electrode is also centred in the horizontal direction. For this purpose an advantageous configuration of the horizontal centring device is a ring, arranged at right angles to the central axis of the electrode, to which at least three guide elements are attached. The degree of freedom of movement of the electrode in the horizontal direction can be still further restricted by an additional centring which is located in the vicinity of the clamping device and acts directly on the traction member.

In order to bestow the correct shape on the electrode, at least in the unbaked region, a tubular shaping device is provided. This tubular shaping device consists of a jacket enclosing a cavity which is fitted with connections for supply of energy-transfer fluids. In this way it is possible to preheat the electrode, at least in this shaping zone.

The tubular shaping device can be combined with the centring device for lost (temporary) moulds. In the case of a shaping device for extrusion of baked electrode masses, the centring is achieved by means of centring sheets of metal, connected to the traction member, which are designed so that they can slide on the inside surface of the wall of the tubular shaping device.

For stiffening the electrodes, fin-shaped reinforcing elements are fastened coaxially to the profiled member. In the utilisation of a metal jacket, which is moved along with the electrode, as the shaping device, at the most one part of the fin-shaped reinforcing elements is connected to the metal jacket. In the case of burn-off of the metal jacket in the region of the baked electrode, the reinforcing elements which are affixed to the traction member are, on the one hand, used to effect the frictional holding together of the baked zone of the electrode and, on the other hand, the

transfer of the entire holding forces to the central traction member.

The central traction member is supported by way of an electrode control on a platform of the steel works hall.

Additional developments of the invention are set out in the dependent Claims.

An advantageous form of embodiment is discussed in greater detail in what follows, with reference to the accompanying drawings, in which:

Fig. 1 is a vertical longitudinal section through electrode and guiding device,

Fig. 2 is a horizontal section along the line A - A in Fig. 1,

Fig. 3 is a side view of the guiding device, and

Fig. 4 is a plan of the guiding device.

Fig. 1 depicts the self-baking electrode 10 with the baked zone 17 and the unbaked zone 18. The traction member 11, which extends along the central axis I, projects out from the upper end of the electrode which is located in the furnace 70 (not depicted). This traction member 11 consists of lengths of profiled tubing. Affixed to the traction member 11 there are vertical fin-shaped reinforcing blades 12 as well as horizontal centring bars 13.

The traction member is held in position by means of the vertical guide device 30. In Fig. 1, the guide device 30 is shown to have superimposed clamping devices 31 and 36. The lower clamping device 31 is seated directly on a cross-beam 62, whereas the upper clamping device 36 can be moved independently of the movement of the

cross-beam 62 by means of vertically acting hydraulic jacks 34, coaxially to the central axis I. The clamping devices 31, 36 include spring packets and hydraulic pistons 33.

The cross-beam 62 is a structural component of an electrode controller 60, which has control cylinders 61 located on a mounting platform 50 and is connected to the cross-beam by means of tie rods 63.

In addition to this, the tie rods 63 are connected to the shaping device 20.

At the left-hand side of Fig. 1, the shaping device 20 is shown to consist of a thin-walled tube 24 which surrounds the electrode 10 coaxially to the central axis I and is in sliding contact with external electricity supply elements 41. The thin-walled tube 24 is built up by welding together shorter lengths of the jacket 21.

At the right-hand side of Fig. 1, the shaping device 20 is shown to consist of a jacket 22 containing a plurality of cavities which are provided with external connections 23. The electrode 10 slides along on the inner surface of the wall of the jacket 22, being centred by the centring bars 13. The electricity supply elements 41 are arranged on the outside of the jacket 22.

Provided for the horizontal guiding of the electrodes there are the horizontal centring device 40 located in the region of the electricity supply elements 41, the horizontal centring device 42 and the horizontal centring device 43 in the region of the clamping device.

Fig. 2 is a horizontal section along line A - A in Fig. 1, showing the electrode 10, the traction member 11, the centring bars 13 and the fin-shaped reinforcing blades 12, as well as reinforcing blades 14 with a Y-shaped cross-section.

On the left-hand side of Fig. 2 the shaping device 20 for the electrode with lost (temporary) mould is depicted. Here the electrode is surrounded by the thin-walled tube 24.

On the right-hand side of Fig. 2 the shaping device for an extruded electrode is depicted. Here the electrode is surrounded by the jacket 22 which is provided with a plurality of cavities.

Fig. 3 and Fig. 4 are elevation and plan respectively of the upper clamping device 36 which is seated on a cross-beam 64. On the right-hand side there is a stationary block 37 which is pivotally attached to a stationary clamping component 35. The clamping component 35 makes half-shell-shaped contact with the traction member 11. On the side of the traction member 11 opposite to the stationary component 35 there are spring packets 32 as well as hydraulic pistons 33 which operate at right angles to the central axis I. The cross-beam 64 is connected to hydraulic jacks 34 which operate vertically and coaxially to the central axis I.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A metallurgical furnace, including:

a traction tube in the furnace;

a self-baking electrode on the traction tube, the traction tube extending along substantially the entire length of the self-baking electrode;

a moving means for moving the traction tube and the self-baking electrode in the furnace;

a tubular shaping device having a jacket for encasing the self-baking electrode at least in an unbaked region of the electrode;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

2. The metallurgical furnace according to claim 1, characterised in that the traction tube consists of short traction tube pieces joined together.

3. The metallurgical furnace according to claim 2, characterised in that the reinforcing blades are affixed coaxially to the traction tube.

4. The metallurgical furnace according to claim 2, characterised in that some of the reinforcing blades are Y-shaped.

5. The metallurgical furnace according to any one of the preceding claims, including a plurality of centring blades for centring the traction tube in the tubular

shaping device.

6. The metallurgical furnace according to claim 1, characterised in that the closed spaces in the jacket are provided with connections for supply of energy-transfer fluid.

7. The metallurgical furnace according to claim 1, wherein the moving means is a locking clamping device containing at least one hydraulic piston acting horizontally against a spring packet.

8. The metallurgical furnace according to claim 7, characterised in that the locking clamping device contains two clamping devices arranged one above the other.

9. The metallurgical furnace according to claim 8, characterised in that at least one of the locking clamping devices is movable vertically by a hydraulic piston.

10. The metallurgical furnace according to claim 7, characterised in that the centring means is located in the region of electricity supply connections and/or of the clamping device and consists of a ring, having at least three segments, disposed in a plane at right angles to a longitudinal axis of the self-baking electrode.

11. The metallurgical furnace according to claim 10, characterised in that the centring device surrounds the electricity supply elements on a side facing away from the furnace.

12. A self-baking electrode arrangement for a metallurgical furnace, including:

a traction tube for location in the furnace;

a tubular sh ing device having a jacket for encasing a self-baking electrode at least in an unbaked region of the electrode;

a moving means for moving the traction tube ~~member~~ and the self-baking electrode in the furnace;

a plurality of reinforcing blades extending radially outwardly of the traction tube;

a centring means for centring the self-baking electrode; and

a plurality of closed spaces in said jacket of the shaping device.

Dated this 13th day of October 1993

MANNESMANN AKTIENGESELLSCHAFT
By Its Patent Attorneys:

GRIFFITH HACK & CO.
Fellows Institute of Patent
Attorneys of Australia.

Fig.1

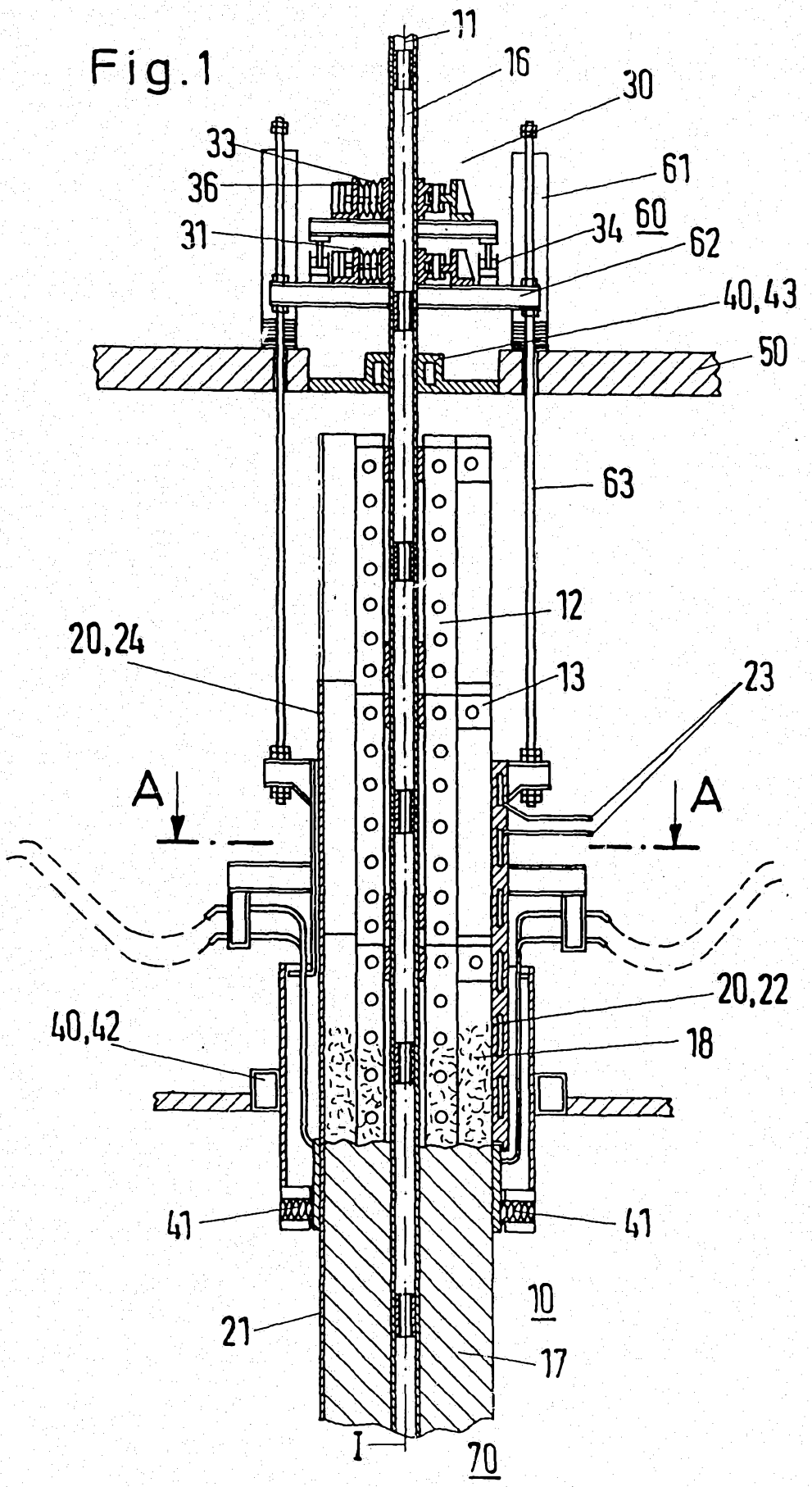
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Fig.2
(A-A)

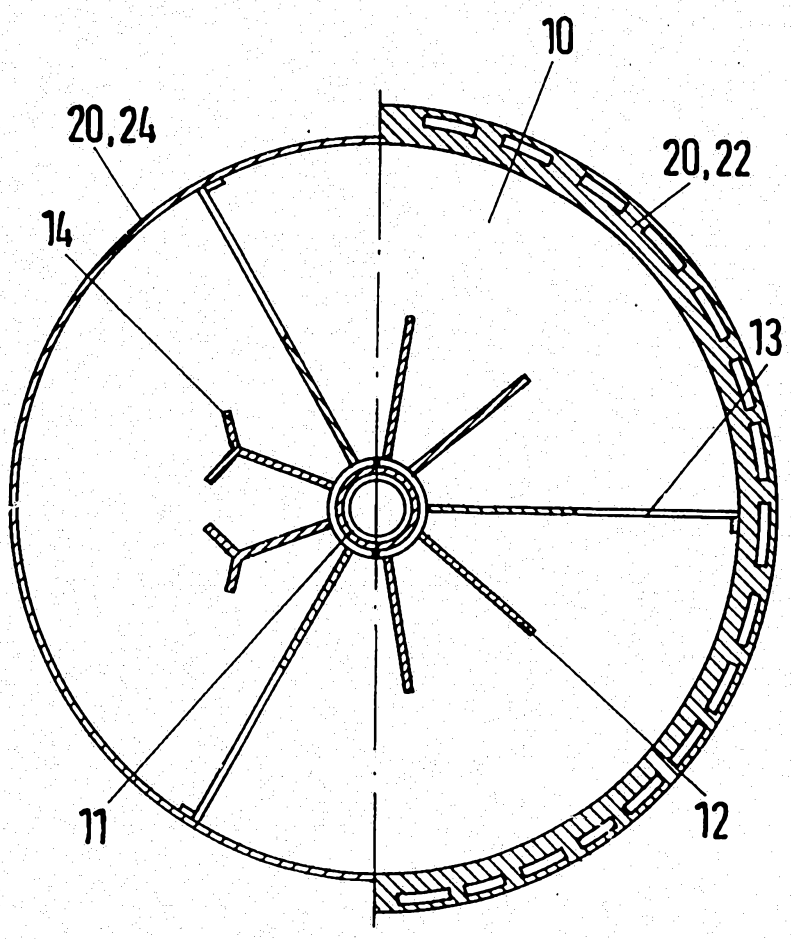

Fig. 3

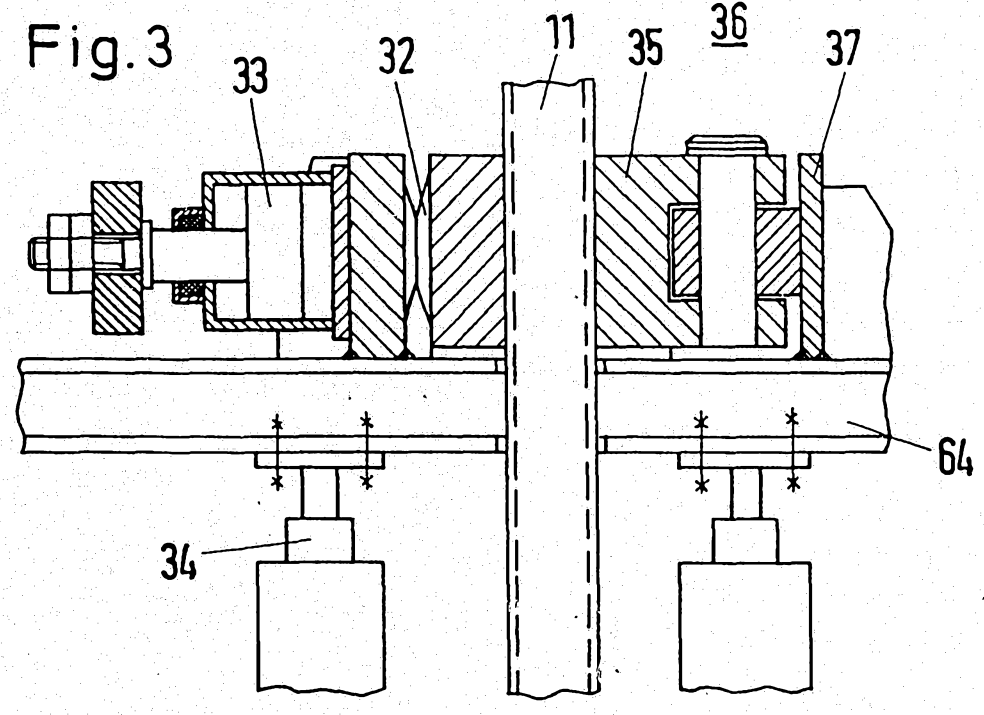

Fig. 4