(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 357 795 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **22.06.94** (51) Int. Cl.[5]: **F27D 1/16**

(21) Application number: **89903237.9**

(22) Date of filing: **08.03.89**

(86) International application number:
PCT/JP89/00247

(87) International publication number:
WO 89/08811 (21.09.89 89/23)

(54) **RADIATION CONSTRUCTION METHOD FOR MOLTEN METAL OUTFLOW PORT, ITS APPARATUS AND RECESS RADIATING IMPELLER USED FOR SAID APPARATUS.**

(30) Priority: **17.03.88 JP 65235/88**

(43) Date of publication of application:
14.03.90 Bulletin 90/11

(45) Publication of the grant of the patent:
22.06.94 Bulletin 94/25

(84) Designated Contracting States:
DE FR GB IT

(56) References cited:
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EP 0 357 795 B1

Description

Technical Field

The present invention relates to a method and an apparatus for molten-metal-discharging hole of converter taphole, vacuum degassing furnace, etc., and a projection impeller for concave section used in said apparatus; having applications for repairing, constructing, and forming a molten-metal-discharging hole by projection.

Background Art

For example, the inside wall of converter taphole which is one of the examples of molten-metal-discharging hole is lined with refractory material and, in proportion to the use, this refractory material gets damage or becomes worn-out and requires repair. As a method of repairing this damage or wear in hot state, there have been techniques such as pressing injection repairing method, spray repairing method, and projection repairing method.

Above-said pressing injection repairing method is a technique to fill a cylinder with flowable repairing material and to push it out by piston, showing therefore a poor rate in the adhesion of repairing material onto a conically-worn-out section (also called a bell-shaped worn-out section) on the inside wall of above-said converter taphole and, even if the repairing material adheres onto said section, no fine nor good structure has been formed at the repaired section.

Above-said spray repairing method is a technique to spray repairing material through the spraying nozzle of a spraying lance onto a section to be repaired by means of compressed air and, as a result, there has been a problem that the effect in adhesion of the repairing material is poor and the structure of repaired section is also poor due to the influence of the compressed air to transfer the repairing material if an enough distance is not secured between said spraying nozzle and the inside wall of the converter taphole.

In the case of above-said spray repairing method which is discribed I.e in document GB 20 46 887, there has been another problem that it becomes impossible to perform spraying onto the conically-worn-out section 10 inside the converter taphole shown in Fig. 11 due to the clogging of repairing material at the bent section between the spraying lance 12 and the spraying nozzle 11, if the spraying nozzle 11 is attached to the spraying lance 12 with such angle that the repairing material may sprayed with an acute angle (θ is smaller than 90 degree).

Further, in the case of above-said projection repairing method, it is possible to repair above-said converter taphole by use of an apparatus for repairing a molten metal degassing equipment registered as Japanese Utility Model No. 1432690 (published in the gazette of the second publication No. 56-32513) and, as shown in Fig. 12, the repairing apparatus 17 published in above-said gazette is provided with a rotating tube 19a and a vertical tube 19 connected to said rotating tube 19a at the bottom center of the rotating impeller 18, wherein the refractory material supplied via said vertical tube 19 is ejected through the periphery of the impeller 18.

However, in the case of above-said apparatus 17 for repairing a molten metal degassing equipment, there has been a problem that the refractory material is discharged only by the centrifugal force which is generated accompanying the rotation of the impeller and, as a result, enough dispersing speed can not be obtained, because the refractory material is supplied from the central vertical tube 19 to the rotating tube 19a connected to the center section of the impeller.

And, there has been another problem that it is impossible to obtain a well-lined layer at a conically-worn-out section with slope because the refractory material is dispersed only in the direction perpendicular to the impeller and therefore it is difficult to disperse the refractory material perpendicularly onto the sloped conically-worn-out section.

Further, there has been a problem that the refractory material is dispersed evenly only in the radial direction, and it is difficult to ejected the refractory material in a limited direction and, therefore, it is difficult to repair efficiently a worn-out section generated only in a limited direction of a converter taphole and, moreover, in the case of said apparatus 17 for repairing molten metal degassing equipment published in the gazette, the repairing function is lost due to the clogging of the material at the joint section between the rotating tube 19a and the impeller 18.

The present invention has been made in view of above-said circumstances and, accordingly, it is an object of this invention to provide a method and an apparatus for repairing, constructing and forming a molten-metal-discharging hole. It is intended to increase the material-projecting speed so as to improve the adhering force of the material and, as the case may be, to project the projection material (including refractory and other repairing materials) in the limited direction to enable an effective repair on a molten-metal-discharging hole having an eccentric or a partial wear, and to perform a construction with high-adhesion and fine structure at a conically-worn-out section (a con-

cave section of a molten-metal-discharging hole) generated on the inside wall of a converter taphole.

Disclosure of Invention

The above mentioned problems are solved by an apparatus as defined in claim 1 and by a method as defined in claim 6. Preferred embodiments of the apparatus are disclosed in the dependent claims 2 to 5.

The projecting construction method for molten-metal-discharging hole relating to the present invention with the object mentioned above comprises the steps of : inserting an impeller connected to a rotating power source to move the impeller forward and backward in a molten-metal-discharging hole, disposing before said impeller a stationary material-supplying pipe having at least one port before said impeller, for supplying projection material to the impeller by air or a pump, and projecting the projection material ejected from said material-supplying pipe onto a concave section of molten-metal-discharging hole while changing the direction of the material by said impeller.

By the method of this invention, it is possible to have the projection material which is ejected out of the material-supplying pipe projected by the impeller near the periphery of the impeller and, by increasing the rotating speed of the impeller, a high-speed projection of the material becomes possible and, as a result, fine constructed layer can be obtained and, in case of transferring the projection material by air, it is also possible to vent said air through the space between the vanes of the impeller and, by this process, the projection material and the transferring air can be separated.

Then, the projecting construction apparatus for molten-metal-discharging hole relating to a first embodiment of the above-said method comprises an impeller which is connected to a rotating shaft, a stationary material-supplying pipe disposed before said impeller and has a ring-shaped port through which the transferred projection material is ejected, and a device to move the pipe and impeller forward and backward inside the molten-metal-discharging hole to be constructed.

And, the projecting construction apparatus for molten-metal-discharging hole relating to a second embodiment of the above-said method comprises an impeller which is connected to a rotating shaft, and material-supplying pipes composed with two or more pipes which are disposed around said rotating shaft and eject the transferred material through the ports disposed before said impeller, and a device to move the pipe and impeller forward and backward inside the molten-metal-discharging hole to be constructed.

In the case of the projecting construction apparatus for molten-metal-discharging hole relating to the first or second embodiment mentioned above, it is possible to form a concave section before the impeller so that the top end section of each material-supplying pipe may come in said concave section and, as a result, the projection material is surely projected by the impeller up to the periphery of the impeller in the radius direction even if the ejecting speed of the projection material is low.

Further, in the case of the projecting construction apparatus for molten-metal-discharging hole relating to the first and second embodiments mentioned above, it is also possible to provide a cutter at the forward section of the impeller, and let the cutter rotate together with said impeller and, as a result, it is possible to form a cylindrical molten-metal-discharging hole by cutting off the convexes made of slag, etc. adhered on the inside wall of the hole.

In addition, each vane of the impeller used in the projecting construction apparatus for molten-metal-discharging hole relating to above-mentioned first or second embodiment is possible to be attached to the rotating shaft with a specified twisting angle to the rotating shaft so that the projection material supplied through the material-supplying pipe may be projected backward obliquely. Accordingly, it becomes possible to project the projection material nearly at a right angle to a conically-worn-out section on the inside wall of a molten-metal-discharging hole, that is, the concave section generated on the molten-metal-discharging hole and, as a result, it becomes possible to construct - a lined layer with high quality.

Brief Description of Drawings

Fig. 1 is a side view showing the embodiment of the projecting construction apparatus for molten-metal-discharging hole relating to the first embodiment of the present invention, Fig. 2 is a diagrammatic sectional view showing above-said apparatus for repairing molten-metal-discharging hole, Fig. 3 is a diagrammatic side view of the apparatus for repairing molten-metal-discharging hole relating to the second embodiment of the present invention, Fig. 4 is a diagrammatic enlarged view in the direction of the arrow A - A in Fig. 3, Fig. 5 is a sectional view with parts omitted of the major components of apparatus for repairing molten-metal-discharging hole relating to the third embodiment of the present invention, Fig. 6 is a sectional view in the direction of the arrow B - B in Fig. 5, Fig.7 is a diagrammatic side view of the projecting construction apparatus for molten-metal-discharging hole relating to the fourth embodiment of the

present invention, Fig. 8 is a front view of a cutter used in above-said fourth embodiment, Fig. 9 is a side view of the same, Fig. 10 is an oblique view of the impeller relating to the other embodiments used in above-said projecting construction apparatus for molten-metal-discharging hole, Fig.11 is a diagrammatic side view showing the method of repairing molten-metal-discharging hole relating to a conventional practice, and Fig. 12 is a sectional view of a repairing apparatus using an impeller relating to a conventional practice.

Best Mode for Carrying Out the Invention

As illustrated in Figs. 1 and 2, apparatus 21 for repairing molten-metal-discharging hole relating to the first embodiment comprises a travelling frame 22a which is supported by supporting members not shown in the figures but disposed before a converter taphole which is one of the examples of molten-metal-discharging hole and is a component of device 22 to move forward and backward, a travelling truck 23 having a driving source therein and travels laterally on above-said travelling frame 22a, a rotating shaft 24 so attached on the lower section of said travelling truck 23 via supporting members as to rotate freely, an impeller 25 which is attached to the top end of said rotating shaft 24, and a material-supporting pipe 26 disposed around said rotating shaft 24. The details of these components will be described hereinunder.

As illustrated in Fig. 1,above-said device 22 to move forward and backward has a well-known composition that the travelling truck 23 moves forward and backward in parallel to the converter taphole 27 driven by an electric motor, a hydraulic or a pneumatic cylinder, etc. and guided by the travelling frame 22a which is supported by supporting members not shown in the figure. Here, though the travelling truck 23 has a composition only to move forward and backward, it is possible to add a well-known laterally-travelling or swinging function to said travelling truck 23 if so intended.

On the lower section of the travelling truck 23, the rotating shaft 24 is disposed via supporting members and, on the top end of said rotating shaft 24, an impeller 25 is attached, wherein aforesaid device moves forward and backward inside said converter taphole 27 accompanying the movement of the travelling truck.

Above-said impeller 25 is made up with metal or ceramic vanes and, as illustrated in Fig. 2, at the center of said impeller 25, the rotating shaft 24 is attached and, at the rear end section of said rotating shaft 24, a motor 32 which is a rotation driving source is connected via a coupling 31 so as to rotate the impeller 25 at high speed.

On the way of said rotating shaft 24, bearings 28, 29, and 30 are disposed, and said bearings 28, 29, and 30 are fixed inside the supporting pipe 26a and, at the outside of this supporting pipe 26a, there disposed an outer cylinder 26b supported by supporting members not shown in the figure, wherein a ring-shaped material-supplying pipe 26 which is concentric with said rotating shaft 24 is formed by said outer cylinder 26b and supporting pipe 26a, and the repairing material that is one of the examples of projection material is ejected toward the vanes of said impeller 25 out of the ring-shaped port 26c at the top section of the material-supplying pipe 26.

At the starting end section of said material-supplying pipe 26 as illustrated in Fig. 1, a material-supplying hose 34 is connected which is also connected to a material-supplying tank 33 and, transferred by the compressed air generated by a compressor not shown in the figure, the repairing material is ejected from the ring-shaped port 26c at the top section of the material-supplying pipe 26, wherein, on the way of said material-supplying hose 34, there disposed a water-adding device 35 which has water-injecting holes formed obliquely to the forward direction of the material so as to add proper amount of water to said repairing material.

In addition, as another example, the water-adding device 35 may be attached at the end section of the outer cylinder 26b. In the figure, the number 36 shows a cooling water recirculation hose (not shown in Fig. 2) for circulating the cooling water to cool said material-supplying pipe, the number 37 shows the hose to supply water to the water-adding device 35, and the number 38 shows the inside conically-worn-out section to be repaired.

In the actual use of the apparatus 21 for repairing molten-metal-discharging hole relating to above-said first embodiment, since it has the function described above, the worn-out state of the converter taphole 27 is confirmed in advance and, after circulating the cooling water used for said apparatus 21 and, driving the rotating motor 32, the impeller 25 is inserted into the converter taphole 27 together with the material-supplying pipe 26 while controlling the travelling truck 23.

Then, by a compressor, etc., not shown in the figure, the repairing material in the material tank 33 is transferred by compressed air to the material-supplying pipe 26 through the material-supplying hose 34, and ejected toward the impeller 25 from the ring-shaped port 26c at the top section of the material-supplying pipe 26. Here, as the repairing material, basic material such as of magnesia or dolomite is used and proper amount of water is added via the water-adding device 35 disposed on the way of the hose.

Since the impeller 25 rotates at high speed, the repairing material ejected onto said impeller 25 is projected by the vanes and, as a result, as shown in Fig. 1, the converter taphole 27 is repaired quickly and, because of the projection nearly perpendicular to the surface to be repaired, a constructed layer finer than that by conventional method can be obtained with good efficiency.

In above-said embodiment (same for the following second to fourth embodiments), dry type repairing material was used. The present invention, however, is suitable even for wet type material (such as above-said magnesia or dolomite basic material added with water, etc.) supplied by a pump for example. Further, since the impeller is made up with plate type vanes with open tops, and large part of the material-transferring compressed air flows in the same direction as of the shaft axis and only the repairing material is projected by the vanes, the adhesion rate of the repairing material is improved, and a clogging of the material at the root of vanes occurred in the case of conventional apparatus mentioned above is eliminated.

Moreover, by disposing the outer cylinder 26b which composes the material-supplying pipe 26 eccentrically to the supporting pipe 26a which supports the rotating shaft 24 of the impeller and, in addition, by giving proper rotation to said material-supplying pipe and changing the relative position of the port of material-supplying pipe 26 to the molten-metal-discharging hole 27, it also becomes possible to eject the projection material eccentrically from the ring-shaped port 26c and to limit the projection of material from the impeller 25 to only one direction. By this modification, the thickness of circumferential layer can be adjusted, and a partial concave section can also be repaired.

In this case, though the projecting position of the material-supplying pipe is to be controlled as it can be rotated against the travelling truck, the material-supplying pipe becomes stationary when the impeller is used as a reference because said pipe dose not rotate together with the impeller.

Then, the details will be described as to the apparatus 39 for repairing molten-metal-discharging hole relating to the second embodiment illustrated in Figs. 3 and 4, and the same components in above-said apparatus 21 for repairing molten-metal-discharging hole are provided with the same number and the descriptions of these components are omitted.

In the apparatus 39 for repairing molten-metal-discharging hole as illustrated in Figs. 3 and 4, the material-supplying pipes 40a through 40h composing of two or more pipes (eight pipes are used in this embodiment) are disposed around the rotating shaft 24, and each of the material-supplying pipes 40a through 40h is connected respectively to the centralized material-supplying pipe 42 via valves 41a through 41h. This centralized material-supplying pipe 42 is connected to above-described material tank from which the predetermined repairing material, that is, one of the projection materials is transferred by air.

Accordingly, as illustrated in Fig. 4, in the case there is a partial wear 43 in the limited direction on the converter taphole 27 by supplying the repairing material only from the material-supplying pipes 40b and 40c, the material can be projected in only one direction(slanted lined portion in the right of Fig. 4) and, as a result, partial repair of the converter taphole becomes possible, because only a limited part of material is ejected from the material-supplying port at the top end section of the pipe and collides with the impeller 25.

Further, in this embodiment, the repairing material is added with water beforehand and transferred by compressed air generated by a compressor not shown in the figure as same as in the first embodiment mentioned hereinbefore, and it is possible to provide a water-adding device to add proper amount of water to the repairing apparatus on the way of the material-supplying pipes 40a through 40h or at the upstream of them.

Then, in the main composition of the projecting construction apparatus for molten-metal-discharging hole relating to the third embodiment illustrated in Figs. 5 and 6, a rotating shaft 48 to rotate freely is disposed via bearings 45, 46, and 47 on a supporting pipe 44 having an enough length longer than that of aforesaid converter taphole and an impeller 49 is fixed on the top end of said rotating shaft 48.

As illustrated in Fig. 6, around above-said supporting pipe 44, there disposed material-supplying pipes 50a through 50d made up with four stainless steel pipes with both ends being held with end plates 51 and 52 and, between the two of the material-supplying pipes 50a through 50d, cooling-water supplying pipes 53a through 53d are disposed. And at the outer periphery of said material-supplying pipes 50a through 50d, an outer cylinder 54 is disposed whose top end is fixed to above-said end plate 51 and whose bottom end is fixed to the supporting metal 55 which holds above-said end plate 52.

To this supporting metal 55, a water-supplying port 56 and a water-draining port 57 are provided. The water-supplying port is connected to above-said four cooling-water supplying pipes 53a through 53d, and the water-draining port 57 is connected to the inside of said outer cylinder 54, wherein the water supplied through above-said water-supplying pipes 53a through 53d to the top section of the material-supplying pipe 54 is drained out of the space between the supporting pipe 44

and the outer cylinder 54 and from above-said water-draining port 57. Here, Fig. 5 illustrates the state wherein no cooling water is supplied and, Fig. 6 illustrates the state wherein cooling water is supplied.

At each starting end section of above-said material-supplying pipes 50a through 50d, there provided a connecting metal 58 to connect the material-supplying hose for transferring the repairing material which is one of the examples of projection material transferred by compressed air and, at said connecting metal 58, there provided an air-replenishing hole 59 for compensating the undersupply of compressed air, and a water-supplying hole 60 for supplying the water used for above-said repairing material. In addition, each of above-said material-supplying pipes is provided with valve by which the repairing material supplied to above-said material-supplying pipes 50a through 50d can be stopped individually.

At the one end of above-said rotating shaft 48, there provided a coupling 60a which is to be coupled with the output shaft of a rotation driving source (such as an electric motor, a hydraulic motor, or an air motor) not shown in the figure. And a concave section 61 is formed before the impeller 49 which is fixed to the other end of said rotating shaft 48 and, to this concave section, the top end section of above-said material-supplying pipes 50a through 50d comes in so that the ejected repairing material may collide with the impeller 49 without fail and may be projected to the periphery of the impeller between the radius and circumferential directions.

Above-said supporting metal 55 is attached to the travelling truck 23 which is a component of aforesaid device 22 so that this apparatus may move forward and backward inside aforesaid converter taphole 27 accompanying the movement of said travelling truck 23.

Therefore, to use this projecting construction apparatus for molten-metal-discharging hole, the worn-out state of the converter taphole 27 to be repaired is first confirmed and the specified amount of water is supplied from the water-supplying port 56 so as to keep the inside cool sufficiently. Then, by driving the device 22 to move forward and backward, said apparatus is inserted up to the specified position inside the converter taphole 27 to be repaired and, with the impeller 49 being rotated by a rotating motor, the valves connected to above-said material-supplying pipes 50a through 50d are opened so that the repairing material may be transferred by compressed air to either one or two or all of the material-supplying pipes 50a through 50d described above.

During this process, proper amount of water is added to the repairing material so as to make it wet and, if so intended, it is possible to supply the repairing material to the vanes of the impeller 49 while increasing the ejecting speed by supplying the compressed air from the air-replenishing port 59.

The repairing material ejected from the material-supplying pipes 50a through 50d is projected by the impeller 49 to its periphery without fail whenever it is ejected even if the ejecting speed is not sufficient, because the top end of said material-supplying pipes 50a through 50d come into the concave section 61 of the impeller 49, and, as a result, the repairing work becomes efficient.

Though this embodiment illustrates the case in which the multiple material-supplying pipes 50a through 50d are disposed around the rotating shaft, and, even in the case of the material-supplying pipe 26 composing the supporting pipe 26a and the outer cylinder 26b as in aforesaid first embodiment, it is possible to let the top end section of the material-supplying pipe come into above-said concave section 61 and, accordingly, the apparatus still has the characteristics that the repairing material is to be well projected by the impeller even if the ejecting speed of the supplied material is low.

Then, the basic difference between the apparatus 62 for repairing molten-metal-discharging hole relating to the fourth embodiment illustrated in Figs. 7, 8, and 9, and above-said apparatus for repairing molten-metal-discharging hole is that the apparatus 62 for repairing molten-metal-discharging hole is provided with a detachable cutter 64 at the forward section of the impeller 63 as illustrated in Figs. 8 and 9. Accordingly, the cutter 64 rotates accompanying the rotating impeller 63 and, by this mechanism, it becomes possible to remove the convexes 65 and 66 inside the converter taphole 27 before a repair and, moreover, in case of overprojection in one direction of the repairing material which is one of the examples of projection material, it is also possible to cut away the overprojected material by use of said cutter 64.

Fig. 10 illustrates an impeller 68 to which each vane 67 of the impeller is attached with a twisting angle α to the rotating shaft(not shown) and with an inclination τ to the direction of rotating radius. By attaching each vane 67 of the impeller with the twisting angle to the rotating shaft as described above, it is possible to project the repairing material which is one of the examples of projection material ejected backward obliquely as shown by the arrow p to the impeller 68 from the material-supplying pipe 69 and, by attaching each vane with an inclination to the direction of rotating radius, it is also possible to take an angle to project the repairing material nearer the rotating shaft.

Accordingly, in the case of repairing the conically-worn-out section 38 inside the converter as shown in Fig. 2, an extremely high efficient projec-

tion becomes possible by projecting the repairing material, with the impeller 68 being set a little ahead of said worn-out section, because the repairing material is projected backward obliquely.

Though above-described embodiment is for the repair of the internal portion of a converter taphole, the present invention has many applications such as for the repair of concave section existing on a reflux tank of vacuum degassing furnace, converter noses and electric furnace throats (inserting hole), and ceramic-producing kilns in which the material-flowing-direction is changed. Further not only for repair, but the present invention is applicable to the construction and forming work at the critical section of converter, etc. by use of castable refractories.

Industrial Applicability

In the case of repairing method for molten-metal-discharging hole relating to the present invention, it has become possible to project only the projection material effectively onto the concave section of a molten-metal-discharging hole while passing the transferring air, etc. along the direction of rotating axis, because the projection material supplied through the material-supplying pipe and ejected to the impeller is projected in the peripheral direction by the collision with the vanes of the impeller which is rotating at high speed.

Accordingly, the present invention enables a repair work in hot state, with high efficiency, without material clogging, and with high-quality lined layer even in the case of the conical section inside a molten-metal-discharging hole to which it is difficult to project repairing material by conventional methods.

Further, the apparatus for repairing molten-metal-discharging hole relating to the first and second inventions can provide an apparatus embodying above-described method, enable the high-speed projection of material onto the inner wall of molten-metal-discharging hole, and, as a result, make it possible to install an inner wall with high-bulk-density (low-porosity).

Especially, in the case of apparatus for repairing molten-metal-discharging hole relating to the second invention, it is possible to eject the projection material only in one concentrated direction by disposing a valve to each material-supplying pipe and, as a result, it becomes possible to adjust the thickness of circumferential layer and to repair efficiently the molten-metal-discharging hole, contributing to decrease the unit cost of the repairing material.

Moreover, because it is possible to repair the molten-metal-discharging hole to a true circle, the air-contacting area of the flowing molten metal is decreased and, as a result, steel quality becomes improved.

In the projecting construction apparatus for molten-metal-discharging hole relating to above-described first or second invention, it is possible to project projection material by use of the impeller without fail, even if the ejecting speed of the material is low, by forming a concave section before the impeller and by making the top end of the material-supplying pipe come into said concave section.

Also, in the projecting construction apparatus for molten-metal-discharging hole relating to above-said first and second inventions, by providing a cutter to the impeller, it becomes possible to remove the convexes and overprojected material which are existing on the inside wall of molten-metal-discharging hole and, as a result , it further becomes possible to form or repair the molten-metal-discharging hole into that with far true circle.

In addition, in the case of the impeller of present invention for repairing the concave section of molten-metal-discharging hole can project the projection material backward obliquely and, accordingly, more efficient projection can be performed to the conically-worn-out section on the inside wall of molten-metal-discharging hole. Therefore, if introducing the projection repairing method by use of the impeller of the present invention to the repair of converter taphole, it becomes possible to repair a molten-metal-discharging hole while a converter is in blowing process.

Claims

1. Apparatus for repairing, constructing and forming a molten-metal-discharging hole by projecting, having a pipe connected to a supply tube, an impeller and a device for moving said pipe and impeller along at the axes of the molten-metal-discharging hole, characterized in that said impeller is connected to a rotating shaft (24) having a motor (32) at its rear end section such that the driving motor is disposed outside the taphole when in use, and said pipe is a stationary material-supplying pipe (26), which is disposed around the rotating shaft (24), and has a port disposed before said impeller, through which the transferred projection material is projected.

2. Apparatus as set forth in claim 1, characterized by the fact that the stationary material-supplying pipe (26) has a ring shape port (26c).

3. Apparatus as set forth in one of the claims 1 and 2, characterized by the fact that the stationary material-supplying pipe (26) comprises at least two separate pipes (40a-h) with individ-

ual ports.

4. Apparatus as set forth in one of former claims 1 - 3 wherein cutters (64) are disposed on the forward section of the impeller and rotated together with said impeller.

5. Apparatus as set forth in one of former claims 1 - 4 characterized by an impeller (25, 63) having vanes (67) which are attached to the rotating shaft (24) with specified twisting angel α to the rotating shaft (24) so as to project backward obliquely the projection material applied through the material-supplying pipe (26, 69).

6. Method for repairing, constructing and forming a molten-metal-discharging hole with an apparatus as set forth in claims 1 - 5, comprising the steps of: inserting an impeller connected to a rotating power source to move the impeller forward and backward in a molten-metal-discharging hole, disposing before said impeller a stationary material-supplying pipe having at least one port before said impeller, for supplying projection material by air or a pump and projecting the projection material ejected from said stationary material-supplying pipe (26) onto a concave section of molten-metal-discharging hole while changing the direction of the material by said impeller (25).

Patentansprüche

1. Vorrichtung zum Reparieren, Aufbauen und Bilden einer Metallabstichöffnung durch Schleudern, mit einer Leitung, die verbunden ist mit einem Zufuhrrohr, einem Flügelrad und einer Vorrichtung zum Bewegen der Leitung und des Flügelrades entlang der Achse der Metallabstichöffnung, **dadurch gekennzeichnet, daß** das Flügelrad mit einer Drehwelle (24) verbunden ist, die einen Motor (32) an ihrem rückwertigen Endabschnitt aufweist, so daß der Antriebsmotor beim Gebrauch außerhalb der Abstichöffnung angeordnet ist und wobei die Leitung eine Materialzufuhrleitung (26) ist, welche um die Drehwelle (24) angeordnet ist und einen Anschluß aufweist, welcher vor dem Flügelrad vorgesehen ist, durch welches das zugeführte Schleudermaterial ausgeworfen wird.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die stationäre Materialzufuhrleitung (26) eine ringförmige Öffnung aufweist (26c).

3. Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** die stationäre Materialzufuhrleitung (26) mindestens zwei getrennte Leitungen (40 a-h) mit jeweiligen Öffnungen umfaßt.

4. Vorrichtung nach einem der vorangegangenen Ansprüche 1 bis 3, worin Schneidewerkzeuge (64) am vorderen Abschnitt des Flügelrades angeordnet sind und zusammen mit dem Flügelrad gedreht werden.

5. Vorrichtung nach einem der vorangegangenen Ansprüche 1 bis 4, **dadurch gekennzeichnet, daß** ein Flügelrad (25, 63) Flügel (67) aufweist, welche an der Welle (24) in einem genau definiertem Drallwinkel α zu der Welle (24) befestigt sind, so daß sie schräg nach hinten wegstehend das durch die Materialzuführleitung (26, 69) zugeführte Schleudermaterial abschleudern.

6. Verfahren zum Reparieren, Aufbauen und Bilden einer Metallabstichöffnung mit einer Vorrichtung nach einem der Ansprüche 1 bis 5 umfassend die Schritte: Einführen eines Flügelrades, das mit einer Rotationsantriebsquelle verbunden ist, durch welche das Flügelrad in einer Metallabstichöffnung hin- und herbewegt wird, Anordnen einer Materialzuführleitung (26) vor dem Flügelrad für die Zufuhr von Schleudermaterial zu dem Flügelrad mit Hilfe von Luft oder einer Pumpe, und Verschleudern des aus der Materialzuführleitung ausgeworfenen Schleudermaterials auf einen konkaven Abschnitt einer Metallabstichöffnung, während die Richtung des Materials durch das Flügelrad (25) geändert wird.

Revendications

1. Appareil pour réparer, réaliser et façonner un trou d'évacuation de métal fondu par projection, ayant une canalisation raccordée à un tube d'alimentation, une turbine et un dispositif pour déplacer ladite canalisation et ladite turbine suivant l'axe du trou d'évacuation de métal fondu, caractérisé en ce que ladite turbine est reliée à un arbre rotatif (24) ayant un moteur (32) sur sa section d'extrémité arrière de façon que le moteur d'entraînement soit disposé à l'extérieur du trou de coulée lorsqu'il est utilisé, et en ce que ladite canalisation est une canalisation stationnaire d'alimentation en matériau (26) qui est disposée autour de l'arbre rotatif (24) et présente un orifice disposé en amont de ladite turbine, par l'intermédiaire duquel le matériau de projection transféré est

projeté.

2. Appareil selon la revendication 1, caractérisé par le fait que la canalisation stationnaire d'alimentation en matériau (26) présente un orifice annulaire (26c).

3. Appareil selon l'une quelconque des revendications 1 et 2, caractérisé par le fait que la canalisation stationnaire d'alimentation en matériau (26) comprend au moins deux canalisations séparées (40a-h) munies d'orifices individuels.

4. Appareil selon l'une des revendications 1 à 3 précédentes, dans lequel des découpeuses (64) sont disposées sur la section avant de la turbine et sont mises en rotation en même temps que ladite turbine.

5. Appareil selon l'une des revendications 1 à 4 précédentes, caractérisé par le fait qu'une turbine (25, 63) comporte des aubes (67) qui sont fixées à l'arbre rotatif (24) avec un angle de torsion a spécifié par rapport à l'arbre rotatif (24) pour projeter obliquement vers l'arrière le matériau de projection appliqué par l'intermédiaire de la canalisation d'alimentation en matériau (26, 69).

6. Procédé pour réparer, réaliser et façonner un trou d'évacuation de métal fondu au moyen d'un appareil tel qu'indiqué dans les revendications 1-5, comprenant les étapes consistant à:
insérer une turbine raccordée à une source motrice rotative pour entraîner la turbine vers l'avant et vers l'arrière dans un trou d'évacuation de métal fondu,
disposer en amont de ladite turbine une canalisation stationnaire d'alimentation en matériau ayant au moins un orifice en amont de ladite turbine, pour introduire du matériau de projection au moyen d'air ou d'une pompe et projeter le matériau de projection éjecté par ladite canalisation stationnaire d'alimentation en matériau (26) sur une section concave du trou d'évacuation de métal fondu tout en modifiant la direction du matériau au moyen de ladite turbine (25).

FIG. 1

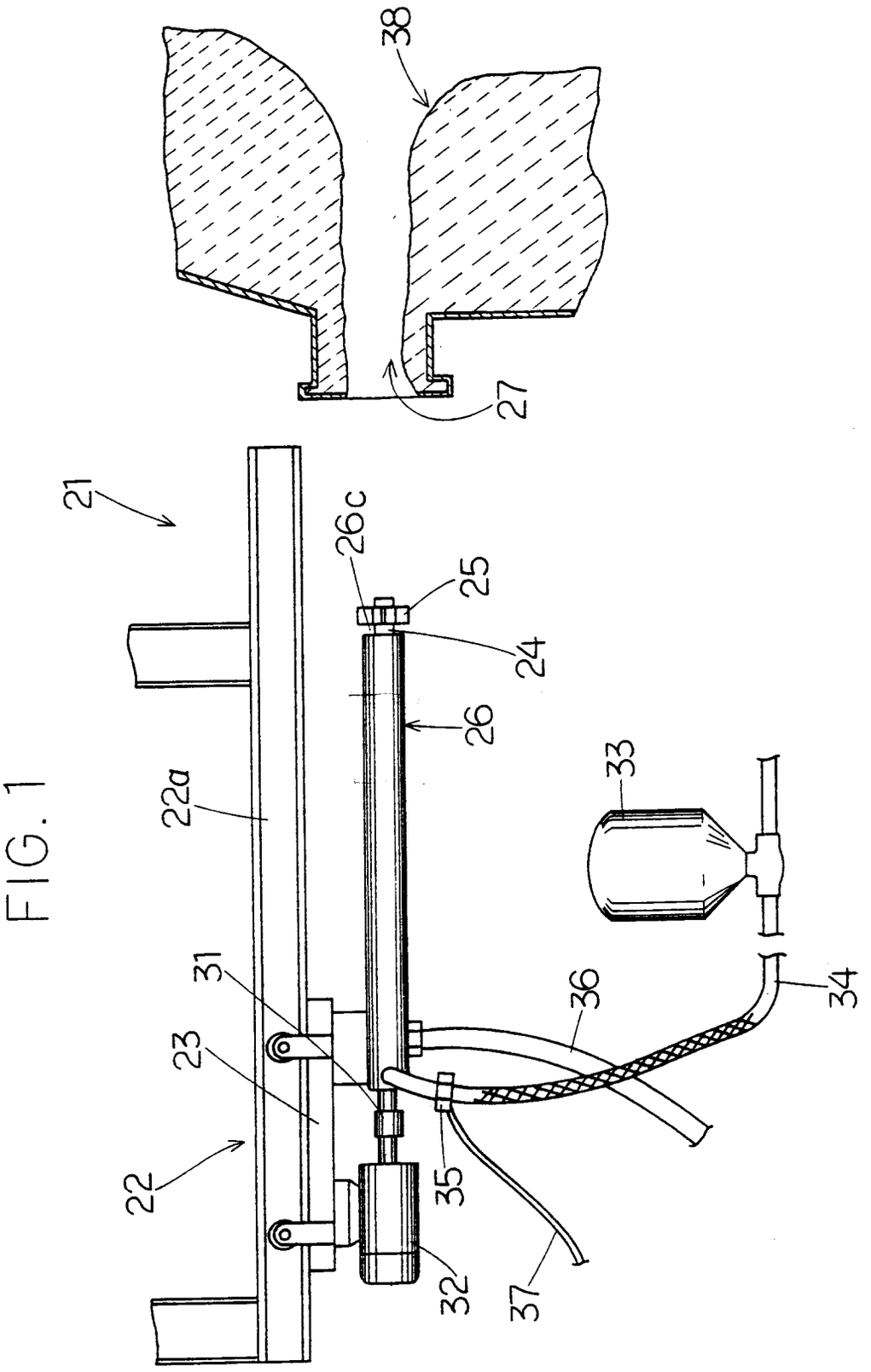


FIG. 2

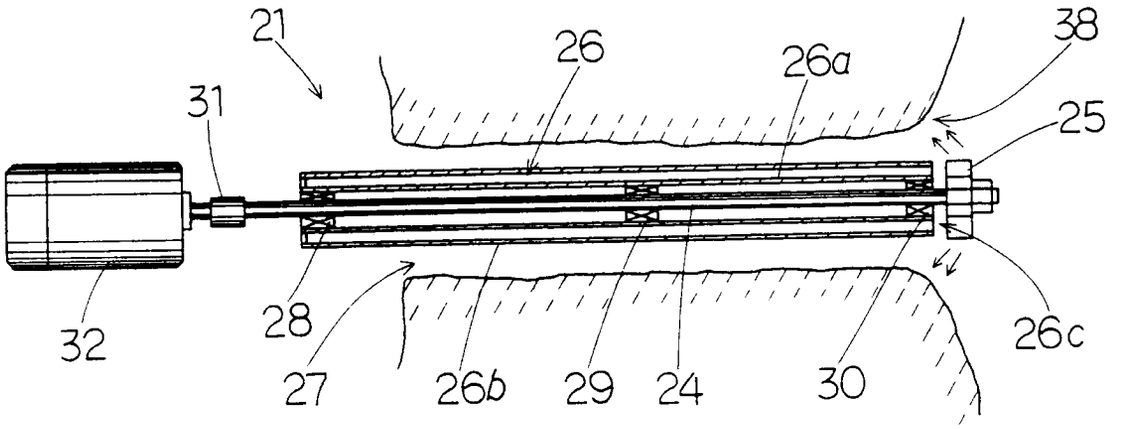


FIG. 3

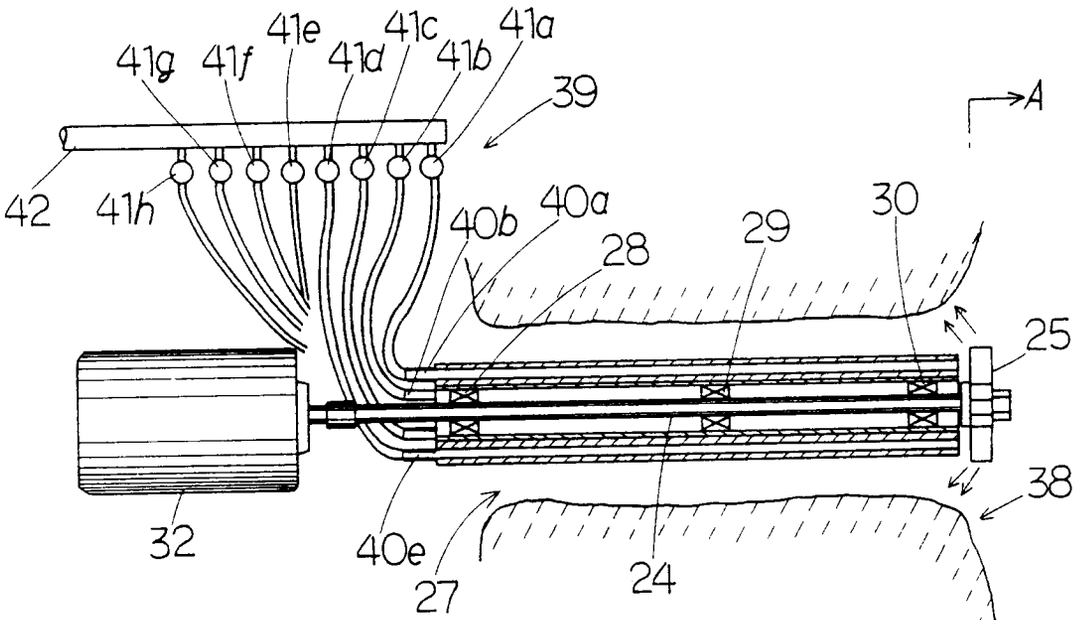
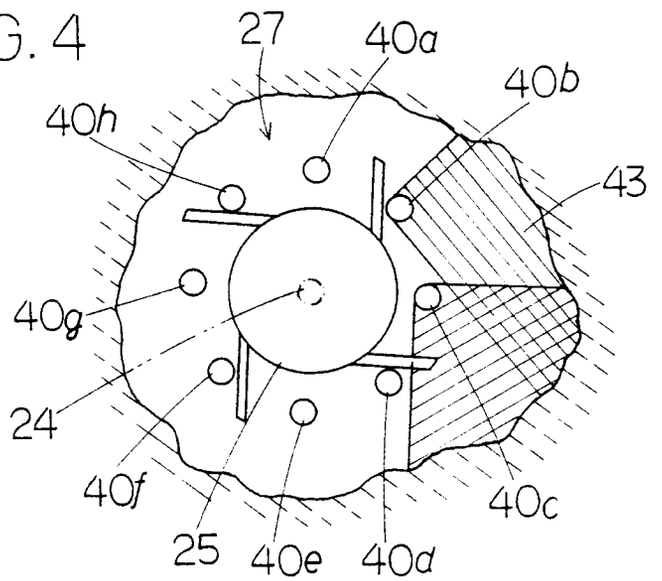


FIG. 4



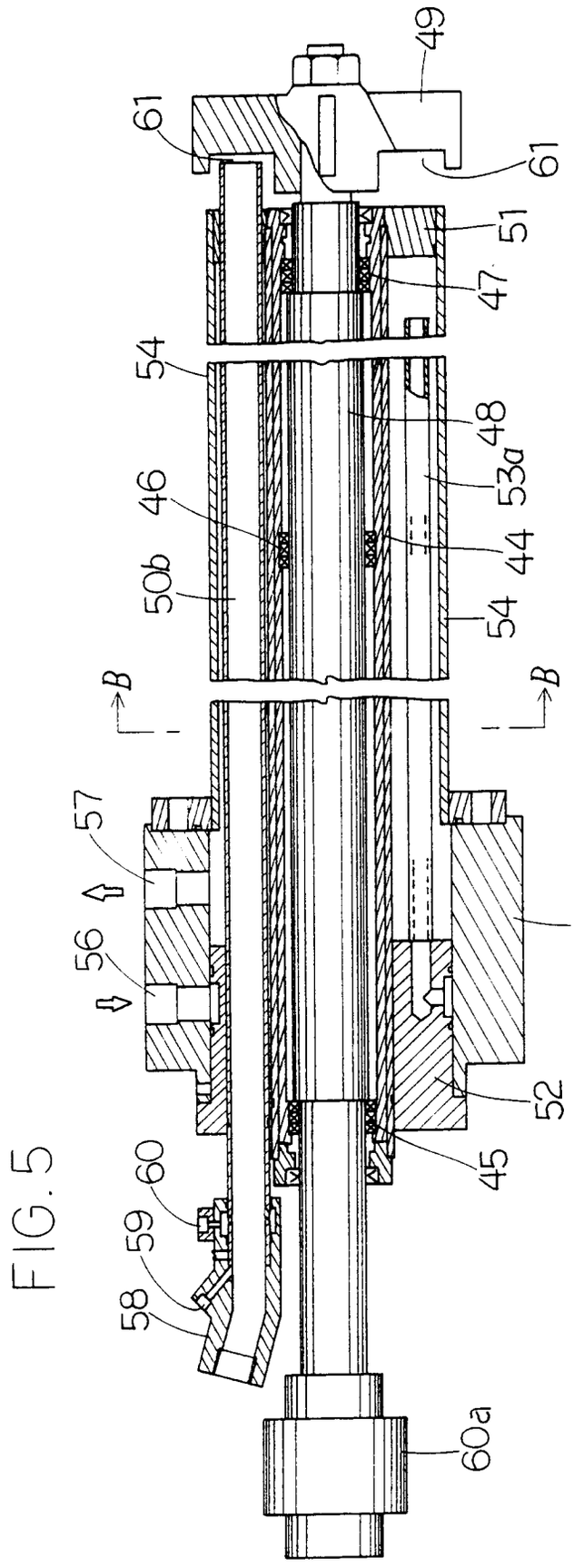

49
61
61
51
47
54
48
53a
46
44
50b
54
B
B
57
56
55
52
45
60
59
58
60a

FIG. 5

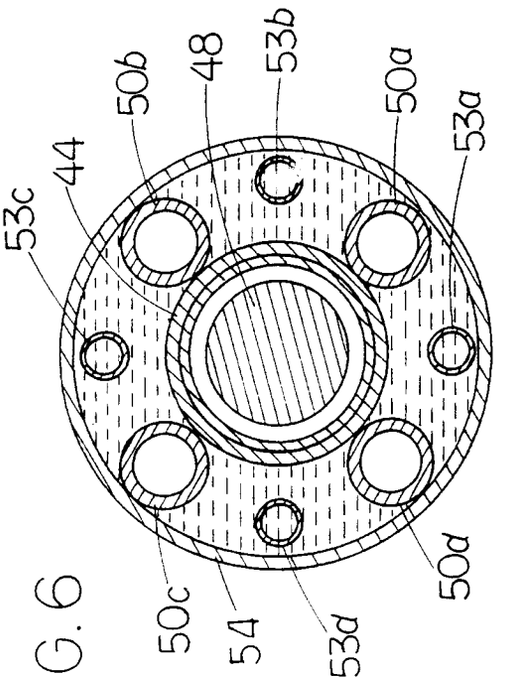

50b
48
53b
50a
53a
44
53c
50c
54
53d
50d

FIG. 6

FIG. 7

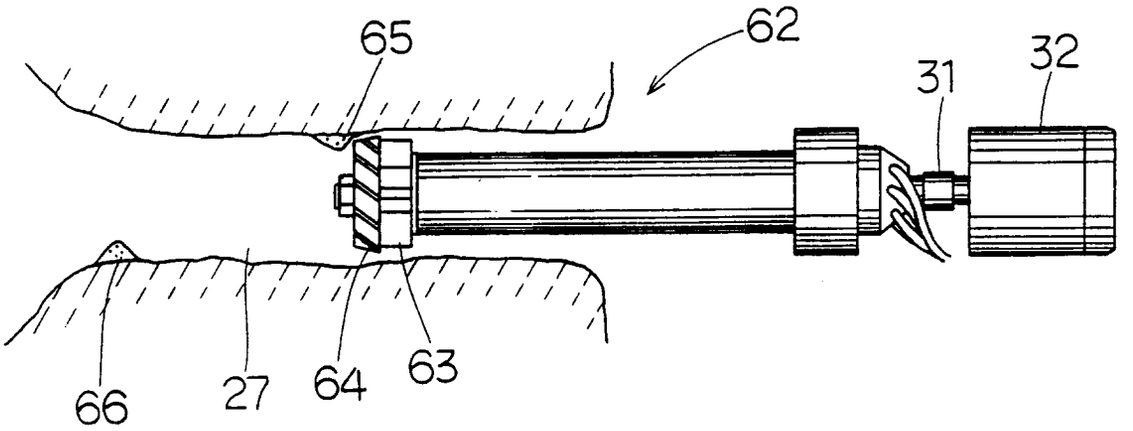


FIG. 8

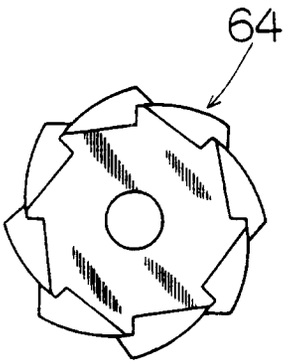


FIG. 9

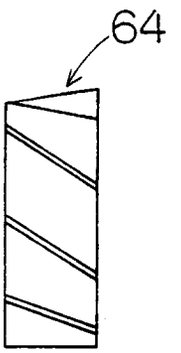


FIG. 10

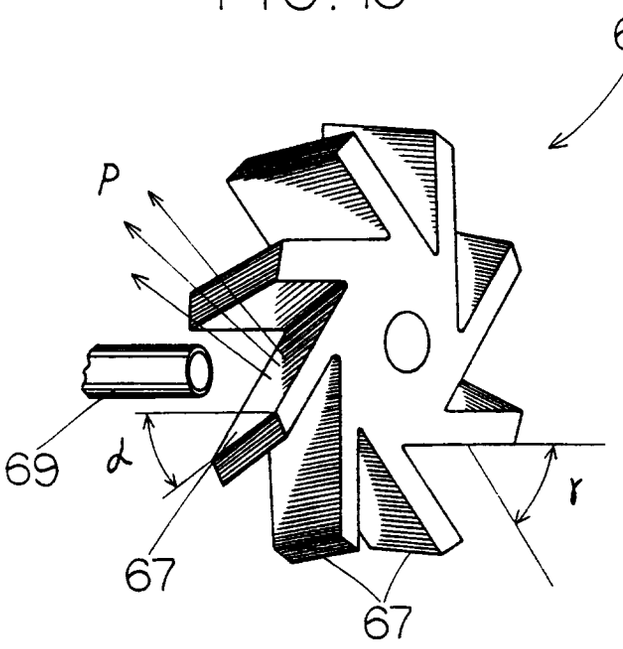


FIG. 11

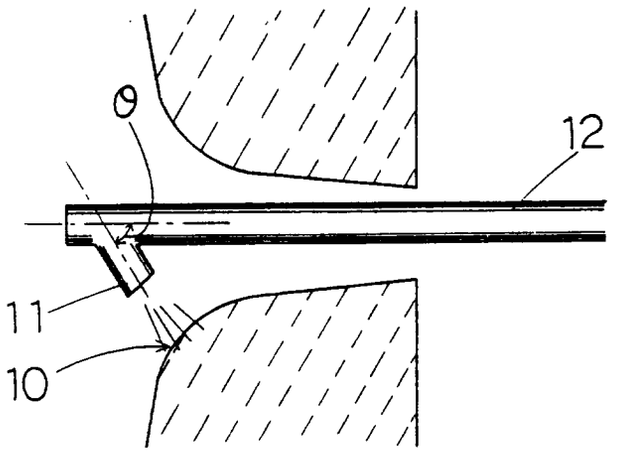


FIG. 12