

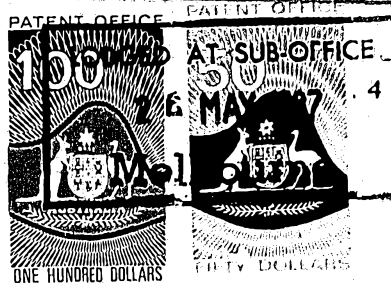
(CONVENTION. By one or more persons and/or a Comp:

73387/87

59 85 42

COMMONWEALTH OF AU

Patents Act 1952-1969



CONVENTION APPLICATION FOR A PATENT

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\$15.00 ATTACHED
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LODGED AT SUB-OFFICE
26 MAY 1987
Melbourne

(1) Here
insert (in
full) Name
or Names of
Applicant or
Applicants,
followed by
Address (es).

Ex (1) We ALCAN INTERNATIONAL LIMITED
of 1188 Sherbrooke Street, West, Montreal, Quebec,
Canada H3A 3G2

(2) Here
insert Title
of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2)
MODULAR MOULD SYSTEM AND METHOD FOR CONTINUOUS CASTING
OF METAL INGOTS

(3) Here insert
number(s)
of basic
application(s)

which is described in the accompanying complete specification. This application is a
Convention application and is based on the application numbered (3)
510,072

(4) Here insert
Name of basic
Country or
Countries, and
basic date or
dates

for a patent or similar protection made in (4) Canada
on 27th May 1986

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 11-4-90

Our address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,
50 Queen Street, Melbourne, Victoria, Australia.

DATED this 25th day of May 1987

(5) Signa-
ture (s) of
Applicant (s)
or
Seal of
Company and
Signatures of
its Officers as
prescribed by
its Articles of
Association.

(5)

ALCAN INTERNATIONAL LIMITED

by

L. J. Dyson

Registered Patent Attorney

(CONVENTION. Company.)

Form 8

COMMONWEALTH OF AUSTRALIA

Patents Act 1952-1969

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

(1) Here
insert (in
full) Name of
Company.

In support of the Convention Application made by⁽¹⁾.....
ALCAN INTERNATIONAL LIMITED, 1188 Sherbrooke Street, West,
Montreal, Quebec, Canada H3A 3G2

(hereinafter referred to as the applicant) for a Patent

(2) Here
insert title
of Invention.

for an invention entitled:⁽²⁾.....
MODULAR MOULD SYSTEM AND METHOD FOR CONTINUOUS CASTING
OF METAL INGOTS

(3) Here
insert full Name
and Address
of Company
official
authorized
to make
declaration.

I, ⁽³⁾..... Paul J. Lemieux
of..... 854 Lancaster Dr.
Kingston, Ontario, Canada K7P 1R6

do solemnly and sincerely declare as follows:

1. I am authorised by the applicant for the patent
to make this declaration on its behalf.

(4) Here
insert basic
Country or
Countries
followed by
date or dates
and basic
Applicant or
Applicants.

2. The basic application as defined by Section 141 of the Act was
..... made in⁽⁴⁾..... Canada
on the 27th..... day of May..... 19 86, by Neil B. Bryson;
David T.T. Auchterlonie; Guy Leblanc; Vincent J. Newberry
~~on the..... day of..... 19....., by.....~~

(5) Here
insert (in
full) Name
and Address
of Actual
Inventor or
Inventors.

3. ⁽⁵⁾ NEIL B. BRYSON, of 74 Lower Union St., Kingston, Ont., Canada;
DAVID T.T. AUCHTERLONIE, of 3015 Dickie, Jonquiere, Quebec, Canada
GUY LEBLANC, of 3215 Parkville, Apt. 3, Montreal, Quebec, Canada
VINCENT J. NEWBERRY, of 263 Conneniara Cresc., Beaconsfield, Que., Canada
is/are the actual inventors of the invention and the facts upon which the applicant
is entitled to make the application are as follow:

The applicant is the assignee of Neil B. Bryson; David T.T.
Auchterlonie; Guy Leblanc and Vincent J. Newberry by virtue of
an assignment dated April 21, 1986

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

DECLARED at..... Kingston, Ontario
this 27th..... day of April..... 19 87
ALCAN INTERNATIONAL LIMITED

(12) PATENT ABRIDGMENT (11) Document No. AU-B-73387/87
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 598542

(54) Title
MODULAR MOULD SYSTEM AND CHILL CASTING METHOD

International Patent Classification(s)
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(21) Application No. : 73387/87 (22) Application Date : 26.05.87

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(31) Number (32) Date (33) Country
510072 27.05.86 CA CANADA

(43) Publication Date : 03.12.87

(44) Publication Date of Accepted Application : 28.06.90

(71) Applicant(s)
ALCAN INTERNATIONAL LIMITED

(72) Inventor(s)
NEIL B. BRYSON; DAVID T.T. AUCHTERLONIE; GUY LEBLANC; VINCENT J. NEWBERRY

(74) Attorney or Agent
WATERMARK MELBOURNE

(56) Prior Art Documents
US 4597432
US 4598763
US 3612151

(57) Claim

1. a modular mould system for continuous casting of metal ingots comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table;

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening;

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity being symmetrically in register with and being smaller than the central opening of the water baffle;

(d) a feed inlet for molten metal removably mounted within the body immediately above the mould; and

(e) means for retaining the components of the mould

system together,

at least said annular members being selectively replaceable with ones of variable inner diameter or length.

10. A method for the production of aluminium ingots by direct chill continuous casting which comprises:

(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,

(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil plate, and

(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and

(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the diameter of the ingot to be produced is changed by changing the annular water baffle,

annular mould and oil shim with ones of a different inner diameter.

11. A method for the production of aluminium ingots by direct chill continuous casting which comprises:

(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,

(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil ^{plate} ~~shim~~, and

(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and

(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the mould system is modified to cast a molten aluminium alloy of different composition by changing the annular mould with one of a different length and also changing the water baffle whereby the total length of the annular mould and water baffle remain unchanged.

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-69

59 854 2 Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

Application Number:
Lodged:

73387/87

Class

Int. Class

Complete Specification Lodged:

Accepted:

Published:

Priority:

Related Art:

This document contains the
specifications made under
Section 44

subject to printing.

Name of Applicant: ALCAN INTERNATIONAL LIMITED

Address of Applicant: 1188 Sherbrooke Street, West, Montreal, Quebec, Canada
H3A 3G2

Actual Inventor: NEIL B. BRYSON, DAVID T. T. AUCHTERLONIE, GUY LeBLANC
and VINCENT J. NEWBERRY

Address for Service: EDWD. WATERS & SONS,
50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

MODULAR MOULD SYSTEM AND METHOD FOR CONTINUOUS CASTING
OF METAL INGOTS

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

Modular mould system and method for continuous casting of metal ingots

This invention relates to an improved mould system and method for the vertical continuous casting of molten metals, such as aluminum, to provide solidified circular cross section ingots for further processing into semi-fabricated metal products. More particularly, the invention relates to a mould apparatus for use in conjunction with a vertical, direct chill casting system for aluminum, magnesium and their alloys.

It is well known to those skilled in the art of direct chill casting that ingots of the highest surface and internal quality can be cast when the mould length is very short and precisely coordinated with the alloy, diameter and casting speed of each particular product it is desired to produce. This is shown, for example, in McCubbin U.S. Patent 4,071,072. Only by using very short moulds of the order of 10-40 mm in length can the direct chill cooling effect be utilized to overcome the inevitable loss of ingot-mould contact which results from the formation of the air-gap.

There are a number of new mould designs based upon the above principles, which are equally capable of casting ingots of very high surface and internal quality. However, all of the new mould designs are characteristi-

cally complex in design, utilize expensive materials, must be built to close tolerances, and hence are relatively inflexible in terms of being able to cast high quality ingot only of the specific alloy and ingot diameter for which the mould is designed and constructed.

Unlike the casting of very large rectangular ingots, which are cast only in small numbers simultaneously, the major market for round cross-section ingots is in small to medium diameters, in the range of 125 to 250 mm. In order to obtain high productivity, large numbers of ingots, e.g. 24 to 96, must be cast simultaneously. Accordingly, mould inventory costs are very high for a plant producing a wide range of alloys and ingot diameters using the new generation moulds capable of casting very high quality ingot.

It is the object of the present invention to provide a simplified mould system which will be capable of casting very high quality ingots while greatly decreasing the cost of mould inventory.

This invention in its broadest aspect relates to a modular mould system for continuous casting of metal ingots. It includes a hollow cylindrical body which is adapted to be mounted in a casting table. An annular water baffle is removably mounted in a lower region of the cylindrical body and this baffle has a central opening through which a forming metal ingot passes with the baffle providing a flow path for cooling water to flow radially inwardly from the cylindrical body and discharge inwardly and downwardly against a forming ingot passing through the central opening. An annular mould is removably mounted in the cylindrical body immediately above the water baffle and this mould has a central forming cavity for forming a metal ingot, the forming cavity having a slightly smaller diameter than the central opening of the water baffle. A feed inlet for molten



This invention in its broadest aspect relates to a modular mould system for continuous casting of metal ingots comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table;

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening;

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity being symmetrically in register with and being smaller than the central opening of the water baffle;

(d) a feed inlet for molten metal removably mounted within the body immediately above the mould; and

(e) means for retaining the components of the mould system together,

at least said annular members being selectively replacable with ones of variable inner diameter or length.

Preferably in the mould system, the feed inlet for molten metal includes an insulating ring immediately above the mould, said insulating ring having an outer diameter less than the diameter of said cylindrical body. In one preferred embodiment disclosed hereinafter, the means for retaining the components of the mould together comprises a pressure ring removably mounted in the cylindrical body in an annular gap between the cylindrical body and the outer diameter of the insulating ring, and a cover plate adapted to compress the components of the mould system together. In a still further preferred arrangement, an annular oil plate is provided positioned immediately above the mould for feeding oil to the mould, said oil plate being connected by a conduit to an oil inlet in the body and being replacable with ones of variable inner diameter.



With the modular mould system of the present invention, rather than having to replace the entire structure each time a different alloy and/or ingot size is to be produced, only certain of the modular parts need be replaced. Thus depending on the diameter or alloy of the ingot to be produced, it may be necessary to replace only two or three modular parts, rather than to replace the entire mould structure as is now conventional.

This provides a great saving the mould inventory required for producing ingots of many different diameters and alloys.

In accordance with a further aspect of the present invention, there is provided a method for the production of aluminium ingots by direct chill continuous casting which comprises:

(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,



(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil plate, and

(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and

(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the diameter of the ingot to be produced is changed by changing the annular water baffle, annular mould and oil shim with ones of a different inner diameter.

In accordance with a still further aspect of the present invention there is provided a method for the production of aluminium ingots by direct chill continuous casting which comprises:

(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,



-2d-

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,

(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil shim, and

(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and

(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the mould system is modified to cast a molten aluminium alloy of different composition by changing the annular mould with one of a different length and also changing the water baffle whereby the total length of the annular mould and water baffle remain unchanged.

Preferred embodiments of the present invention will hereinafter be described with reference to the accompanying drawings, in which:

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metal is provided immediately above the mould and this comprises an insulating ring or rings removably mounted within the cylindrical body and having an outer diameter which is less than the inner diameter of the cylindrical body. A pressure ring is removably mounted in the body in the annular gap between the inner face of the cylindrical body and the outer diameter of the insulation ring. Finally, a cover plate is provided for mounting above the feed inlet and pressure ring and this cover plate is fastened to the top of the body such as to compress components of the mould system together. This provides a close fit between the components.

An annular oil plate for feeding lubricating oil to the mould is mounted directly above the mould with a connection from the oil plate to an oil inlet in the cylindrical body.

With the modular mould system of this invention, rather than having to replace the entire structure each time a different alloy and/or ingot size is to be produced, only certain of the modular parts need be replaced. Thus, depending on the diameter or alloy of the ingot to be produced, it may be necessary to replace only two or three modular parts, rather than to replace the entire mould structure as is now conventional.

This provides a great saving in the mould inventory required for producing ingots of many different diameters and alloys.

In the drawings which illustrate the invention:

Figure 1 is an exploded view of one embodiment of the invention;

Figure 2 is a cross-sectional view of one embodiment of the assembled mould system;

Figure 3 is a cross-sectional view of a further embodiment of the invention; and

Figure 4 is a cross-sectional view of a still further



embodiment of the invention.

Figure 2 shows a modular mould system designed to cast a 152 mm diameter ingot using a mould having a length of 20 mm. A casting table may contain as many as 96 individual moulds depending upon the diameter of the product to be cast. Supported by casting table bottom plate 10 and top plate 11 is a hollow cylindrical body 12 which is the main support structure for the internal components. This body 12 is snugly held within a hole in table bottom plate 10 by means of an O-ring 32 and held within a hole in top plate 11 by means of O-ring 30. It is fastened to top plate 11 by means of screws 27.

The bottom end of body 12 comprises an inward projection 13 forming on the top edge thereof an annular support shoulder 14. Supported on this shoulder 14 is an annular water baffle 15, preferably fabricated of steel. This water baffle provides water conduits 16 for delivering cooling water from water inlets 17 in body 12 to the inner edge of the baffle. There, the water is sprayed in an inward and downward direction onto a forming ingot emerging from the ingot mould.

Directly above the water inlet and water baffle is the mould proper 18. The inner cylindrical wall 26 of the mould 18 is of the appropriate dimensions to produce the desired circular cross-section ingot with very high surface quality and internal quality. The outer cylindrical wall of mould 18 is designed to fit snugly within body 12, with assistance of O-rings 31. A portion of the water conduit 16 is in the form of a gap between a portion of the bottom face of mould 18 and a portion of the top face of water baffle 15. This gap preferably loops upwardly within the mould to provide cooling of the mould by the water.

An annular oil plate 19 is positioned directly above the mould 18 and this plate has grooves in the bottom

face thereof providing access for lubricating oil to the inner wall 26 of the mould 18. Oil is introduced through inlet 20 in the upper flange 21 of body 12.

5 An annular pressure ring 22, preferably of steel, is mounted snugly within body 12 directly above the oil plate 19. This ring 22 applies pressure to the mould 18 and water baffle 15, holding them firmly together. It includes an O-ring seal 34 above the oil inlet 20 to provide a tight seal between ring 22 and body 12. Extending
10 downwardly below O-ring 34 is an annular gap 35 down through which oil travels to oil plate 19. The bottom face of pressure ring 22 includes a further O-ring 33 to provide a seal between the pressure ring 22 and oil plate 19, thereby assuring that the oil travels only along the
15 top face of mould 18. Adjacent the inner cylindrical wall of pressure ring 22 are mounted insulation rings 23, preferably made of a ceramic insulating material. Finally there is mounted over the entire assembly a cover plate 24 which is bolted to flange 21 of body 12 by means of
20 bolts 25. By tightening the bolts 25, the components of the mould assembly as described above are tightly held in their correct relationship for use. To provide some resilience within the assembly, elastomeric springs 28 are mounted in pockets between cover plate 24 and pressure
25 ring 22. This assures that a uniform pressure is transmitted by pressure ring 22 to the mould 18 and water baffle 15. A further resilience is provided in the assembly by means of a compressible insulating gasket 29, e.g. Fibrefrax, mounted between cover plate 24 and
30 insulating rings 23.

If the assembly is to be changed to cast a larger diameter ingot, e.g. one having a diameter of 178 mm, then parts 15, 18 and 19 are replaced by parts 15a, 18a and 19a, as shown in Figure 3.

35 It can be seen that the water baffle 15a has an

identical outer diameter but a greater inner diameter than water baffle 15. The mould 18a also has an identical outer diameter to mould 18, while having a greater inner diameter than mould 18 of 178 mm. The oil plate 19a also has an identical outer diameter and a greater inner diameter than oil plate 19. It is not necessary to change the pressure ring 22, insulating ring 23 and cover plate 24 when changing production between 152 mm diameter ingots and 178 mm diameter ingots.

When the composition of the alloy is changed, it may be necessary to change the length of the mould even if the diameter is unchanged. Thus, Figure 4 shows a mould assembly in which the mould 18b has the same diameter as mould 18a in Figure 3, but has a greater length of 40 mm. This requires a different water baffle 15b such that the total length of the mould 18b and water baffle 15b remains unchanged. No other change of components is necessary.

It is to be understood that the invention is not limited to the features and embodiments hereinabove specifically set forth, but may be carried out in other ways without departure from its spirit.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. a modular mould system for continuous casting of metal ingots comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table;

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening;

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity being symmetrically in register with and being smaller than the central opening of the water baffle;

(d) a feed inlet for molten metal removably mounted within the body immediately above the mould; and

(e) means for retaining the components of the mould system together,

at least said annular members being selectively replacable with ones of variable inner diameter or length.

2. A modular mould system according to claim 1, wherein said feed inlet for molten metal includes an insulating ring immediately above the mould, said insulating ring having an outer diameter less than the diameter of said cylindrical body.

3. A modular mould system according to claim 2, wherein said means for retaining the components of the mould together comprises a pressure ring removably mounted in the cylindrical body in an annular gap between the cylindrical body and the outer diameter of the insulating ring, and a



cover plate adapted to compress the components of the mould system together.

4. A modular mould system according to claim 3, which includes an annular oil plate positioned immediately above the mould for feeding oil to the mould, said oil plate being connected by a conduit to an oil inlet in the body and being replacable with ones of variable inner diameter.

5. A modular mould system according to claim 3 or 4, wherein at least part of said cooling water flow path comprises a gap between the water baffle and the annular mould.

6. A modular mould system according to any one of claims 3 to 5, wherein elastomeric springs are provided between the pressure ring and the cover plate.

7. A modular mould system according to any one of claims 3 to 6, wherein a compressible insulating gasket is provided between the insulating ring and the cover plate.

8. A modular mould system according to any one of claims 3 to 7, wherein the bottom end of the pressure ring presses against the oil plate and part of the oil conduit comprises said annular gap between the pressure ring and the cylindrical body.

9. A modular mould system according to claim 8, which includes a seal between the pressure ring and the hollow cylindrical body above said annular gap.

10. A method for the production of aluminium ingots by direct chill continuous casting which comprises:



(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,

(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil plate, and

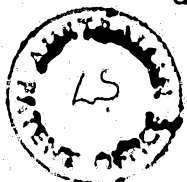
(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and

(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the diameter of the ingot to be produced is changed by changing the annular water baffle, annular mould and oil shim with ones of a different inner diameter.



11. A method for the production of aluminium ingots by direct chill continuous casting which comprises:

(1) forming a modular mould system comprising:

(a) a hollow cylindrical body adapted to be mounted in a casting table,

(b) an annular water baffle removably mounted in said body, said baffle having a central opening through which a forming ingot passes and said baffle providing a flow path for cooling water to flow radially inwardly from the body and discharge inwardly and downwardly against a forming ingot passing through the central opening,

(c) an annular mould removably mounted in the body immediately above the water baffle having a central forming cavity for forming a metal ingot, said forming cavity having a smaller diameter than the central opening of the water baffle,

(d) an annular oil plate mounted on top of the mould,

(e) a feed inlet for molten metal comprising an insulating ring removably mounted within the body immediately above the mould and resting on the oil plate, the outer diameter of said insulation ring being less than the diameter of the body,

(f) a pressure ring removably mounted in the body in an annular gap between the body and the outer diameter of the insulation ring and resting on the oil/^{plate}~~skin~~, and

(g) a cover plate adapted to compress the components of the mould system together;

(2) pouring molten aluminium into the top of the mould system;

(3) forming a continuous ingot in the mould section; and



(4) applying cooling water directly to the surface of the ingot emerging from the mould section,

characterised in that the mould system is modified to cast a molten aluminium alloy of different composition by changing the annular mould with one of a different length and also changing the water baffle whereby the total length of the annular mould and water baffle remain unchanged.

DATED this 17th day of July, 1989.

ALCAN INTERNATIONAL LIMITED

WATERMARK PATENT ATTORNEYS
50 Queen Street
MELBOURNE. VIC. 3000
AUSTRALIA

Disk 0054/1.17

MG



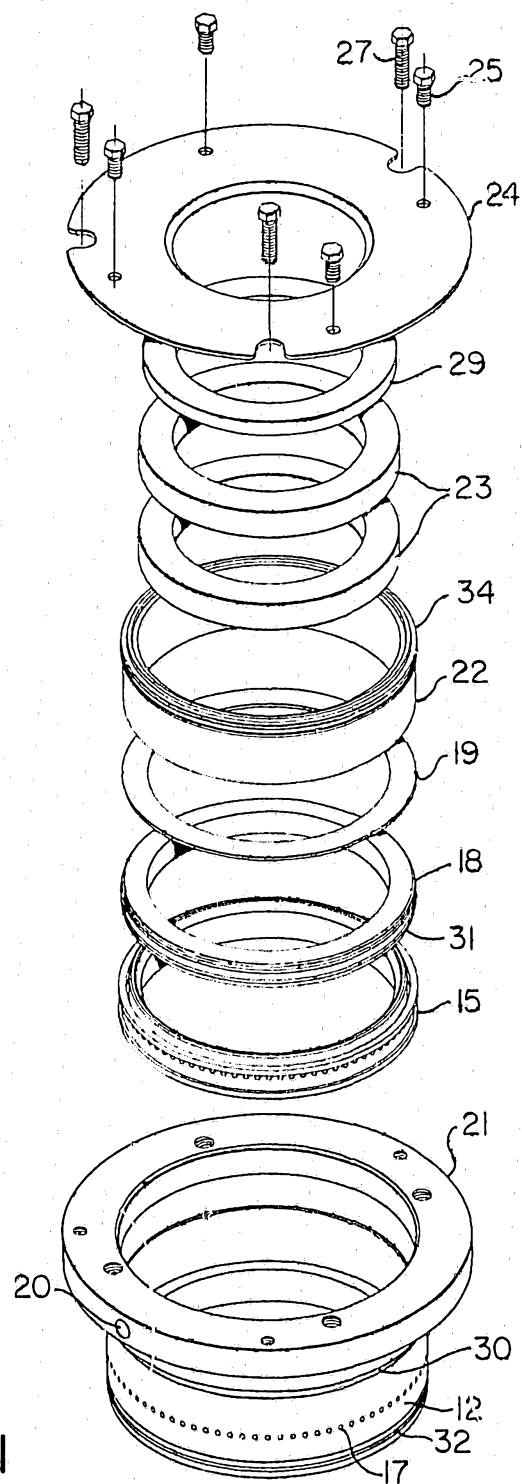


FIG. 1

73387/87

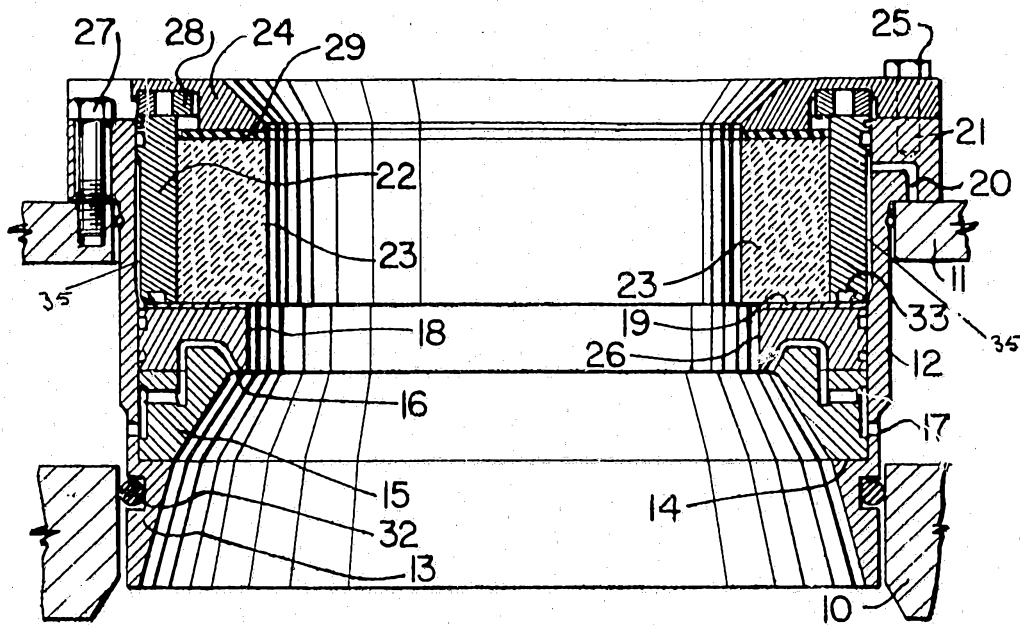


FIG. 2

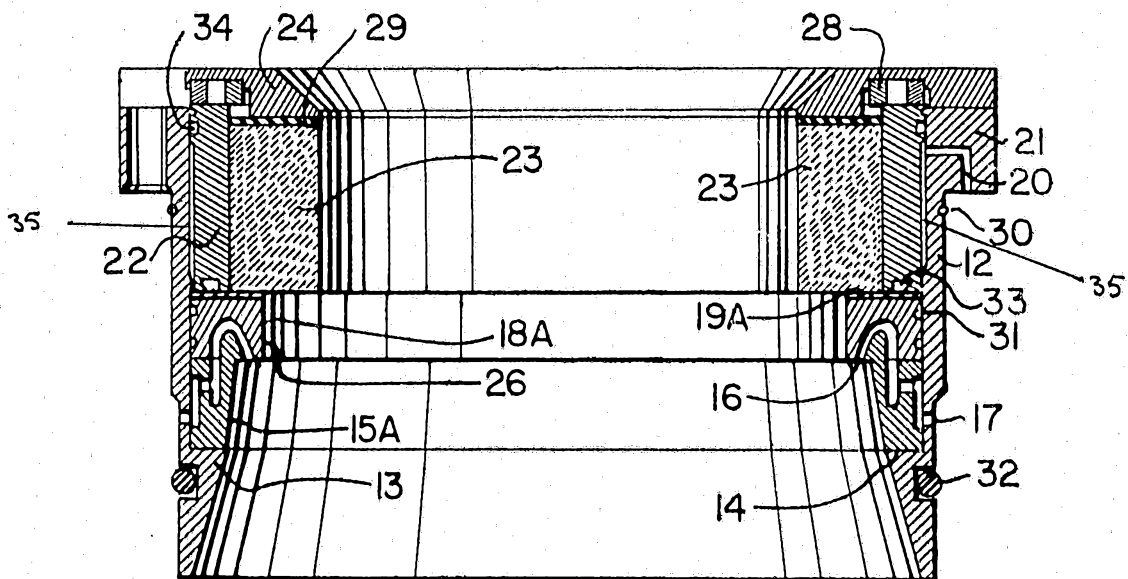


FIG. 3

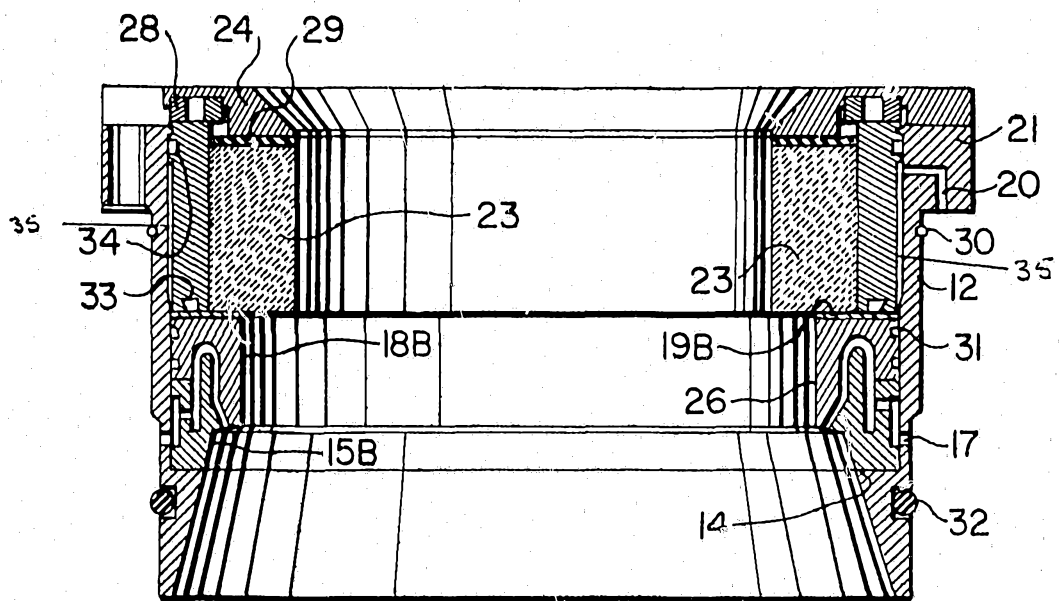


FIG. 4