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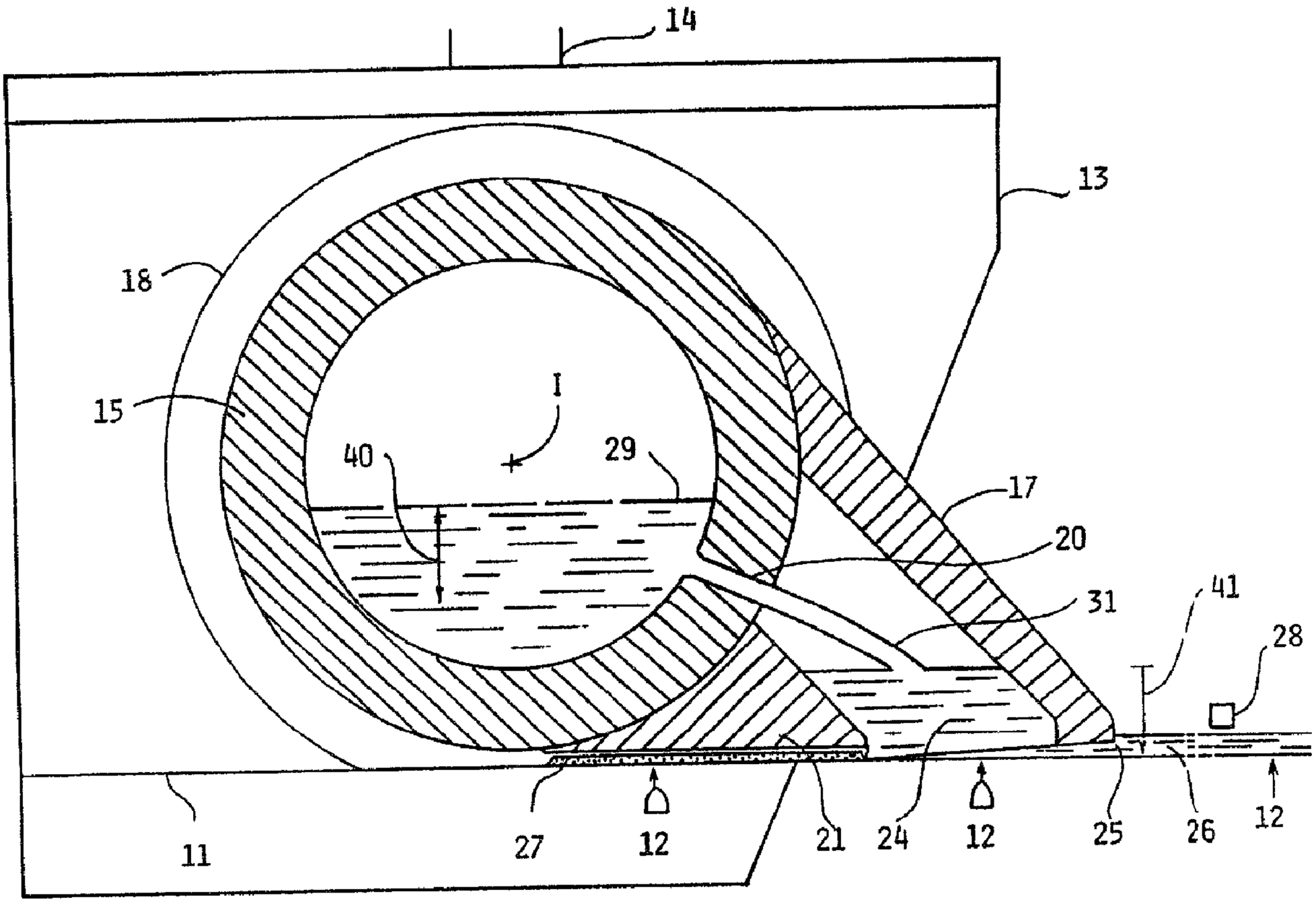
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(54) Titre : METHODE ET MACHINE DE COULEE CONTINUE DE BANDES METALLIQUES
(54) Title: MACHINE AND METHOD OF CONTINUOUSLY CASTING A METAL STRIP



(57) Abrégé/Abstract:
In a continuous casting machine for casting a steel strip, the liquid steel is fed onto a cooled endless belt (11) through a tundish (13) and a tube-formed rotatable distributor (15). The distributor has a row of side outlets (20) from which streams of liquid steel fills a pool (24) of liquid steel against the steel belt (11). The liquid steel flows from the pool through a clearance (25) against the steel belt. A control system operates to maintain the level of liquid steel constant in the distributor and to turn the distributor in response to the actual thickness of the cast steel strip.

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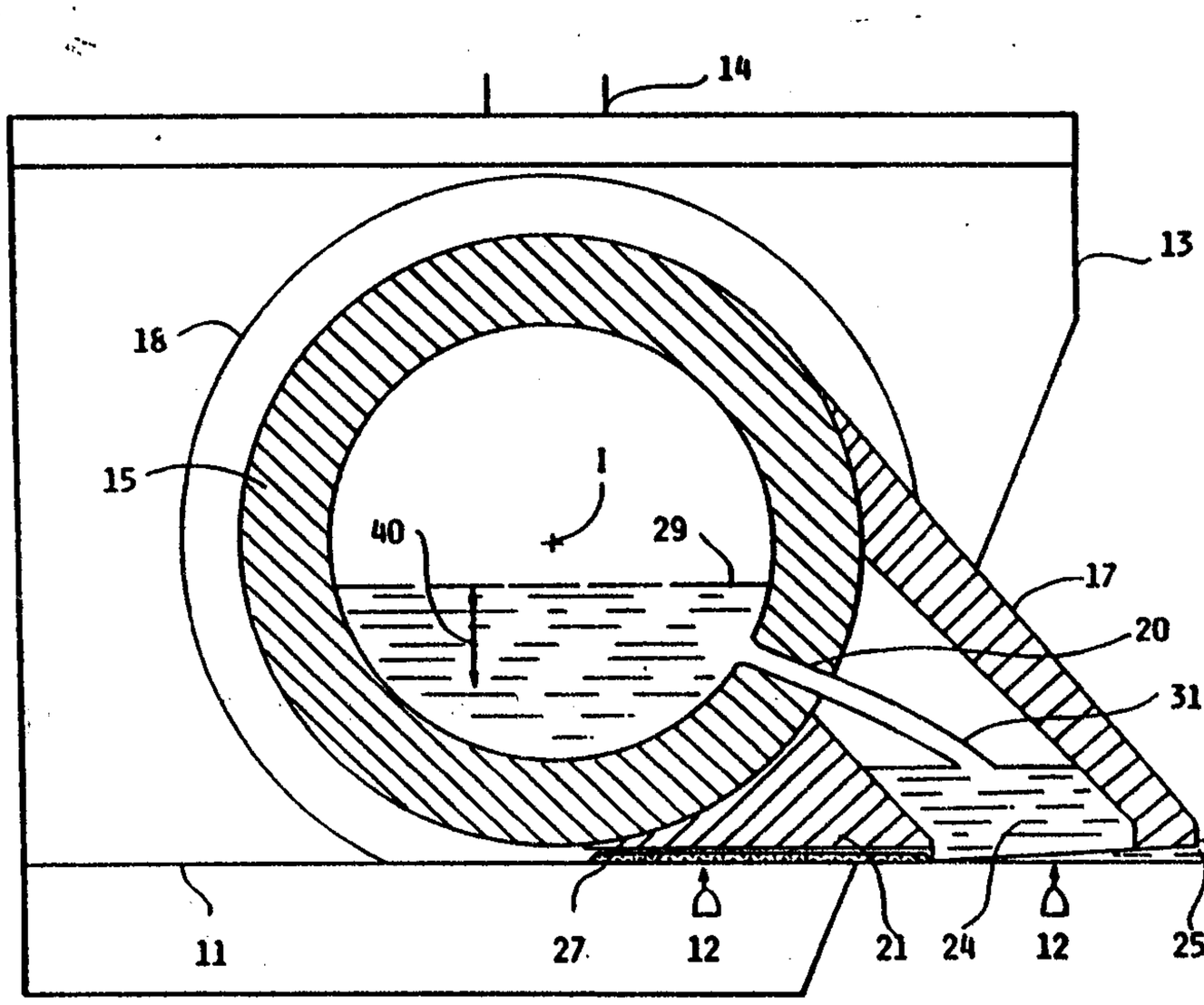
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(54) Title: MACHINE AND METHOD OF CONTINUOUSLY CASTING A METAL STRIP



(57) Abstract

In a continuous casting machine for casting a steel strip, the liquid steel is fed onto a cooled endless belt (11) through a tundish (13) and a tube-formed rotatable distributor (15). The distributor has a row of side outlets (20) from which streams of liquid steel fills a pool (24) of liquid steel against the steel belt (11). The liquid steel flows from the pool through a clearance (25) against the steel belt. A control system operates to maintain the level of liquid steel constant in the distributor and to turn the distributor in response to the actual thickness of the cast steel strip.

MACHINE AND METHOD OF CONTINUOUSLY CASTING A METAL STRIP

This invention relates to a machine for casting metal strips, comprising a cooled and moved substrate, for example an endless belt and a feeding device that comprises a tundish and a distributor for distributing the liquid metal over the substrate. The invention relates also to a method of casting a metal strip by supplying liquid metal to a cooled and moving substrate on which the metal solidifies. Most prior art machines of this kind are made to produce comparatively narrow strips. The wider the strip and the faster the casting, the more difficult the feeding of the liquid metal to the substrate will be because of the larger flow necessary.

The invention provides for an improved feeding of the liquid metal to the substrate and it will permit for a fast casting of the strip also when the strip is wide. The feeding is reliable and its control is fast. The starting of the casting will be fast and reliable.

One aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said pouring means having a vertical axis, a horizontal axis, a longitudinal axis and at least one side; said longitudinal axis of said pouring means being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling; said pouring means comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said at least one side of said pouring means; said outlet means comprising exit means for permitting a stream of molten metal to exit said outlet means at a substantial angle from said horizontal axis and a substantial angle from

said vertical axis; said angle from said vertical axis being substantially larger than said angle from said horizontal axis; means for varying said angle from said vertical axis and said angle from said horizontal axis of the stream of molten metal; means for feeding molten metal to be received by said pouring means; said means for varying comprising one of the following sets of features a) and b): a) coupling means for permitting said pouring means to rotate independently of said feeding means; hydraulic cylinder means for rotating said pouring means; sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip; said sensor means having means for sending a signal to said hydraulic cylinder means to rotate said pouring means based on the sensed thickness of the metal strip; and b) means for attaching said pouring means to said feeding means; means for rotating said pouring means and said feeding means together as a unit; sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip; and said sensor means having means for sending a signal to said rotating means to rotate said pouring means and said feeding means based on the sensed thickness of the metal strip.

Another aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for moving and cooling metal strip disposed in a horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said pouring means having a longitudinal axis and at least one side; said longitudinal axis of said pouring means being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling; said pouring means comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said at least one side of said pouring means; and means for varying the pressure of the molten metal at said outlet means.

A further aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said means for pouring having a longitudinal axis; said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip; said means for pouring comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said pouring means; said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means; means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip; said receiving means being disposed to contact at least a portion of said exit means; said means for receiving comprising: a bottom portion and first and second side portions; said bottom portion having a first side and a second side disposed opposite from one another; said bottom portion being disposed in a direction substantially parallel to said moving and cooling means; said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape; said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm; said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

Yet another aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for

moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said means for pouring having a longitudinal axis; said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip; said means for pouring comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said pouring means; means for receiving and guiding molten metal, having exited from said outlet means, to said means for moving and cooling metal strip; means for covering, said means for covering for covering at least over said outlet means, said means for covering defining a space with respect to said moving and cooling means, said space containing a gaseous medium; said covering means comprising one of the following sets of features a) and b): a) said covering means comprises a portion extending from said pouring means towards said means for moving and cooling metal strip; said portion being disposed at an angle with respect to said means for moving and cooling metal strip; said portion having a first end and a second end; said first end is disposed adjacent said pouring means; said second end is disposed to form a clearance with said means for moving and cooling metal strip; said means for receiving being disposed within said covering means; and b) said covering means comprises a portion surrounding at least said pouring means and said means for receiving and guiding; said portion having a first end and a second end; said first end being disposed adjacent said means for moving and cooling metal strip; said second end being disposed adjacent said means for moving and cooling metal strip, at a predetermined distance from said first end; said receiving means being disposed to contact at least a portion of said outlet means; said means for receiving comprising: a bottom portion and first and second side portions; said bottom portion having a first side and a second side disposed opposite from one another; said bottom portion being disposed

in a direction substantially parallel to said means for moving and cooling metal strip; said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape; said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm; said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

Yet a further aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip, said pouring means being mounted for rotation; said means for pouring having a longitudinal axis; said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip; said means for pouring comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said pouring means; said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means; means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip; means for varying the pressure of the molten metal at said outlet means; said means for varying the pressure comprising: means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means; and said means for varying the hydrostatic height comprises means for rotating said pouring means.

Another yet further aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said means for pouring having a longitudinal axis; said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip; said means for pouring comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said pouring means; said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means; and means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip; said means for receiving comprising: a bottom portion and first and second side portions; said bottom portion having a first side and a second side disposed opposite from one another; said bottom portion being disposed in a direction substantially parallel to said means for moving and cooling metal strip; said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape; said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm; and said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

An additional aspect of the invention resides broadly in a machine for the continuous casting of a metal strip, said machine comprising: means for

moving and cooling metal strip disposed in a substantially horizontal direction; said means for moving and cooling metal strip having a direction of movement; means for pouring molten metal to be received by said means for moving and cooling metal strip; said means for pouring having a longitudinal axis; said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip; means for rotating said means for pouring about said longitudinal axis of said pouring means; said means for pouring comprising: outlet means for permitting the exit of molten metal from said pouring means; said outlet means being disposed on at least a portion of said pouring means; said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means; means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip; said means for receiving comprising: a bottom portion and first and second side portions; said bottom portion having a first side and a second side disposed opposite from one another; said bottom portion is disposed in a direction substantially parallel to said means for moving and cooling metal strip; said first side portion is disposed along said first side of said bottom portion and said second side is disposed along said second side of said bottom portion to form a U shape; said first side portion, said second side portion, and said bottom portion together forming a hollow portion configured for allowing molten metal exiting from said exit means to accumulate in said hollow portion and to calm; said bottom portion further comprises a raised portion disposed adjacent said hollow portion; and means for permitting the molten metal to move onto said means for moving and cooling metal strip.

A still further aspect of the invention resides broadly in a method of continuously casting metal strip, said method comprising the steps of: providing means for feeding molten metal; providing means for pouring; providing outlet means in the pouring means; providing means for moving

and cooling metal strip; attaching the feeding means to the pouring means; feeding molten metal, with the feeding means, to the pouring means; disposing the means for moving and cooling metal strip in a horizontal direction, the means for moving and cooling metal strip having a direction of movement; receiving molten metal from the outlet means with the means for moving and cooling metal strip; moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip; discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means; said method further comprising the steps of: providing means for rotating at least the pouring means; providing an end outlet in one end of the pouring means; rotating the pouring means, with the means for rotating, and moving the outlet means in an upward direction, away from the means for moving and cooling metal strip, to prevent the flow of molten metal from the outlet means, and moving the end outlet in a downward direction, towards the means for moving and cooling metal strip, to allow the flow of molten metal from the end outlet; and preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet of the pouring means.

A further additional aspect of the invention resides broadly in a method of continuously casting metal strip, said method comprising the steps of: providing means for feeding molten metal; providing means for pouring; providing outlet means in the pouring means; providing means for moving and cooling metal strip; providing means for varying the pressure at the outlet means; attaching the feeding means to the pouring means; feeding molten metal, with the feeding means, to the pouring means; discharging molten metal from the outlet means; disposing the means for moving and cooling metal strip in a horizontal direction, the means for moving and cooling metal strip having a direction of movement; receiving molten metal from the outlet means with means for moving and cooling metal strip; moving and cooling metal strip in the direction of movement of the means

for moving and cooling metal strip; and varying the pressure of the molten metal at the outlet means with the means for varying.

Another further additional aspect of the invention resides broadly in a method of continuously casting metal strip, said method comprising the steps of: providing means for feeding molten metal; providing means for pouring; providing outlet means in the pouring means; providing means for moving and cooling metal strip; providing an end outlet in one end of the pouring means; attaching the feeding means to the pouring means; feeding molten metal, with the feeding means, to the pouring means; disposing the means for moving and cooling metal strip in a substantially horizontal direction, the means for moving and cooling metal strip having a direction of movement; disposing the pouring means substantially transversely with respect to the means for moving and cooling metal strip; receiving molten metal from the outlet means with the means for moving and cooling metal strip; moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip; discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means; and preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet of the pouring means.

Yet another further additional aspect of the invention resides broadly in a method of continuously casting metal strip, said method comprising the steps of: providing means for feeding molten metal; providing means for pouring; providing outlet means in the pouring means; providing means for moving and cooling metal strip; attaching the feeding means to the pouring means; feeding molten metal, with the feeding means, to the pouring means; disposing the pouring means substantially transversely with respect to the means for moving and cooling metal strip; disposing the means for moving and cooling metal strip in a substantially horizontal direction, the means for moving and cooling metal strip having a direction

of movement; receiving molten metal from the outlet means with the means for moving and cooling metal strip; moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip; discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means; providing means for rotating at least the pouring means; providing an end outlet in one end of the pouring means; rotating the pouring means, with the means for rotating, and moving the outlet means in an upward direction, away from the means for moving and cooling metal strip, to prevent the flow of molten metal from the outlet means; and preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet in the pouring means.

The invention will be described with reference to the drawings. Figure 1 is a fragmentary and schematic perspective view of a casting machine according to the invention. Figure 2 is an enlarged fragmentary section taken along the line 2-2 in Fig. 1. Figure 3 is a fragmentary end view of a distributor which is modified with respect to a distributor shown in Figures 1 and 2.

In Figures 1 and 2, parts of a strip casting machine is shown which is in accordance with the invention. It has a power driven substrate in the form of a horizontal or substantially horizontal endless steel belt 11, that runs on two rollers that are not shown. The belt need not be completely horizontal, it can be somewhat inclined, in particular, it can be inclined such that it runs somewhat upwardly in the direction of casting. The steel belt 11 is water cooled at its back by means of closely arranged nozzles 12 that spray water on the band 11. Only two of the numerous nozzles 12 are indicated. A feeding device consists of a tundish 13, a supply pipe 14 for supplying liquid-steel to the tundish 13, a tubular distributor 15 with a stopper 16 and a hood 17 supplied with a protective gas, for example an inert gas such as argon. Between the tundish 13 and the distributor 15,

there is a coupling 18 that permits turning of the distributor about the longitudinal axis 1 of the distributor 15. The coupling 18 is made of the same material as conventional sliding gate valves of ladles. A turning device in the form of a hydraulic cylinder 19 is arranged to turn the distributor relative to the tundish 13.

Figure 2 is an enlarged transverse section taken along line 2-2 in Figure 1 and it shows the steel belt 11, the distributor tube 15, the hood 17 and the tundish 13. The ceramic distributor tube 15 has a side outlet 20 that extends over the entire width of the steel belt 11. The side outlet 20 consists of a large number of discrete openings, but it could also be a single slot. The flow velocity in the longitudinal direction of the distributor tube 15 should not be too high since it could then disturb the flow through the outlet.

The distance between the openings 20 and/or the diameter of the holes can be adapted to give an evenly distributed outlet flow along the distributor tube 15, that is along the width of the steel belt 11. The interior cross sectional area of the distributor pipe 15 should be 3 times, preferably 5 times, as great as the total area of the outlet holes 20. The openings 20 could preferably be conically narrower towards their outlet end in order to provide for a more stable stream.

The distributor tube 15 is journaled against the ceramic hood 17 and against a fixed ceramic sealing element 21. A pool 24 of liquid steel is formed between the ceramic hood 17 and the ceramic sealing element 21. The liquid steel flows through the protective argon gas into the pool 24. The hood 17 has a clearance 25 to the steel belt 11 through which the liquid steel flows and forms a thin layer 26 on the belt 11. Since the underside of the endless steel belt is heavily cooled, the solidification begins already in the pool 24. A lubricant, that can be a conventional casting powder with low melting point, is supplied behind the sealing element 21 and fills the clearance between the sealing element 21 and

the steel belt 11 in order to prevent air from being sucked through the clearance. The thickness of the clearance and the casting powder is exaggerated in the Figure and have been given the common reference 27.

The casting machine is only schematically shown and necessary edges along the sides of the steel belt 11 are not shown. They may be in the form of chains, wires or ropes that moves with the steel belt.

The thickness of the cast strip 26 is monitored by a sensor 28, the output signal of which controls, via an automatic control equipment, the hydraulic cylinder 19 that turns the distributor 15. The level 29 of the liquid steel in the distributor and in the tundish is the same and it is maintained constant by means of a conventional level control equipment and the tolerance is conventionally one or a few millimeters.

The hydrostatic height 40 that drives the flow out of the outlets 20 of the distributor centre is varied by the turning of the distributor 15, and a change of this flow will change the height of the pool 24 which is the hydrostatic height 40 that drives the flow out of the clearance 25 between the hood 17 and the steel belt 11.

Thus, simply by automatically controlling the turning of the distributor 15 in response to the actual thickness of the cast steel strip 26 one can control the thickness of the cast steel strip 26 provided that the other parameters such as the level in the tundish 13, the width of the clearance 25, and the velocity of the steel belt 11 are maintained constant. The height of the pool 24 can for example be 40-60 mm and the height of the clearance 25 can be 5-7 mm.

The described feeding device is simple and its cost of investment is low. Since the consumable parts are small, the operation cost will also be low. The automatic control during operation will be rapidly responding, accurate and reliable, and it will be so also when the production is high.

Before starting the casting, the operator preheats the tundish 14 and the distributor 15 with a burner. The stopper 16 is then removed as shown in Figure 1. By having liquid steel flowing through the distributor to a vessel 30, the operator carries out the final preheating of the distributor. During the preheating the distributor is turned so that its outlet 20 is directed upwardly, that is, it is above the level of the flowing liquid steel in the distributor 15. When the distributor 15 has been preheated, its open end is closed by the stopper 16 and when the distributor is then turned so that its outlet 20 is below the level of the liquid steel in the distributor, the casting starts. The starting is fast and a steady state is reached very quickly.

In the embodiment described above with reference to Figures 1 and 2, the tundish 13, the hood 17 and the sealing element 21 are fixed and only the distributor 15 is turnable. In Figure 3, a modified embodiment is shown in a view seen from the end of the distributor 15. There is no stopper 16, but there is a fixed end wall 50 of the distributor 15. The end wall 50 has an opening 51. The interior wall 52 of the ceramic lining of the tundish 13 is semi circular in cross section and its axis is common to the axis of the tubular distributor 15 which is also circular in cross section. The walls 53 of the upper part of the tundish are parallel. The interior wall of the tubular ceramic lining of the distributor 15 has been given reference 54. There is no coupling 18, but the tundish 13 and the distributor 15 are fixed together and are turnable as a unit. For the final preheating of the distributor 15, the distributor 15 and tundish 13 are turned so that the liquid steel will pass through the opening 51, while the side openings 20 will be above the level of the liquid steel in the distributor. Then, when the distributor 15 and tundish 13 are turned so that the opening 51 will be above the level of liquid steel and the row of side openings 20 will be below the level of liquid steel, the continuous casting will begin. Since the bottom of the tundish is semi circular, the level of liquid steel will not change because of the turning. The wide opening of the tundish 13 permits for about 45°. turning even though the pipe 14 is fixed. Such an angle of turning will

suffice both for the preheating and for the control during casting since the level of liquid steel can be maintained at or below the center of the distributor 15. In Figure 3, a fitting 55 is shown on the distributor 15 for a laser sensor for sensing the level of the liquid steel directly in the distributor 15. The laser sensor is part of a conventioned level control equipment for maintaining the level constant in the tundish 13 and distributor 15.

The outlets 20 are shown radially directed in Figure 2 but are shown somewhat upwardly directed with respect to a radius in Figure 2. The upward direction is advantageous since it makes it possible to have a lower hydraulic height that drives the outlet flow through the outlets 20.

The casting machine described is primarily intended for casting a steel strip with a width of up to 2 m and a thickness of up to 10 mm. It can, however, be designed for other methods and other strip sizes.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said pouring means having a vertical axis, a horizontal axis, a longitudinal axis and at least one side;

said longitudinal axis of said pouring means being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling;

said pouring means comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said at least one side of said pouring means;

said outlet means comprising exit means for permitting a stream of molten metal to exit said outlet means at a substantial angle from said horizontal axis and a substantial angle from said vertical axis;

said angle from said vertical axis being substantially larger than said angle from said horizontal axis;

means for varying said angle from said vertical axis and said angle from said horizontal axis of the stream of molten metal;

means for feeding molten metal to be received by said pouring means;

said means for varying comprising one of the following sets of features a) and b):

a) coupling means for permitting said pouring means to rotate independently of said feeding means;

hydraulic cylinder means for rotating said pouring means;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip;

said sensor means having means for sending a signal to said hydraulic cylinder means to rotate said pouring means based on the sensed thickness of the metal strip; and

b) means for attaching said pouring means to said feeding means;

means for rotating said pouring means and said feeding means together as a unit;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip; and

said sensor means having means for sending a signal to said rotating means to rotate said pouring means and said feeding means based on the sensed thickness of the metal strip.

2. The machine according to claim 1 wherein:

said pouring means has an interior surface and an exterior surface;

said pouring means has a first point and a second point;

said second point is disposed on said longitudinal axis;

said first point is disposed away from said second point;

said first point is disposed between said second point and said interior surface;

said exit means extends radially from said interior surface to said exterior surface in a direction substantially in alignment with said first point;

said angle from said vertical axis is about 70° with respect to said vertical axis;

said means for varying further comprises means for varying the pressure of the molten metal at said outlet means;

said means for varying the pressure comprises means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means;

said exit means comprises means for pouring the stream of molten metal into a gaseous medium which is in the environs of said outlet means;

said machine further comprises:

means for receiving and guiding the stream of molten metal, having exited into the gaseous medium, from said exit means to said means for moving and cooling metal strip;

said receiving means comprises one of the following sets of features c) and d):

c) said means for receiving comprises a first wall portion and a second wall portion disposed a distance from one another, the stream of molten metal forming a pool between said first wall portion and said second wall portion, said pool having a height;

said first wall portion is disposed between said pouring means and said means for moving and cooling metal strip, said first wall portion and said second wall portion forming a clearance with said means for moving and cooling metal strip, said clearance having a height extending from said means for moving and cooling metal strip to said first wall portion; and

said first wall portion and said second wall portion are configured such that said height of said pool is at least two times as great as said height of said clearance; and

d) said receiving means is disposed to contact at least a portion of said exit means;

said means for receiving comprises:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion is disposed in a direction substantially

parallel to said moving and cooling means;

said first side portion is disposed along said first side of said bottom portion and said second side is disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprises an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm;

said bottom portion further comprises a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip;

said machine further comprising:

means for covering, said means for covering for covering at least over said outlet means, said means for covering defining a space with respect to said moving and cooling means, said space containing a gaseous medium;

said covering means comprises one of the following sets of features e) and f):

e) said covering means comprises a portion extending from said pouring means towards said means for moving and cooling metal strip;

said portion being disposed at an angle with respect to said means for moving and cooling metal strip;

said portion having a first end and a second end;

said first end is disposed adjacent said pouring means;

said second end is disposed to form a clearance with said means for moving and cooling metal strip;

said means for receiving being disposed within said covering means; and

f) said covering means comprises a portion surrounding at least said pouring means and said means for receiving and guiding;

said portion having a first end and a second end;

said first end is disposed adjacent said means for moving and cooling metal strip; and

said second end is disposed adjacent said means for moving and cooling metal strip, at a predetermined distance from said first end;

said means for varying further comprises means for sensing and for controlling the level of molten metal in said pouring means based on the sensed level of molten metal in said pouring means;

said pouring means further comprises a substantially tubular shape;

said pouring means is disposed in a direction substantially perpendicular to said direction of movement;

said pouring means further comprises one of the following sets of features g) and h);

g) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially away from said first end;

said second end comprising orifice means for permitting molten metal to exit said pouring means substantially only during preheating of said pouring means;

stopper means for being inserted into said orifice means after the preheating of said pouring means; and

h) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially from said first end;

said second end comprising an end wall portion;

said end wall portion being configured to prevent the flow of molten metal from said pouring means during casting;

said end wall portion comprising orifice means for permitting the exit of molten metal from said pouring means substantially only during preheating of said pouring means;

said machine further comprising:

means for controlling the velocity of said moving and cooling means;

pipe means for supplying molten metal to said feeding means;

said means for moving and cooling comprises a plurality of nozzles disposed along said means for moving and cooling metal strip;

said plurality of nozzles are configured for spraying a cooling substance towards the metal strip moving along said means for moving and cooling metal strip;

said exit means comprises a plurality of outlet holes;

said outlet means comprises a total area; and

said pouring means has an interior area and said interior area of said pouring means is one of:

at least three times; and

at least five times

greater than said total area of said outlet means.

3. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said pouring means having a longitudinal axis and at least one side;

said longitudinal axis of said pouring means being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling;

said pouring means comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said at least one side of said pouring means; and

means for varying the pressure of the molten metal at said outlet means.

4. The machine according to claim 3 wherein said means for varying the pressure comprises means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means.

5. The machine according to claim 4 wherein:

said pouring means is mounted for rotation; and

said means for varying the hydrostatic height comprises means for rotating said pouring means.

6. The machine according to claim 5 wherein:

said machine further comprises means for feeding molten metal to be received by said pouring means;

said means for rotating comprises one of the following sets of features a) and b):

a) coupling means for permitting said pouring means to rotate independently of said feeding means;

hydraulic cylinder means for rotating said pouring means;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip;

said sensor means having means for sending a signal to said hydraulic cylinder means to rotate said pouring means based on the sensed thickness of the metal strip; and

b) means for attaching said pouring means to said feeding means;

means for rotating said pouring means and said feeding means together as a unit;

sensor means for sensing the thickness of the metal strip moving

along said means for moving and cooling metal strip; and

said sensor means having means for sending a signal to said rotating means to rotate said pouring means and said feeding means based on the sensed thickness of the metal strip.

7. The machine according to claim 6 wherein:

said pouring means has a vertical axis and a horizontal axis;

said outlet means comprises exit means for permitting a stream of molten metal to exit said outlet means at a substantial angle from said horizontal axis and a substantial angle from said vertical axis;

said angle from said vertical axis is substantially larger than said angle from said horizontal axis;

said means for varying the hydrostatic height further comprises means for varying said angle from said vertical axis and said angle from said horizontal axis of the stream of molten metal;

said angle from said vertical axis is about 70°;

said pouring means has an interior surface and an exterior surface;

said pouring means has a first point and a second point;

said second point is disposed on said longitudinal axis;

said first point is disposed away from said second point;

said first point is disposed between said second point and said interior surface;

said exit means extends radially from said interior surface to said exterior surface in a direction substantially in alignment with said first point;

said exit means comprises means for pouring the stream of molten metal into a gaseous medium which is in the environs of said outlet means;

said machine further comprises:

means for receiving and guiding the stream of molten metal, having exited into the gaseous medium, from said exit means, to said means for moving and cooling metal strip;

said receiving means comprises one of the following sets of

features c) and d):

c) said means for receiving comprises a first wall portion and a second wall portion disposed a distance from one another, the stream of molten metal forming a pool between said first wall portion and said second wall portion, said pool having a height;

said first wall portion is disposed between said pouring means and said means for moving and cooling metal strip, said first wall portion and said second wall portion forming a clearance with said means for moving and cooling metal strip, said clearance having a height extending from said means for moving and cooling metal strip to said first wall portion; and

said first wall portion and said second wall portion are configured such that said height of said pool is at least two times as great as said height of said clearance; and

d) said receiving means is disposed to contact at least a portion of said exit means;

said means for receiving comprises:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion is disposed in a direction substantially parallel to said means for moving and cooling metal strip;

said first side portion is disposed along said first side of said bottom portion and said second side is disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprises an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm; and

said bottom portion further comprises a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip;

said machine further comprising:

means for covering, said means for covering for covering at least over said outlet means said means for covering defining a space with respect to said moving and cooling means, said space containing a gaseous medium;

said covering means comprises one of the following sets of features e) and f):

e) said covering means comprises a portion extending from said pouring means towards said means for moving and cooling metal strip;

said portion being disposed at an angle with respect to said means for moving and cooling metal strip;

said portion having a first end and a second end;

said first end is disposed adjacent said pouring means;

said second end is disposed to form a clearance with said means for moving and cooling metal strip;

said means for receiving being disposed within said covering means; and

f) said covering means comprises a portion surrounding at least said pouring means and said means for receiving and guiding;

said portion having a first end and a second end;

said first end is disposed adjacent said means for moving and cooling metal strip;

said second end is disposed adjacent said means for moving and cooling metal strip, at a predetermined distance from said first end;

said means for varying further comprises means for sensing and for controlling the level of molten metal in said pouring means based on the sensed level of molten metal in said pouring means;

said pouring means further comprises a substantially tubular shape;

said pouring means is disposed in a direction substantially perpendicular to said direction of movement;

said pouring means further comprises one of the following sets of features g) and h);

g) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially away from said first end;

said second end comprising orifice means for permitting molten metal to exit said pouring means substantially only during preheating of said pouring means;

stopper means for being inserted into said orifice means after the preheating of said pouring means; and

h) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially away from said first end;

said second end comprising an end wall portion;

said end wall portion being configured to prevent the flow of molten metal from said pouring means during casting;

said end wall portion comprising orifice means for permitting the exit of molten metal from said pouring means substantially only during preheating of said pouring means;

said machine further comprising:

means for controlling the velocity of said moving and cooling means;

pipe means for supplying molten metal to said feeding means;

said means for moving and cooling metal strip comprises a plurality of nozzles disposed along said means for moving and cooling metal strip;

said plurality of nozzles are configured for spraying a cooling substance towards the metal strip moving along said means for moving and cooling metal strip;

said exit means comprises a plurality of outlet holes;

said outlet means comprises a total area; and

said pouring means has an interior area, said interior area of said pouring means is one of: at least three times; and at least five times; greater than said total area of said outlet means.

8. The machine according to claim 5 wherein:

said machine further comprises means for feeding molten metal to be received by said pouring means;

said means for rotating comprises:

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip; and

said sensor means having means for sending a signal to said rotating means to rotate said pouring means and said feeding means based on the sensed thickness of the metal strip.

9. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said means for pouring having a longitudinal axis;

said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip;

said means for pouring comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said pouring means;

said outlet means comprising exit means for pouring a

stream of molten metal into a gaseous medium which is in the environs of said outlet means;

means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip;

said receiving means being disposed to contact at least a portion of said exit means;

said means for receiving comprising:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion being disposed in a direction substantially parallel to said moving and cooling means;

said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm;

said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

10. The machine according to claim 9 wherein:

said pouring means has a vertical axis, a horizontal axis, and at least one side;

said outlet means is disposed on at least a portion of said at least one side of said pouring means;

said exit means comprises means for permitting the stream of molten metal to exit said outlet means at a substantial angle from said horizontal axis and a substantial angle from said vertical axis, said angle from said vertical axis being substantially larger than said angle from said

horizontal axis;

said machine further comprises means for varying said angle from said vertical axis and said angle from said horizontal axis of the stream of molten metal;

said machine further comprises means for feeding molten metal to be received by said pouring means;

said means for varying comprises one of the following sets of features a) and b):

a) coupling means for permitting said pouring means to rotate independently of said feeding means;

hydraulic cylinder means for rotating said pouring means;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip;

said sensor means having means for sending a signal to said hydraulic cylinder means to rotate said pouring means based on the sensed thickness of metal strip; and

b) means for attaching said pouring means to said feeding means;

means for rotating said pouring means and said feeding means together as a unit;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip; and

said sensor means having means for sending a signal to said rotating means to rotate said pouring means and said feeding means based on the sensed thickness of the metal strip;

said pouring means has an interior surface and an exterior surface;

said pouring means has a first point and a second point;

said second point is disposed on said longitudinal axis;

said first point is disposed away from said second point;

said first point is disposed between said second point and said interior surface;

said exit means extends radially from said interior surface to said exterior surface in a direction substantially in alignment with said first

point;

said angle from said vertical axis is about 70°;

said means for varying further comprises means for varying the pressure of the molten metal at said outlet means;

said means for varying the pressure comprises means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means;

said machine further comprises:

means for covering, said means for covering for covering at least over said outlet means, said means for covering defining a space with respect to said moving and cooling means, said space containing a gaseous medium;

said covering means comprises one of the following sets of features c) and d):

c) said covering means comprises a portion extending from said pouring means towards said means for moving and cooling metal strip;

said portion being disposed at an angle with respect to said means for moving and cooling metal strip;

said portion having a first end and a second end;

said first end is disposed adjacent said pouring means;

said second end is disposed to form a clearance with said means for moving and cooling metal strip;

said means for receiving being disposed within said covering means; and

d) said covering means comprises a portion surrounding at least said pouring means and said means for receiving and guiding;

said portion having a first end and a second end;

said first end is disposed adjacent said means for moving and cooling metal strip;

said second end is disposed adjacent said means for moving and cooling metal strip, at a predetermined distance from

said first end;

said means for varying further comprises means for sensing and for controlling the level of molten metal in said pouring means based on the sensed level of molten metal in said pouring means;

said pouring means further comprises a substantially tubular shape;

said pouring means is disposed in a direction substantially perpendicular to said direction of movement;

said pouring means further comprises one of the following sets of features e) and f);

e) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially from said first end;

said second end comprising orifice means for permitting molten metal to exit said pouring means substantially only during preheating of said pouring means;

stopper means for being inserted into said orifice means after the preheating of said pouring means; and

f) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially from said first end;

said second end comprising an end wall portion;

said end wall portion being configured to prevent the flow of molten metal from said pouring means during casting;

said end wall portion comprising orifice means for permitting the exit of molten metal from said pouring means substantially only during preheating of said pouring means;

said machine further comprising:

means for controlling the velocity of said moving and cooling means;

pipe means for supplying molten metal to said feeding means;

said means for moving and cooling metal strip comprises a

plurality of nozzles disposed along said means for moving and cooling metal strip;

said plurality of nozzles are configured for spraying a cooling substance towards the metal strip moving along said means for moving and cooling metal strip;

said exit means comprises a plurality of outlet holes;

said outlet means comprises a total area; and

said pouring means has an interior area, said interior area of said pouring means is one of: at least three times; and at least five times; greater than said total area of said outlet means.

11. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said means for pouring having a longitudinal axis;

said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip;

said means for pouring comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said pouring means;

means for receiving and guiding molten metal, having exited from said outlet means, to said means for moving and cooling metal strip;

means for covering, said means for covering for covering at least over said outlet means, said means for covering defining a space with respect to said moving and cooling means, said space containing a

gaseous medium;

said covering means comprising one of the following sets of features a) and b):

a) said covering means comprises a portion extending from said pouring means towards said means for moving and cooling metal strip;

said portion being disposed at an angle with respect to said means for moving and cooling metal strip;

said portion having a first end and a second end;

said first end is disposed adjacent said pouring means;

said second end is disposed to form a clearance with said means for moving and cooling metal strip;

said means for receiving being disposed within said covering means; and

b) said covering means comprises a portion surrounding at least said pouring means and said means for receiving and guiding;

said portion having a first end and a second end;

said first end being disposed adjacent said means for moving and cooling metal strip;

said second end being disposed adjacent said means for moving and cooling metal strip, at a predetermined distance from said first end;

said receiving means being disposed to contact at least a portion of said outlet means;

said means for receiving comprising:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion being disposed in a direction substantially parallel to said means for moving and cooling metal strip;

said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm;

said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

12. The machine according to claim 11 wherein:

said pouring means has a vertical axis and a horizontal axis and at least one side;

said outlet means is disposed on at least a portion of said at least one side of said pouring means;

said outlet means comprises exit means for permitting a stream of molten metal to exit said outlet means at a substantial angle from said vertical axis and a substantial angle from said horizontal axis, said angle from said vertical axis being substantially larger than said angle from said horizontal axis;

said machine further comprises means for feeding molten metal to be received by said pouring means;

said means for varying comprises one of the following sets of features c) and d):

c) coupling means for permitting said pouring means to rotate independently of said feeding means;

hydraulic cylinder means for rotating said pouring means;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip;

said sensor means having means for sending a signal to said hydraulic cylinder means to rotate said pouring means based on the sensed thickness of the metal strip; and

d) means for attaching said pouring means to said feeding means;

means for rotating said pouring means and said feeding means together as a unit;

sensor means for sensing the thickness of the metal strip moving along said means for moving and cooling metal strip;

said sensor means having means for sending a signal to said means for rotating to rotate said pouring means and said feeding means based on sensed thickness of the metal strip;

said pouring means having an interior surface and an exterior surface;

said pouring means having a first point and a second point;

said second point is disposed on said longitudinal axis;

said first point is disposed away from said second point;

said first point is disposed between said second point and said interior surface;

said exit means extends radially from said interior surface to said exterior surface in a direction substantially in alignment with said first point;

said angle from said vertical axis is about 70° with respect to said vertical axis;

said means for varying further comprises means for varying the pressure of the molten metal at said outlet means;

said means for varying the pressure comprises means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means;

said exit means comprises means for pouring the stream of molten metal into a gaseous medium which is in the environs of said outlet means;

said machine further comprises:

means for receiving and guiding the stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip;

said receiving means comprises one of the following sets of features e) and f):

e) said means for receiving comprises a first wall portion and a second wall portion disposed a distance from one another, the stream of molten metal forming a pool between said first wall portion and said second wall portion, said pool having a height;

said first wall portion is disposed between said pouring means and said means for moving and cooling metal strip, said first wall portion and said second wall portion forming a clearance with said means for moving and cooling metal strip, said clearance having a height extending from said means for moving and cooling metal strip to said first wall portion; and

said first wall portion and said second wall portion are configured such that said height of said pool is at least two times as great as said height of said clearance; and

f) said receiving means is disposed to contact at least a portion of said exit means;

said means for receiving comprises:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second disposed opposite from one another;

said bottom portion is disposed in a direction substantially parallel to said means for moving and cooling metal strip;

said first side portion is disposed along said first side of said bottom portion and said second side is disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprises an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm;

said bottom portion further comprises a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip;

said means for varying further comprises means for sensing and for controlling the level of molten metal in said pouring means based on the sensed level of molten metal in said pouring means;

said pouring means further comprises a substantially tubular shape;

said pouring means is disposed in a direction substantially perpendicular to said direction of movement;

said pouring means further comprises one of the following sets of features g) and h);

g) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially from said first end;

said second end comprising orifice means for permitting molten metal to exit said pouring means substantially only during preheating of said pouring means;

stopper means for being inserted into said orifice means after the preheating of said pouring means; and

h) a first end and a second end;

said first end being disposed adjacent said feeding means;

said second end being disposed axially from said first end;

said second end comprising an end wall portion;

said end wall portion being configured to prevent the flow of molten metal from said pouring means during casting;

said end wall portion comprising orifice means for permitting the exit of molten metal from said pouring means substantially only during preheating of said pouring means;

said machine further comprising:

means for controlling the velocity of said means for moving and cooling metal strip;

pipe means for supplying molten metal to said feeding means;

said means for moving and cooling metal strip comprises a plurality of nozzles disposed along said means for moving and cooling metal strip;

said plurality of nozzles are configured for spraying a cooling substance towards the metal strip moving along said means for moving and cooling metal strip;

said exit means comprises a plurality of outlet holes;

said outlet means comprises a total area; and

said pouring means has an interior area, said interior area of said pouring means is one of: at least three times; and at least five times; greater than said total area of said outlet means.

13. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip, said pouring means being mounted for rotation;

said means for pouring having a longitudinal axis;

said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip;

said means for pouring comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said pouring means;

said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means;

means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip;

means for varying the pressure of the molten metal at said outlet means;

said means for varying the pressure comprising:

means for varying the hydrostatic height of the molten metal to vary the pressure of the molten metal at said outlet means; and

said means for varying the hydrostatic height comprises means for rotating said pouring means.

14. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said means for pouring having a longitudinal axis;

said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip;

said means for pouring comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said pouring means;

said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means; and

means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip;

said means for receiving comprising:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion being disposed in a direction substantially parallel to said means for moving and cooling metal strip;

said first side portion being disposed along said first side of said bottom portion and said second side being disposed along said second side of said bottom portion to form a U shape;

said bottom portion comprising an indented portion configured for allowing molten metal exiting from said exit means to accumulate in said indented portion and to calm; and

said bottom portion further comprising a raised portion disposed adjacent said indented portion, said raised portion being configured for permitting the molten metal to move onto said means for moving and cooling metal strip.

15. A machine for the continuous casting of a metal strip, said machine comprising:

means for moving and cooling metal strip disposed in a substantially horizontal direction;

said means for moving and cooling metal strip having a direction of movement;

means for pouring molten metal to be received by said means for moving and cooling metal strip;

said means for pouring having a longitudinal axis;

said longitudinal axis of said means for pouring being disposed in a direction to form an angle with said direction of movement of said means for moving and cooling metal strip;

means for rotating said means for pouring about said longitudinal axis of said pouring means;

said means for pouring comprising:

outlet means for permitting the exit of molten metal from said pouring means;

said outlet means being disposed on at least a portion of said pouring means;

said outlet means comprising exit means for pouring a stream of molten metal into a gaseous medium which is in the environs of said outlet means;

means for receiving and guiding a stream of molten metal, having exited into the gaseous medium from said exit means, to said means for moving and cooling metal strip.;

said means for receiving comprising:

a bottom portion and first and second side portions;

said bottom portion having a first side and a second side disposed opposite from one another;

said bottom portion is disposed in a direction substantially parallel to said means for moving and cooling metal strip;

said first side portion is disposed along said first side of said bottom portion and said second side is disposed along said second side of said bottom portion to form a U shape;

said first side portion, said second side portion, and said bottom portion together forming a hollow portion configured for allowing molten metal exiting from said exit means to accumulate in said hollow portion and to calm;

said bottom portion further comprises a raised portion disposed adjacent said hollow portion; and

means for permitting the molten metal to move onto said means for moving and cooling metal strip.

16. A method of continuously casting metal strip, said method comprising the steps of:

providing means for feeding molten metal;

providing means for pouring;

providing outlet means in the pouring means;

providing means for moving and cooling metal strip;

attaching the feeding means to the pouring means;

feeding molten metal, with the feeding means, to the pouring means;

disposing the means for moving and cooling metal strip in a horizontal direction, the means for moving and cooling metal strip having a direction of movement;

receiving molten metal from the outlet means with the means for moving and cooling metal strip;

moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip;

discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means;

said method further comprising the steps of:

providing means for rotating at least the pouring means;

providing an end outlet in one end of the pouring means;

rotating the pouring means, with the means for rotating, and moving the outlet means in an upward direction, away from the means for moving and cooling metal strip, to prevent the flow of molten metal from the outlet means, and moving the end outlet in a downward direction, towards the means for moving and cooling metal strip, to allow the flow of molten metal from the end outlet; and

preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet of the pouring means.

17. The method according to claim 16 further comprising the steps of:

providing means for controlling the level of molten metal in the pouring means; and

controlling the level of molten metal in the pouring means with the means for controlling.

18. The method according to claim 17 wherein said step of controlling the level of molten metal in the pouring means further comprises maintaining the level of molten metal in the pouring means so that the pouring means is only partially filled with molten metal during casting.

19. The method according to claim 18, said method further comprising the step of:

beginning casting, and ending said step of preheating, by rotating the pouring means, with the rotating means, and moving the outlet means in a downward direction towards the means for moving and cooling metal strip so that the outlet means is below the level of molten metal in the pouring means, and so that the end outlet is above the level of molten metal in the pouring means.

20. The method according to claim 19, said method further comprising the steps of:

adjusting the quality of the metal strip by performing one of the following steps a), b) and c):

a) providing means for adjusting the velocity of the means for moving and cooling metal strip;

adjusting the velocity of the means for moving and cooling metal strip with the means for adjusting;

b) adjusting the level of molten metal in the pouring means with the means for controlling; and

c) rotating the pouring means with the rotating means.

21. A method of continuously casting metal strip, said method comprising the steps of:

providing means for feeding molten metal;

providing means for pouring;

providing outlet means in the pouring means;

providing means for moving and cooling metal strip;

providing means for varying the pressure at the outlet means;

attaching the feeding means to the pouring means;

feeding molten metal, with the feeding means, to the pouring means;

discharging molten metal from the outlet means;

disposing the means for moving and cooling metal strip in a horizontal direction, the means for moving and cooling metal strip having a direction of movement;

receiving molten metal from the outlet means with means for moving and cooling metal strip;

moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip; and

varying the pressure of the molten metal at the outlet means with the means for varying.

22. The method according to claim 21 further comprising the steps of:

providing means for rotating at least the pouring means;

providing an end outlet in one end of the pouring means;

rotating the pouring means, with the means for rotating, and moving the outlet means in an upward direction, away from the means for moving and cooling metal strip, to prevent the flow of molten metal from the outlet means, and moving the end outlet in a downward direction, towards the means for moving and cooling metal strip, to allow the flow of molten metal from the end outlet; and

preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet in the pouring means.

23. The method according to claim 22 further comprising the steps of:

providing means for controlling the level of molten metal in the pouring means;

controlling the level of molten metal in the pouring means with the

means for controlling; and

said step of controlling the level of molten metal further comprises maintaining the level of molten metal in the pouring means so that the pouring means is at least partially filled with molten metal during casting.

24. The method according to claim 23, said method further comprising the step of:

beginning casting, and ending said step of preheating, by rotating the pouring means, with the rotating means, and moving the outlet means in a downward direction towards the means for moving and cooling metal strip so that the outlet means is below the level of molten metal in the pouring means, and so that the end outlet is above the level of molten metal in the pouring means.

25. The method according to claim 24, said method further comprising the step of:

adjusting the quality of the metal strip by performing one of the following steps a), b) and c):

a) providing means for adjusting the velocity of the means for moving and cooling metal strip;

adjusting the velocity of the means for moving and cooling metal strip with the means for adjusting;

b) adjusting the level of molten metal in the pouring means with the means for controlling; and

c) rotating the pouring means with the rotating means.

26. A method of continuously casting metal strip, said method comprising the steps of:

providing means for feeding molten metal;

providing means for pouring;

providing outlet means in the pouring means;

providing means for moving and cooling metal strip;

providing an end outlet in one end of the pouring means;

attaching the feeding means to the pouring means;

feeding molten metal, with the feeding means, to the pouring means;

disposing the means for moving and cooling metal strip in a substantially horizontal direction, the means for moving and cooling metal strip having a direction of movement;

disposing the pouring means substantially transversely with respect to the means for moving and cooling metal strip;

receiving molten metal from the outlet means with the means for moving and cooling metal strip;

moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip;

discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means; and

preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet of the pouring means.

27. A method of continuously casting metal strip, said method comprising the steps of:

providing means for feeding molten metal;

providing means for pouring;

providing outlet means in the pouring means;

providing means for moving and cooling metal strip;

attaching the feeding means to the pouring means;

feeding molten metal, with the feeding means, to the pouring means;

disposing the pouring means substantially transversely with respect to the means for moving and cooling metal strip;

disposing the means for moving and cooling metal strip in a substantially horizontal direction, the means for moving and cooling metal strip having a direction of movement;

receiving molten metal from the outlet means with the means for moving and cooling metal strip;

moving and cooling metal strip in the direction of movement of the means for moving and cooling metal strip;

discharging a stream of molten metal from the outlet means at a substantial angle from a vertical axis of the pouring means and a substantial angle from a horizontal axis of the pouring means;

providing means for rotating at least the pouring means;

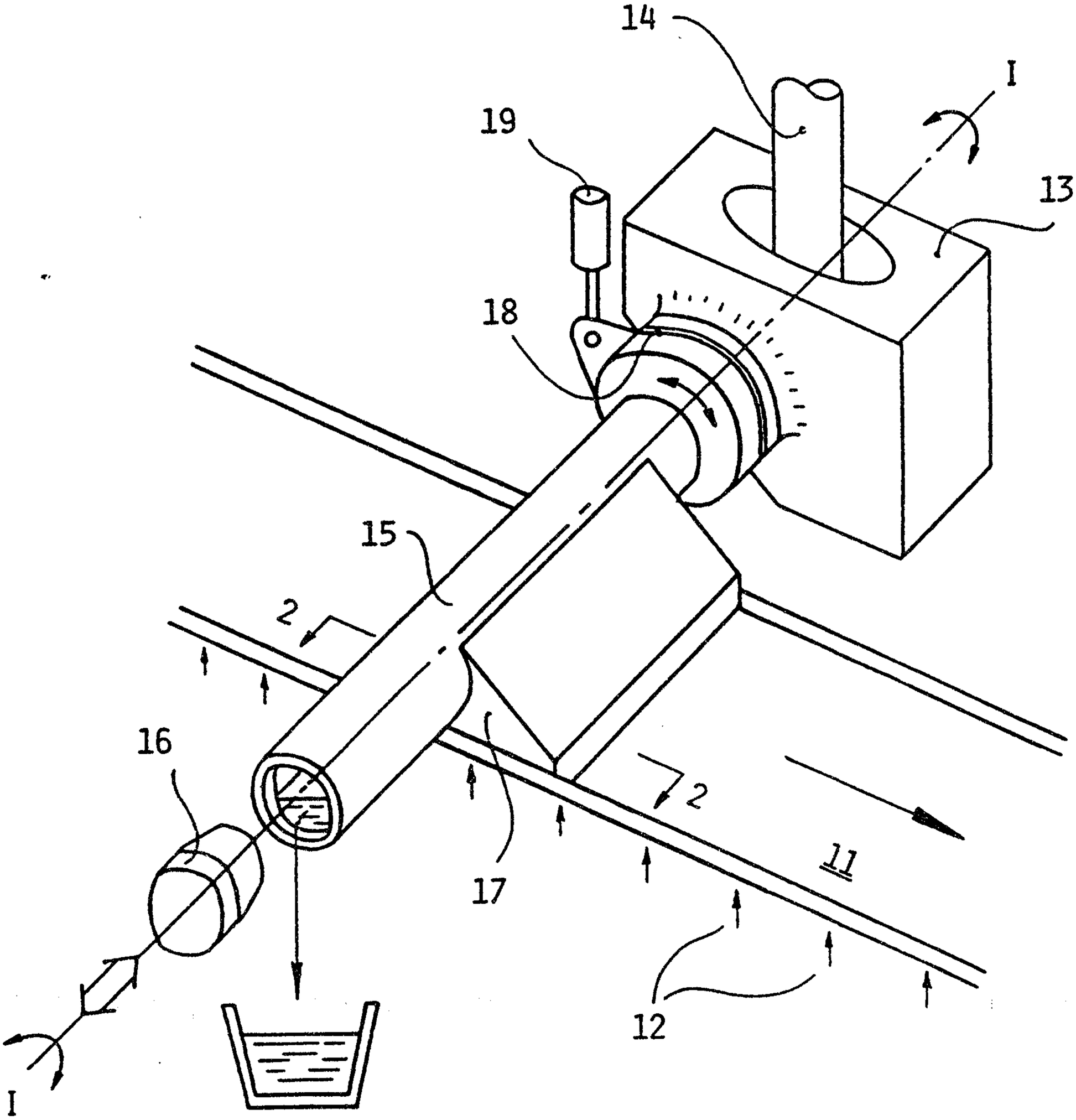
providing an end outlet in one end of the pouring means;

rotating the pouring means, with the means for rotating, and moving the outlet means in an upward direction, away from the means for moving and cooling metal strip, to prevent the flow of molten metal from the outlet means; and

preheating the pouring means by flowing molten metal through the pouring means and out of the end outlet in the pouring means.

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FIG 1



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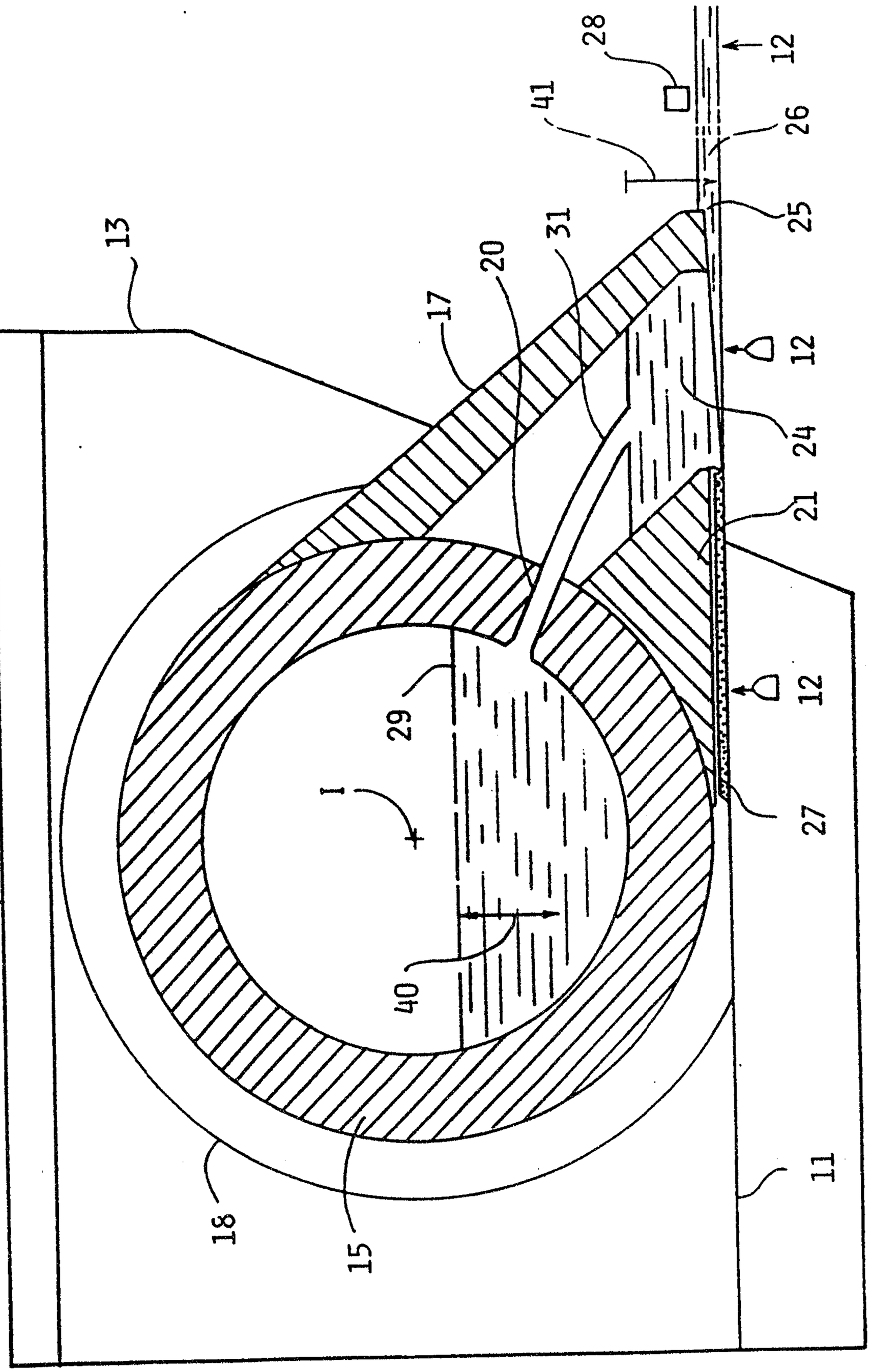
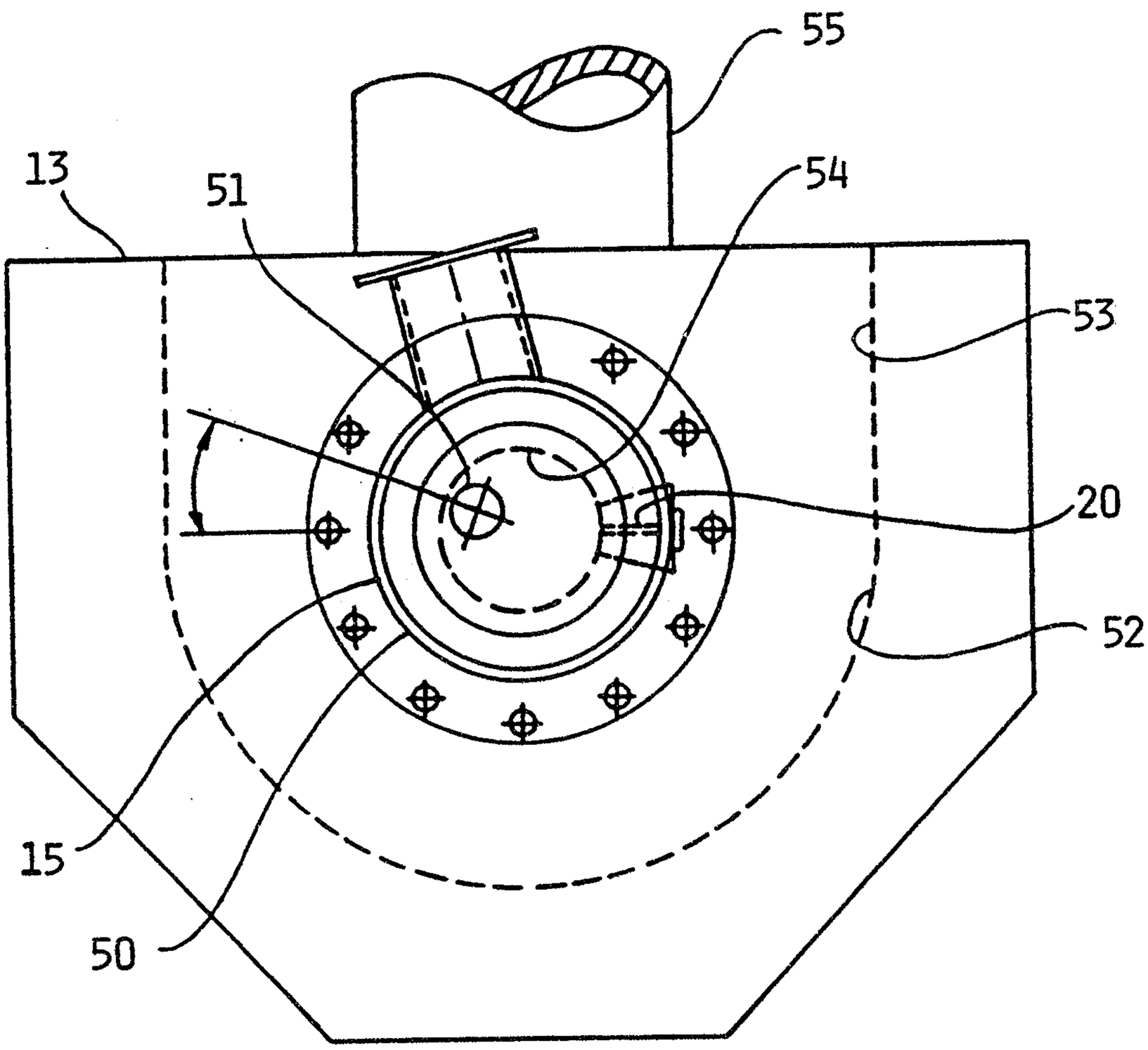
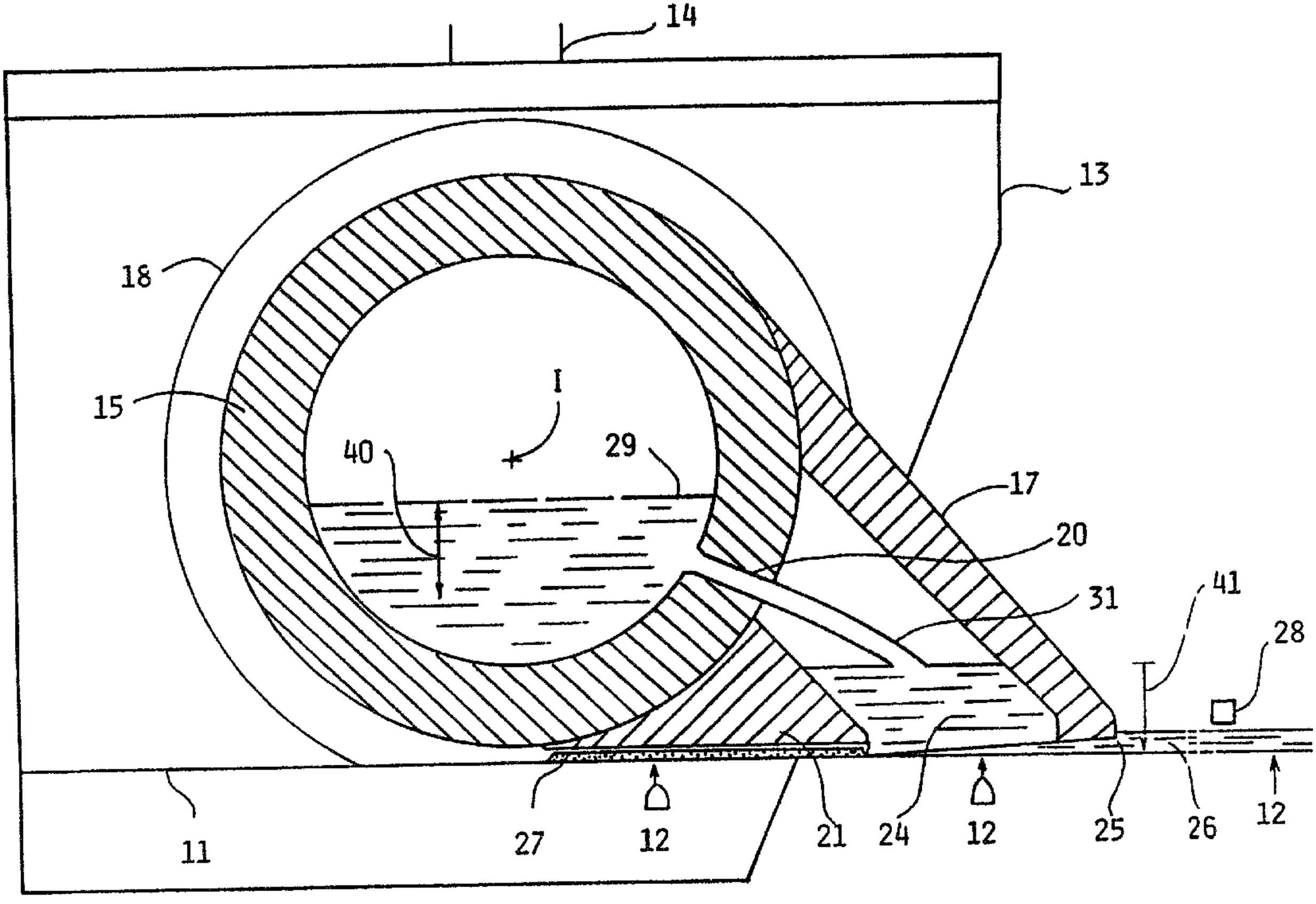


FIG 2

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FIG 3




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