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Pierson, Sr. et al.

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[54] **RADIANT HEATING SYSTEM**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 300,168, Oct. 24, 1972, abandoned.

[52] **U.S. Cl.** ..... **266/34 R**, 164/133, 164/335, 266/33, 266/38, 432/146, 432/161

[51] **Int. Cl.** **F27b 19/00**

[58] **Field of Search** ..... 266/34 R, 38, 40; 13/33; 164/66, 67, 133, 335, 337, 259; 432/146, 152

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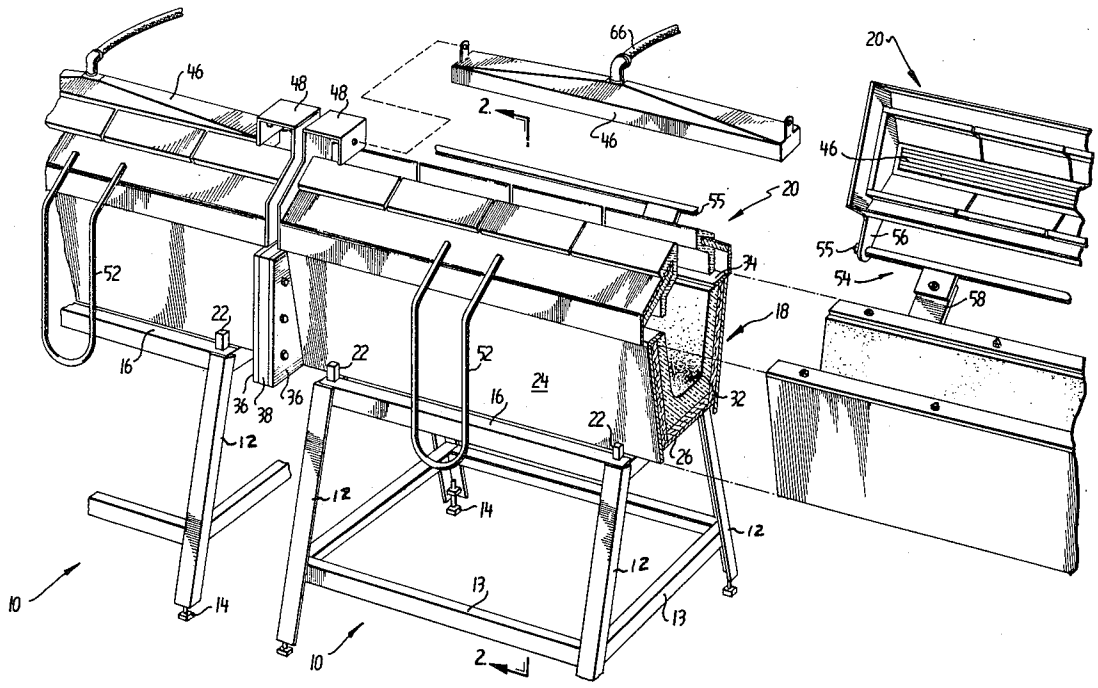
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[57] **ABSTRACT**

A radiant heating system for maintaining the temperature of molten metals within a narrow preselected range. A radiant heater is affixed substantially centrally of a cover which is hingedly secured to a U-shaped trough so as to cover an open top end thereof. The cover is provided with heat reflecting means which extend longitudinally thereof on opposite sides of the radiant heater member. A handle cooperates with the hinge so that the cover may be moved into and out of close proximity with respect to the open end of the U-shaped trough member.

4 Claims, 4 Drawing Figures



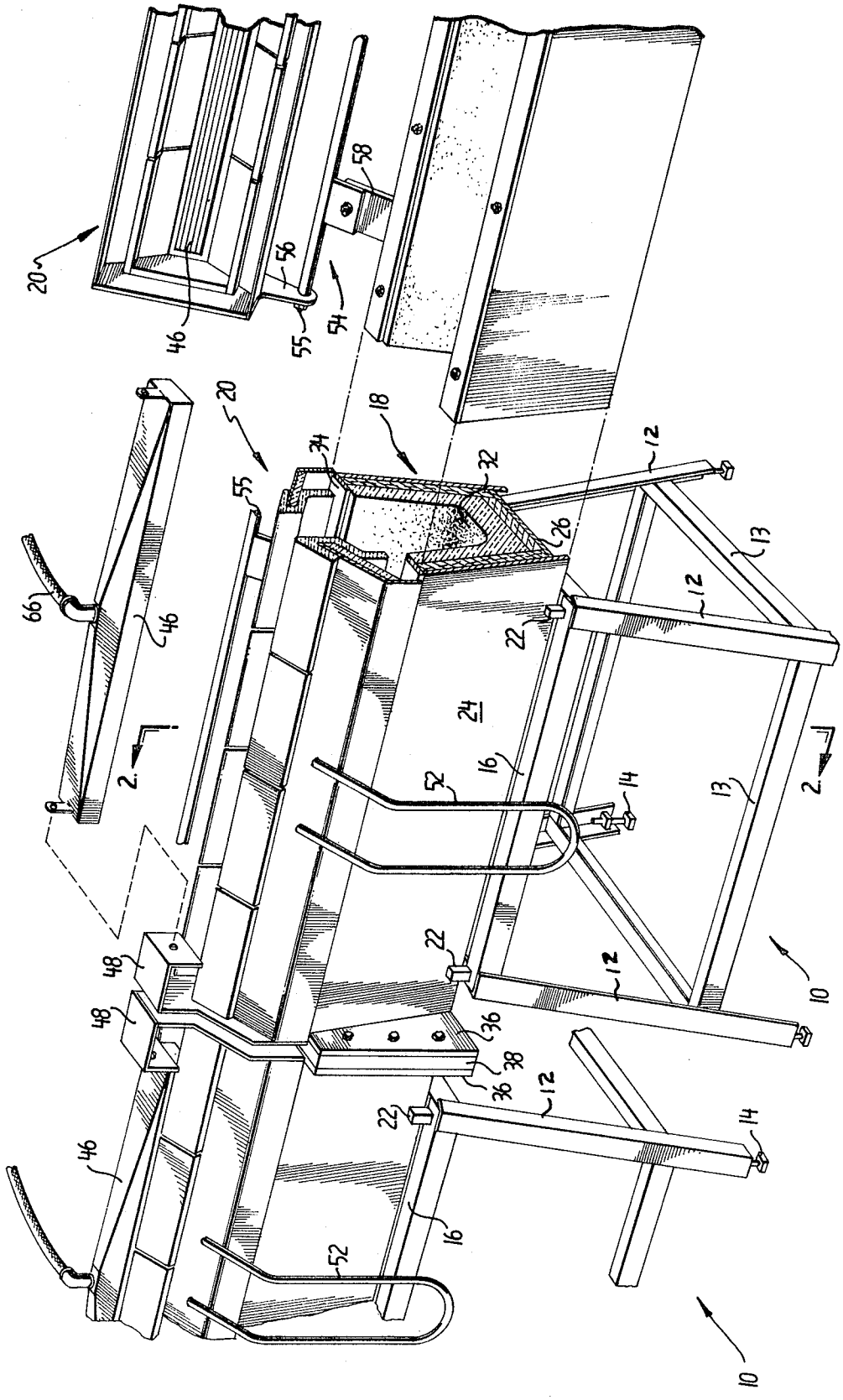


FIG. 1

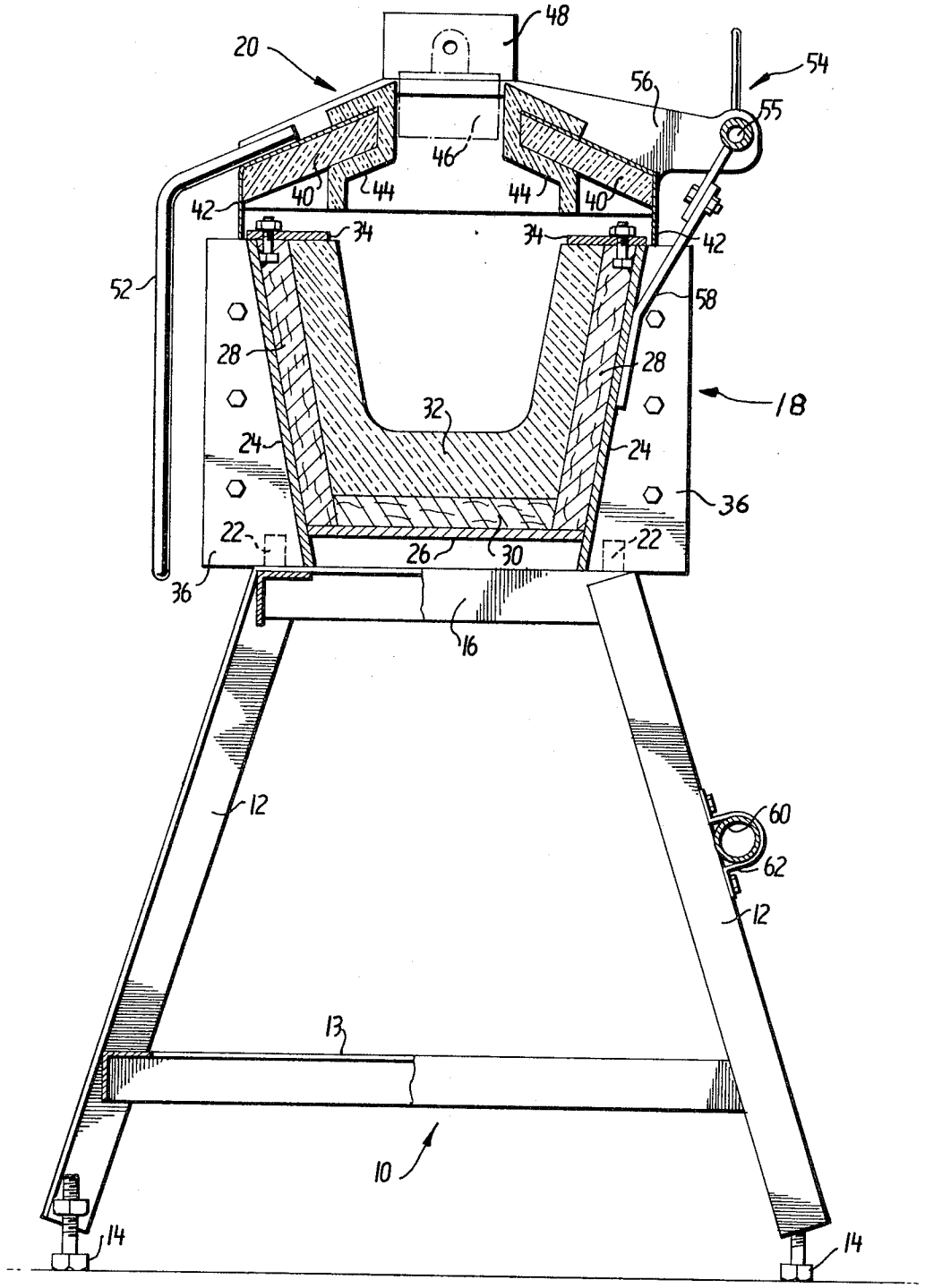

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FIG. 2

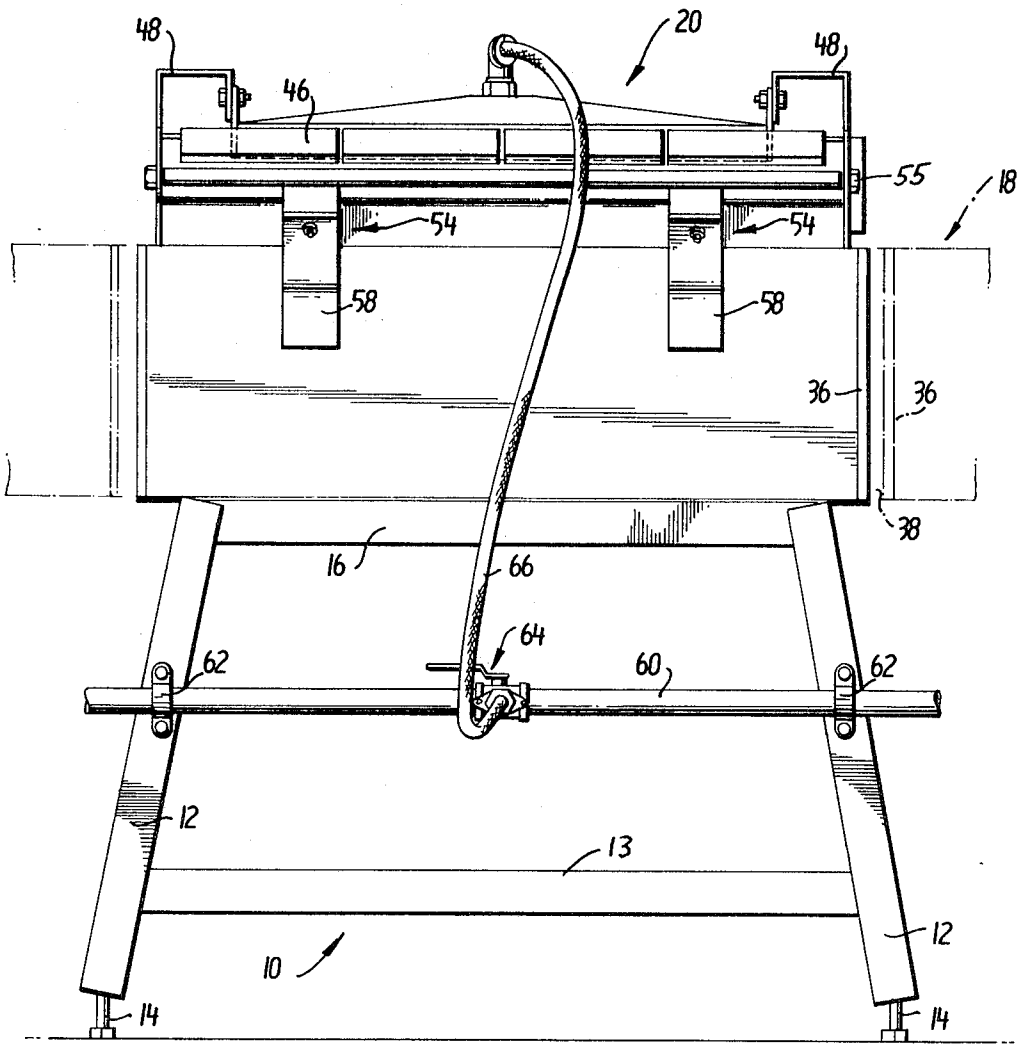

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FIG. 3

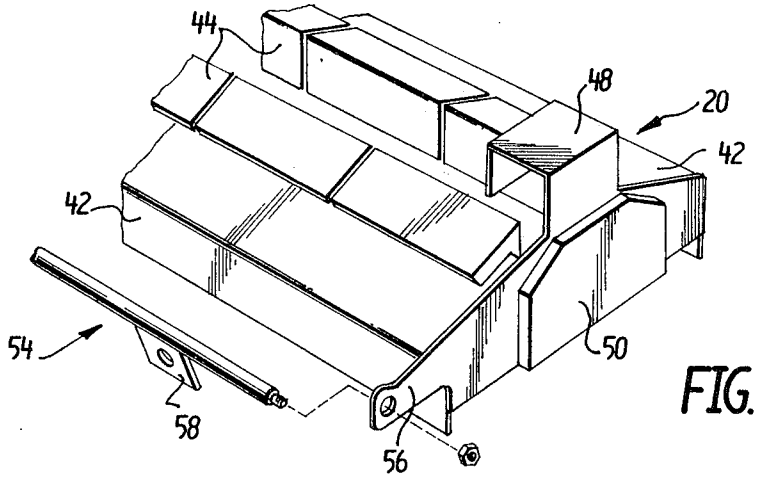

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FIG. 4

RADIANT HEATING SYSTEM

This is a continuation-in-part of U.S. Ser. No. 300,168 and now abandoned, filed Oct. 24, 1972.

This invention relates to a radiant heating system and cover structure for use in connection therewith and, more particularly, to such a radiant heating system for maintaining the temperature of molten metal within narrow limits of temperature from a melting furnace to a die casting machine, for example.

Heretofore, it has been the practice to insert a heat transfer tube directly into the melt in order to maintain the temperature of molten metal sufficiently high for use in a die casting machine, for example. The life expectancy of these heat transfer tubes has been relatively short, usually in the order of one year, and the system has required the use of a substantial amount of control equipment in order to maintain the desired temperature of the molten metal.

In accordance with the present invention, a radiant heating means is disposed in a cover for a U-shaped trough in close proximity to the upper surface of molten metal disposed in the trough in order to maintain a desired temperature for the molten metal. The cover is provided with heat reflecting means which extend longitudinally of the cover on opposite sides of the radiant heater member.

An inert atmosphere is established and maintained over the molten metal within the trough and it has been found that a predictable, easy to balance, heat is obtained. Thus it is possible to maintain the temperature of the molten metal within very narrow temperature limits, such as 775°–800°F., with no adjustment or control equipment of any kind. It has also been found that the amount of scrap has dropped significantly, such as to 0.5 percent, by use of the instant radiant heating system.

The inherent advantages and improvements of the present invention will become more readily apparent upon considering the following detailed description of the invention and by reference to the drawings in which:

FIG. **1** is a fragmentary exploded perspective view illustrating the radiant heating system of the present invention;

FIG. **2** is a side elevational view taken in vertical cross section along line **2**—**2** of FIG. **1**;

FIG. **3** is a fragmentary rear elevational view of a portion of the apparatus shown in FIG. **1**; and,

FIG. **4** is a fragmentary perspective view, partially exploded, showing a portion of a cover construction shown in FIG. **1**.

Referring now to FIGS. **1** and **2** of the drawings, there is illustrated a trough support member indicated generally at **10** having legs **12** and leg brace members **13**. The trough support **10** is provided with adjustable height means by the use of suitable bolt and nut assembly members with the head of the bolt resting on the floor and the nut being suitably secured as by welding to the angle leg members **12**. The adjustable height means permits the attitude of the trough support member and the trough to be adjusted to establish a gravity flow of metal in the trough. The trough support member is provided with a top support member **16** on which trough means, indicated generally at **18**, are placed. Trough cover means are indicated generally at **20** and the trough means **18** are retained on the top support

member **16** by use of suitable trough-retaining means **22** which may take the form of suitable stud members welded to the top support member **16**.

As seen best in FIG. **2**, the trough means **18** comprises a trough shell which consists of steel side wall members **24** and a steel bottom member **26**. Next to the steel trough shell are placed felt side wall lining members **28** and felt bottom lining member **30**. A cast silica member **32** overlays the felt members and provides a surface which is contacted by the molten metal. Tie down members **34** are suitably secured as by welding to the inside of the steel side wall members and provide a hold-down for the felt side wall lining members and the cast silica member **32**. These tie down members are spaced adequately along the top of the U-shaped trough to preserve a unitary structure. It is customary to make at least one of the cast silica members **32** T-shaped so that the molten metal may be delivered sideways to a die casting machine, for example.

The trough means **18** are provided with connecting flanges **36** which are provided with felt insulator material **38** to establish a joint between adjacent trough means **18**. Joints are also provided between adjacent sections of the cast silica member by the use of suitable gasket means, not shown.

The trough cover means **20** is illustrated best in FIGS. **2** and **3** and includes a pair of insulation means **40** made from felt. A steel frame member **42** provides a skirt which extends along opposite longitudinal sides of the U-shaped trough member **18**. A cover shield means **44** made from silica provides a heat reflecting means which extend longitudinally of the cover construction and are positioned on opposite sides of radiant heater member **46**. The radiant heater member **46** extends substantially centrally of the cover and is supported at its ends by a radiant holder member **48**. A silica plate member is disposed externally of the radiant holder member **48** and with the use of suitable nut and bolt assemblies, not shown, hold the cover member in place as a rigid self-contained unit.

A handle member **52** is attached on one side of the U-shaped trough member and secured as by welding, to the steel frame member **42**. Disposed on the opposite side of the U-shaped frame member is a hinge means **54** having a hinge axis **55** which is secured in a hinge extension member **56** which is part of the radiant holder member **48**.

As seen best in FIGS. **2** and **3**, hinge support members **58** are secured to one of the external steel side wall members **24** in order to support the hinge means **54**. The cover construction of the present invention can be used with radiant natural gas atmospheric burners or with a pre-mix blower.

In order to supply natural gas to the radiant heater **46**, a pipe **60** is secured to the legs **12** by means of brackets **62** and connected to a suitable source of gas, not shown. A gas valve **64** which may be, for example, Niblet Model **400** of a ball type gas valve admits the natural gas from pipe **60** through flexible hose **66** to the radiant heater **46**.

The heaters themselves are R322 (or equivalent) natural gas atmospheric heaters or pre-mix radiant heaters (RE-Verber-Ray Industrial Processing Type).

The arrangement provides an inert gas atmosphere which reduces the build-up of dross and substantially minimizes scrap. The ends of the silica cover shield members **44** are substantially in line with the upper

ends of the U-shaped trough so as to provide a heat reflecting means for the molten metal within the cast silica member **32.** The handle **52** is conveniently made from a one-half inch diameter reinforcing rod although other handle materials and sizes may be used. Handle **52** permits the cover to be lifted from a position substantially covering the U-shaped trough member to an open position shown on the right-hand side of FIG. **1.** In the open position, relatively free access is had to any molten metal within trough means **18.**

The mold construction of the present invention has been used to transport molten zinc, aluminum and copper though other molten non-ferrous metals may be transported. The radiant heater construction and cover permit the temperature of the molten metal to be controlled with a relatively predictable heat from the burners after an initial stable condition is reached without adjustments of any kind and to control the temperature within extremely narrow ranges, for example, from 775°–800°F. for aluminum.

The radiant heater **46** is preferably a catalytic burner which relies upon cracking and has a maximum temperature of about 1,800°F. When the burner is adjusted properly there is virtually no flame but only a red glow therefrom. Such a burner produces a temperature of about 1,350°F. at a distance one inch away from the burner. These temperatures are substantially less than the 2,700° to 3,000°F. required for steel, but are satisfactory for non-ferrous metals. Temperatures for zinc, for example, customarily range from 825°F. to 900°F.

It is to be noted that the sides of the radiant heater member **46** as seen in phantom in FIG. **2** are spaced inwardly from the most inward vertically extending wall portion of the cover shield means **44.** Thus each radiant heater member **46** is self-venting.

In similar fashion and again with reference to FIG. **2,** the longitudinally extending skirt **42** of the steel frame not only extends along opposite longitudinal sides of the U-shaped trough member **18** but are also spaced slightly outwardly from the uppermost ends of the front and rear side wall members **24.** Thus venting to the atmosphere occurs along substantially the entire length of the U-shaped trough member **18** and along each section of the trough member.

The practical advantage and significance of the venting which occurs is that sufficient oxidation occurs so that no carbon monoxide (CO) is produced from the burner since sufficient venting is present to ensure the formation of only carbon dioxide (CO_2). Thus it becomes possible to use the trough construction at an "in plant" location, that is, within a building without providing for an expansive arrangement to obtain venting exteriorly of the building.

In the conveying of non-ferrous metals such as aluminum and zinc, an oxide skull or skin develops over the top of the metal in the trough. In accordance with the present invention, the metal is maintained in a quiescent condition and the gases are permitted to escape. The apparatus is not suitable for conveying steel because in that instance the skin continues to break up and more oxide is formed which is deleterious to the end products.

When zinc is being conveyed, for example, it is not unusual for the apparatus to be used continuously for seven days with the molten metal being pumped from a furnace to a casting operation. The handle structure permits periodic checking to be certain that the metal is flowing properly and permits cleaning of the trough. It also permits access to the top of the molten metal in the trough which may be skimmed with a ladle periodically. The purpose of this skimming operation is to prevent the build-up of an excess of an oxide layer which acts as an insulator and tends to defeat the purpose of the radiant heater.

It is preferred that the trough member be composed of a plurality of sections arranged in end abutting relationship with each section being vented substantially throughout its length and further with each section being provided with its own cover member and its own radiant heater member. With the associated hinge means and handle members it becomes possible to open each section individually as requisite for inspection, cleaning, and/or skimming.

While presently preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced within the scope of the claims which follow.

What is claimed is:

1. A cover construction for use in conveying molten non-ferrous metal in a substantially U-shaped trough member having upwardly extending front and rear side wall members and having an open top end, said cover construction comprising:

a. means for supporting a radiant heater member substantially centrally of said cover member,

b. heat reflecting means extending longitudinally of said cover construction,

c. hinge means on said cover construction,

d. handle means cooperating with said hinge means for movement of said cover construction into and out of close proximity with respect to the open end of said U-shaped trough member,

e. and longitudinally extending skirt means which extend along opposite longitudinal sides of said U-shaped trough member,

1. said skirt means being spaced slightly outwardly from the uppermost ends to said front and side wall members to effect venting of gases from within said trough with said venting occurring substantially along the entire length of said trough member.

2. A cover construction as defined in claim **1** wherein said heat reflecting means extends along the front and rear sides of said radiant heater member and said radiant heater member is self venting by having its front and rear sides spaced inwardly from opposed sides of said heat reflecting means.

3. A cover construction as defined in claim **1** wherein said radiant heater member is a catalytic burner having a maximum temperature of about 1,800°F.

4. A cover construction as defined in claim **1** wherein said U-shaped trough member is composed of a plurality of sections positioned in end abutting relationship with each section being provided with its own cover member and its own radiant heater member.

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