Dec. 29, 1970 R. A. SCHWIETERMAN ET AL 3,551,185

METHOD OF BREAKING SEAL BETWEEN FURNACE AND CLADDING POT

Filed Sept. 18, 1969 2 Sheets-Sheet 1

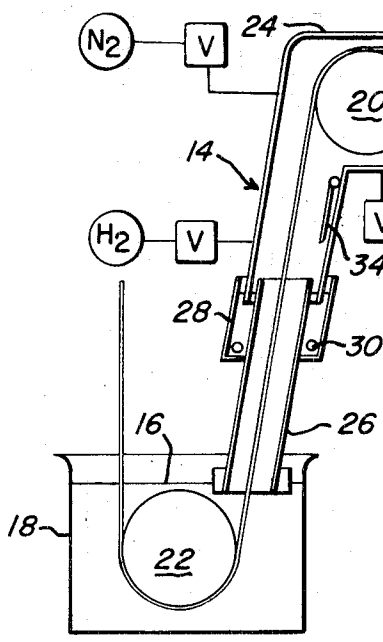


FIG-1

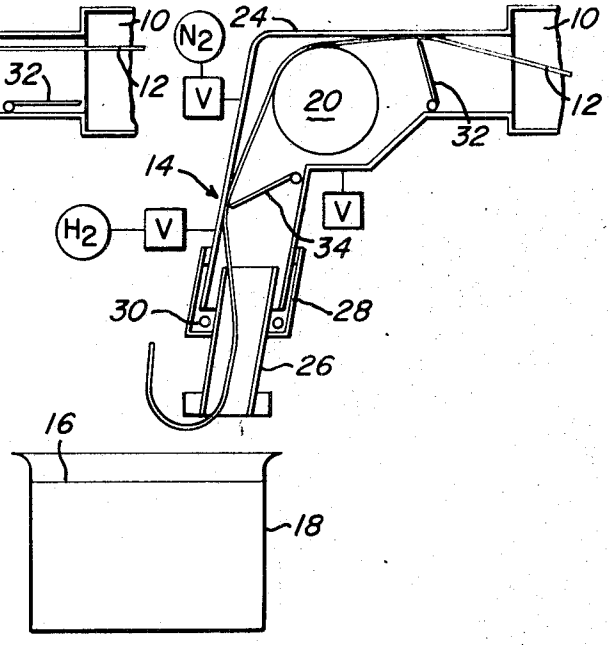


FIG-2

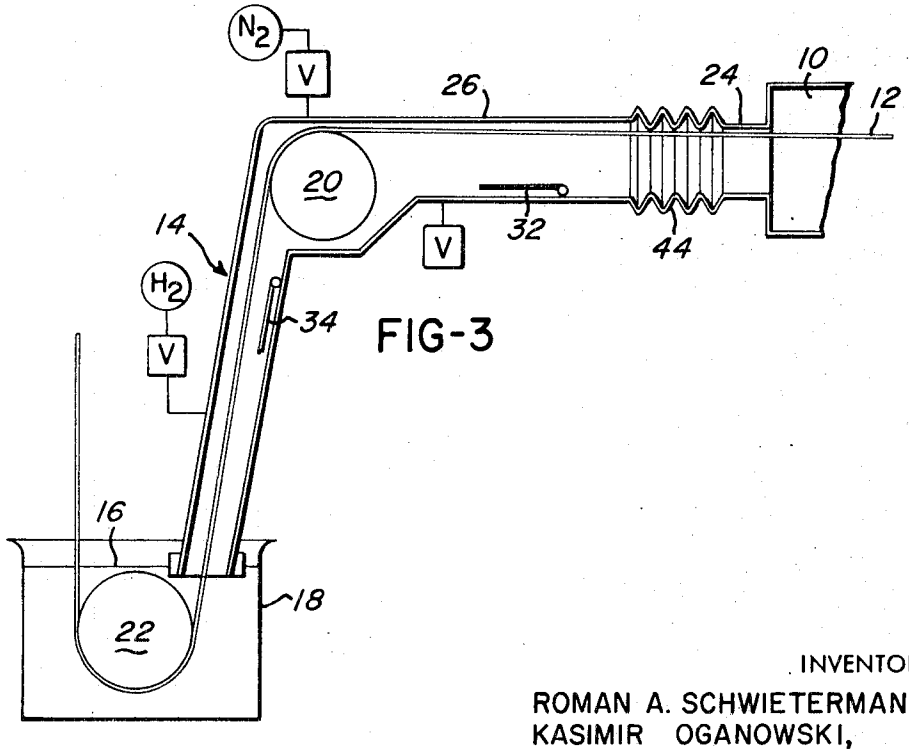


FIG-3

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METHOD OF BREAKING SEAL BETWEEN FURNACE AND CLADDING POT

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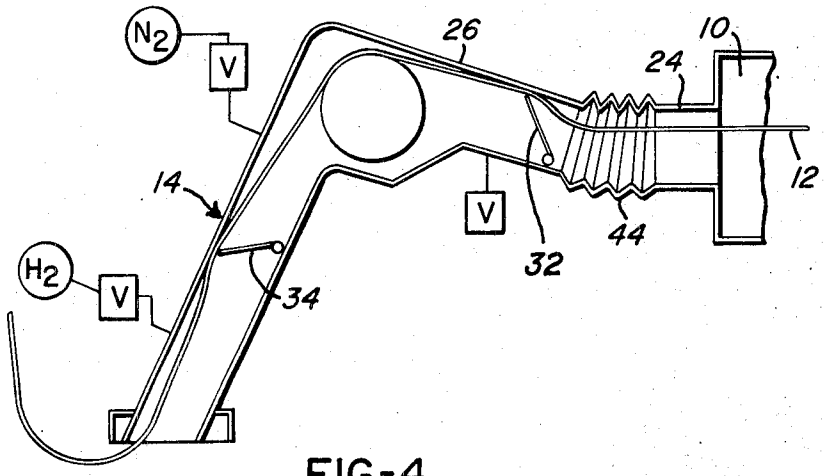


FIG-4

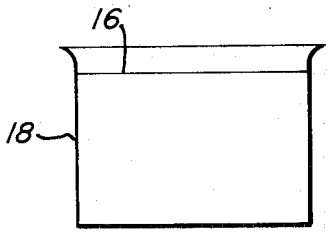
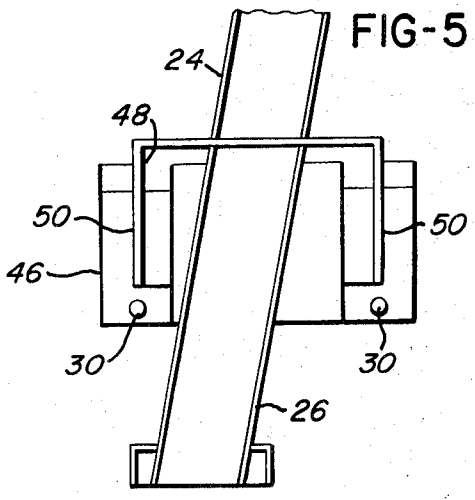


FIG-5



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United States Patent Office 3,551,185
Patented Dec. 29, 1970

3,551,185

METHOD OF BREAKING SEAL BETWEEN FURNACE AND CLADDING POT

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Filed Sept. 18, 1969, Ser. No. 859,033
Int. Cl. C23c 1/00
U.S. Cl. 117—51 3 Claims

ABSTRACT OF THE DISCLOSURE

In a strand cladding operation a process for breaking the seal between the molten metal in the cladding pot and the snout which communicates with a pretreatment furnace by closing off a portion of said snout which communicates with the furnace, degassing the remaining snout portion and providing an inert gaseous environment therein, closing off said snout within said remaining portion and effecting relative movement between said snout and molten metal to break said seal.

BACKGROUND OF THE INVENTION

This application relates to a continuous metallic coating operation wherein a ferrous base metal strand is conducted through a strip preparation furnace, and then, in a protective atmosphere through a down turned snout into a bath of molten coating metal. Exemplary commercial procedures now in wide-spread commercial use are described in U.S. Patents 3,320,085 in the name of Turner and 3,396,951 in the name of Cope et al. The former contemplates a strip preparation furnace utilizing carefully controlled temperatures and furnace atmospheres to achieve non-oxidizing surface cleaning by gas. The latter, while particularly directed to a procedure for preventing excessive strip oxidation during line stops, describes a modification of the so-called "Sendzimir process," wherein the surface of the strip is prepared to receive a molten metal coating by successive heat treatment in an oxidizing and then a reducing atmosphere.

In either case, a down turned snout is provided at the end of the strip preparation furnace, one end of which is normally disposed beneath the surface of the molten coating metal. This snout serves to maintain a protective atmosphere about the cleaned strip until it comes into contact with the coating metal.

This invention is directed primarily to the problem of changing a given coating line from one metallic coating metal to another by changing the bath and/or container. Reference is made to United States Patent 3,130,068 in the name of Whitley which describes in detail many of the problems associated with the changeover in coating metals. According to this patent, the changeover is accomplished by rapidly pumping the coating metal out of the coating pot and into a holding pot, removing the coating machine (pot roll and finishing rolls) and coating pot, placing a new coating pot in position, and finally pumping the new coating metal into the new pot.

In addition, as explained in that patent, the heating furnace and down turned snout are normally filled with a reducing gas, such as hydrogen. During the course of the coating metal changeover, the entire furnace has to be degassed to eliminate the danger of explosion when the lower end of the snout is no longer immersed in the coating metal.

SUMMARY OF THE INVENTION

The instant invention, in its broadest aspect, contemplates a method wherein a gas impermeable flexible joint is associated with the down turned snout and effecting movement of the snout from the position wherein its lower end is immersed in the coating metal bath to a position thereabove.

The gas impermeable, flexible joint just referred to can take many specific forms, two of which are described in more detail hereinafter.

Once the coating machine is removed in a conventional manner, the snout is raised to a position above the coating pot, and the strip can be drawn up snugly against the lower end of the snout, which of course means that the entire strip will be above the top of the coating pot. This will permit the original coating pot to be moved horizontally out of position, and a new pot moved into position.

The invention also contemplates the manipulation of a pair of baffles mounted within the snout, these baffles preferably being movable to a position substantially closing the open end of the snout so that degassing of the entire strip preparation furnace can be eliminated.

DESCRIPTION OF THE FIGURES

FIG. 1 is a schematic view of the end of a continuous coating apparatus including the down turned snout and the coating pot in the normal operating position.

FIG. 2 is a schematic diagram similar to FIG. 1 showing the snout in the retracted position.

FIG. 3 is a schematic diagram of the end of a coating apparatus showing a modified snout arrangement in the normal operating position.

FIG. 4 is a schematic diagram similar to FIG. 3 showing the snout in the raised position.

FIG. 5 is a schematic diagram showing a modified liquid seal retractable joint.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, the end of a conventional strip preparation furnace is indicated at **10**, and the strip being coated is shown at **12**. It will be seen that securely fixed to the end of the furnace **10** is the down turned snout indicated generally at **14**. It will be observed that the lowermost end of the snout is immersed below the surface **16** of molten coating metal contained in the pot **18**.

The strip **12** passes through the furnace **10**, over the turn down roll **20**, through the snout **14**, and into the bath of coating metal. It then passes under the pot roll **22** submerged in the bath and emerges from the bath in a generally vertical path of travel. It will of course be understood that suitable apparatus will be provided for finishing the molten coating metal as the strand emerges. Such apparatus might include exit rolls, jet nozzles, or the like, all of which are now known in the art.

The snout **14** shown in FIG. 1 includes the fixed portion **24** which is secured to the strip preparation furnace **10**, and the retractable portion **26**. The joint between these portions has several very important requirements. According to this invention, it must be flexible or retractable so that the portion **26** of the snout is movable from the normal operating position immersed in the coating metal

to the position shown in FIG. 2 wherein it is spaced above the coating pot. In addition, the joint must be gas impermeable.

That is, as explained earlier, the strip preparation furnace **10** and snout **14** will be charged with a reducing gas such as hydrogen. These reducing gases will be introduced into the apparatus in the region of the snout and travel countercurrent to the strip through the strip preparation furnace. In order to eliminate the risk of fire and explosion, it is most important that the flexible joint between the fixed portion **24** and the retractable portion **26** of the snout be gas impermeable.

In the embodiment shown in FIGS. 1 and 2, the gas impermeable, flexible joint is formed by providing the annular cavity **28** around the upper end of the retractable portion **26** of the snout. This annular cavity contains, at its bottom, heating means indicated schematically at **30**, and is adapted to be filled with a low melting point metal or alloy having little tendency to vaporize at coating temperatures. Since some vaporization may occur, the metal or alloy selected should be one which will not adversely affect the molten metallic coating. Lead and the alloy Woods' Metal are exemplary of those which may be used with success. The lower or free end of the fixed portion **24** of the snout is received in the annular cavity and immersed below the surface of the molten liquid carried by the cavity.

It should therefore be apparent that relative movement between the portions **24** and **26** of the snout can be accomplished, and the joint will be gas impermeable so long as the lower edge of the fixed portion **24** is below the surface of liquid in the cavity **28**.

It will of course be understood that suitable means will be provided for raising the retractable portion **26** of the snout from the position shown in FIG. 1 to the position shown in FIG. 2. Such lifting means may take any desired form, and do not, per se, form a part of this invention.

In order to change coating pots with the apparatus just described, the strip would be stopped, the coating equipment including the pot roll **22** and the finishing apparatus would be removed, the retractable portion **26** will be moved upward to the position shown in FIG. 2, the strip will be pulled out of the bath and into a snug position about the retracted snout, the original coating pot moved horizontally out of the way, and the new coating pot moved into position. The above steps are then reversed and the coating operation with a new or different coating metal may be commenced.

It will be apparent to the skilled worker in the art that once the lowermost end of the snout is taken out of the coating metal bath, it will be possible for air to enter the snout and strip preparation furnace. The existence of the hydrogen or other reducing gas in these components at elevated temperatures presents a great risk of explosion, and hence the prior art has always found it necessary to degas the furnace before the seal between the snout and the bath is broken. This degassing may be accomplished by shutting off the supply of reducing gas, opening an auxiliary port, and burning the reducing gases as they issue from the port. Alternatively, the furnace can be de gassed by purging with nitrogen or some other inert gas.

As seen in FIGS. 1 and 2, the snout **14** includes the pivotally mounted baffles **32** and **34**. It will be seen that these baffles are each pivotally movable from the position shown in FIG. 1 wherein free passage of the strip **12** is permitted, to the position shown in FIG. 2 wherein these baffles in effect clamp the strip being coated against a side wall of the snout. By means of these baffles, it is possible to eliminate the step of degassing the furnace.

When these baffles are provided, the upper baffle **32** is closed and nitrogen or other inert gas is introduced into the snout in the region between the baffles. An auxiliary port may be provided between the baffles to burn out the gases therein. The lower baffle **34** is then closed. The

inert purging gas is continued in the region between the baffles at a pressure higher than that of the furnace in order to insure that any leakage is into the furnace and not the other way. At this time, the lower end of the retractable portion **26** of the snout can be raised from the coating metal bath. The higher pressure region between the baffles again insures that any gas flow is out of the snout and not the other way. In other words, this higher pressure region prevents mixing of the reducing gas in the furnace **10** and atmosphere via the open end of the snout portion **26**, thereby eliminating the hazard of explosion.

The concept of utilizing two baffles and a supply of inert gas therebetween does not depend on the pivotal baffles shown. The invention may be practiced by utilizing two restrictive baffles in the snout and a sufficient supply of inert gas to insure that there is no leakage out of the strip preparation furnace.

Since the lowermost end of the retractable portion **26** of the snout has been immersed in the coating metal, it may be necessary to change this portion of the snout when changing coating metal pots to avoid contamination of the coating metal. This may be accomplished by severing the strip adjacent the lower end of the retractable portion **26** of the snout, and simply removing this portion of the snout. When a new portion **26** is in place, the strip can be welded together at the severed point, and the operation can be continued.

FIGS. 3 and 4 illustrate diagrammatically a slightly different embodiment of this invention. As seen in these figures, a gas impermeable flexible bellows joint **44** is provided adjacent the end of the snout which is secured to the reducing furnace **10**. A joint of this character will permit pivotal motion at this point, thereby in turn permitting the lower end of the snout to be raised upwards out of the coating metal pot.

The baffle construction according to this embodiment is substantially the same as that shown in FIGS. 1 and 2, and has been identified with similar reference numerals.

While not shown in the drawings, it will be apparent that the lower end of the snout (that portion immersed in the coating pot) may be formed as a separate element, suitably joined to the remainder of the snout in order to facilitate its removal when changing coating metal. In this event, the change can be accomplished as indicated earlier. That is, the strip can be severed and the lowermost portion of the snout removed, or the lowermost portion can be formed in two halves which may be removed without severing the strip.

FIG. 5 schematically illustrates an alternative form of a retractable, gas impermeable joint utilizing a liquid seal. According to this embodiment, the annular molten liquid containing cavity **46** is formed as a separate unit. The upper end of the retractable portion **26** of the snout, and the lower end of the fixed portion **24** of the snout are provided with the mating sealing flanges **48** and **50** respectively, each of which are immersed in the liquid contained in the cavity **46**. This embodiment has the advantage that when changing snouts, the annular cavity **46** need not be emptied of its molten sealing metal.

It is believed that the foregoing constitutes a full and complete disclosure of this invention. Various modifications can be made without departing from its scope and spirit.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a process for coating a base strand with a molten coating metal in an apparatus including a pretreatment furnace, a pot of molten coating metal, and a snout extending from said furnace to said pot, an end of said snout normally extending into and below the surface of said metal, the improved method of removing said snout from said molten coating metal comprising:

passing said strand through said furnace, snout and

molten metal while maintaining a controlled environment in each of said furnace and snout;

stopping the feed of said strand;

closing off the other end of said snout;

purging the remaining portion of said snout with an inert gas;

closing off the free end of said snout;

removing said free end from said molten metal.

2. In a process for coating a base strand with a molten coating metal including a strip preparation furnace having a snout normally in sealed relation with said molten coating metal and through each of which said strip continuously passes, the improved method of breaking said sealed relation without degassing said furnace comprising the steps of:

providing a pair of spaced apart, restrictive baffle means within said snout;

stopping the feed of said strip;

degassing the portion of said snout between said baffle means;

supplying an inert gas to said portion between said baffle

means at a pressure at least as high as the pressure of gases in said strip preparation furnace; and

effecting relative movement between the snout and molten coating metal to break the seal therebetween.

3. A process as in claim 2 wherein the seal is broken by removing the snout from the molten coating metal.

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U.S. Cl. X.R.

117—114