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E. W. CLARK

2,143,408

INGOT MOLD COATING DEVICE

Filed April 22, 1937

2 Sheets-Sheet 1

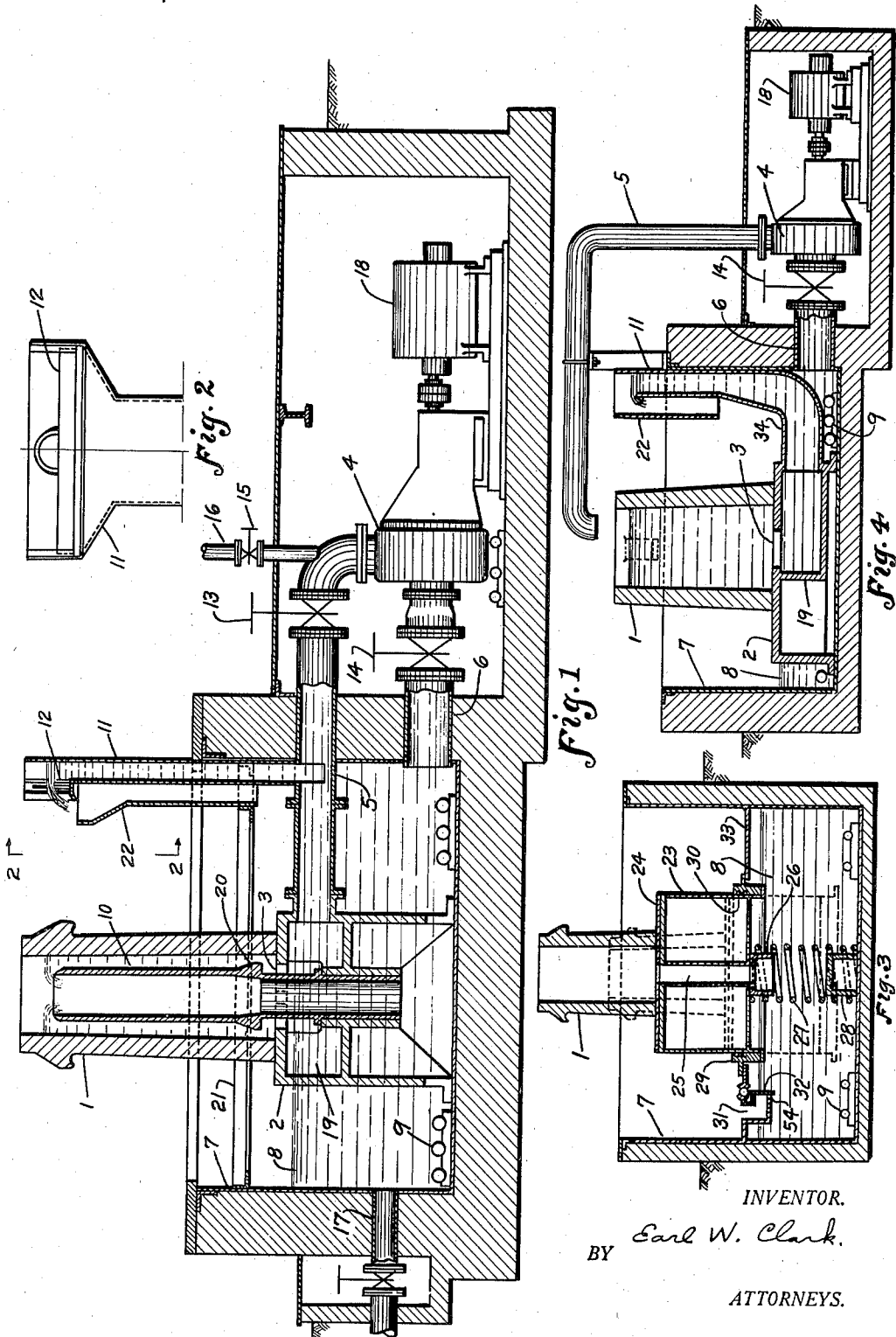


Fig. 1

Fig. 4

Fig. 3

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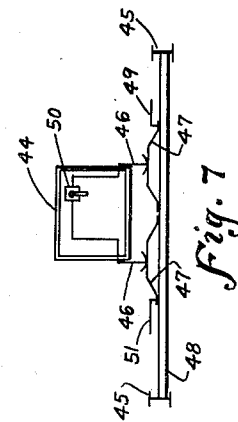
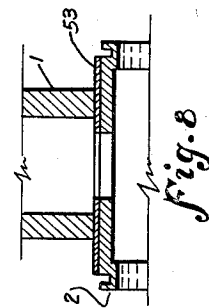
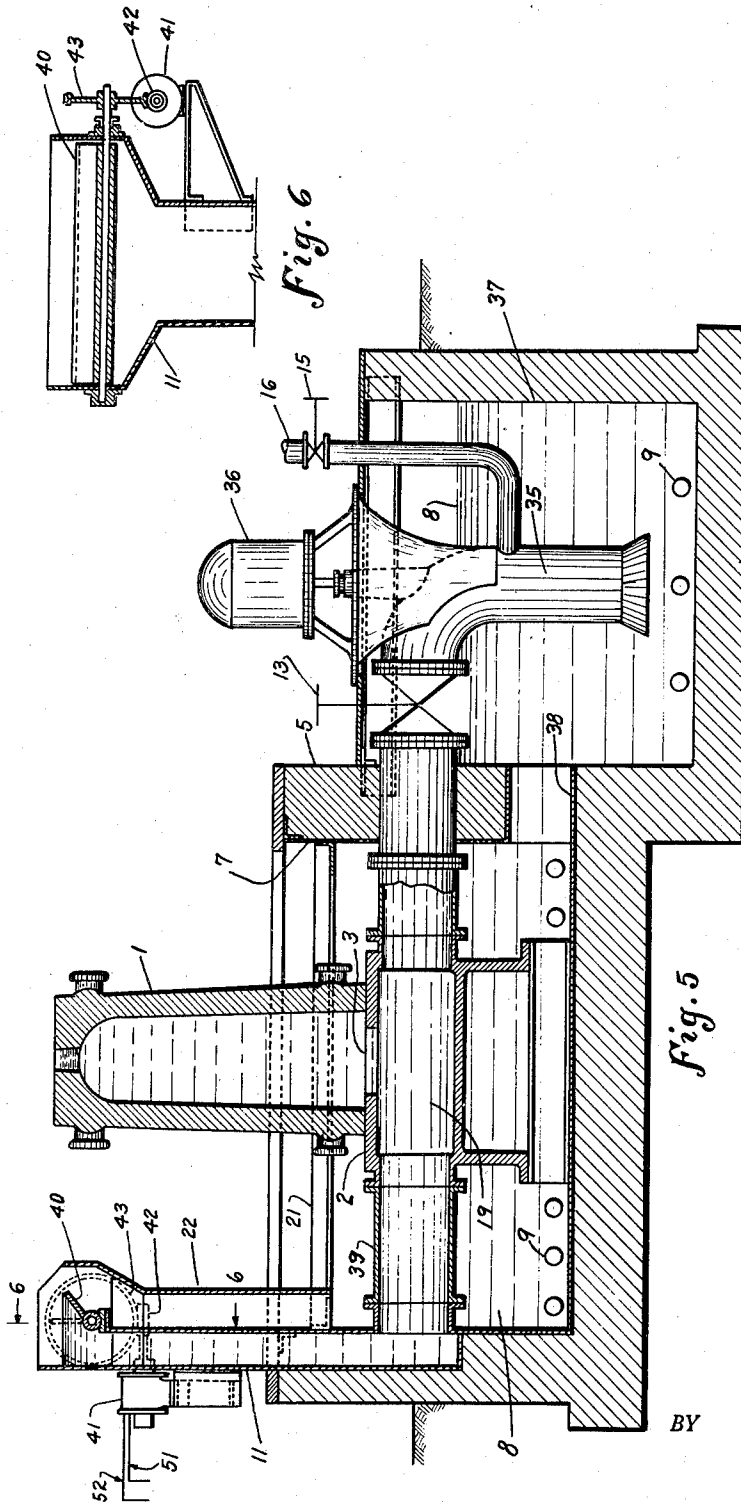
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2 Sheets-Sheet 2



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INGOT MOLD COATING DEVICE

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7 Claims. (Cl. 22—88)

This invention relates to method and means for coating the inside surface of ingot molds and other similar containers with tar or other suitable material that will produce a coating which will give a satisfactory surface finish on the ingot.

The method and means disclosed herein is especially adapted for coating the inside surfaces of cast iron ingot molds such as are used in open hearth plants. Various compounds and salts have been used in coating molds, but hot liquid tar made in by-product coke plants seems to give the best and smoothest coating, gives longest mold life by protecting the inside mold surface from developing fire cracks and enables the ingot to be readily removed from the mold. It is essential, however, that the coating be applied very uniformly to the inside surface of the mold, otherwise, if the coating is uneven or streaked, the surface of the ingot will not be smooth and uniform, but will have grooves or depressions and sometimes cracks which will, after rolling, show up in the surface of the slabs as surface defects which must be chipped or cut out before rolling into finished material such as, plates, sheets or strip steel.

Two methods have hitherto been used to coat the inside of molds, one method is known as dipping and the other as spraying. In the dipping process the ingot is lowered down into a tank of hot tar and both the inside and outside of the mold is coated. In the spraying process the mold is generally lowered down over a spray nozzle from which hot tar is sprayed, the tar being pumped to the spray head under pressure by a pump and only the inside of the mold is coated.

The dipping process has given very satisfactory results, while the spraying process has proven unsatisfactory and has been abandoned wherever possible. However, when the dipping process is used, an excessive quantity of yellow tar smoke is given off from the mold surfaces since the molds must be hot when coated and the heat vaporizes some of the tar. The greater portion of the tar smoke given off during the dipping process comes from the outside of the mold due primarily to the outside surface being larger than the inside surface. This tar smoke is very disagreeable and unhealthy for the men working in the vicinity of the dipping tank and on the pouring platform and the workmen complain continually when the dipping process is used. When only the inside surface of the mold is coated the quantity of smoke given off is reduced by 60 to 75 percent and the workmen do not object to the smoke.

One of the objects of this invention is to provide method and means which will coat only the inside of the ingot mold, excepting the bottom, and give results fully equal to those obtained by the dipping process.

A further and important object is to reduce to a minimum the amount of tar smoke given off when the molds are coated and thus reduce the hazards to the health and safety of the men who are required to use molds in the steel mills.

An additional object is, by coating only the inside surfaces and not allowing the tar to get on the outside surface of the mold where it is a detriment, to reduce, by 60% or more, the amount of tar required for coating.

This invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings and pointed out in the appended claims.

In the drawings:

Fig. 1 is a sectional elevation showing one arrangement of ingot mold coating device, including mold, tank, stand, interior and exterior overflow, tar circulating pump and piping.

Fig. 2 is a partial elevation taken on line 2—2 of Fig. 1 looking in direction of arrows and showing the exterior overflow with removable wler which may be changed to suit various heights of ingots, the mold being filled from the bottom.

Fig. 3 is a sectional elevation of a simplified form of coating device in which a displacement cylinder actuated by the weight of the mold replaces the circulating pump.

Fig. 4 is a sectional elevation of another modification wherein the mold is filled from the top, outside overflow being provided to prevent overfilling of mold, and a pump which circulates the tar.

Fig. 5 is a sectional elevation showing a mold coating device with outside overflow and quickly adjustable wler, a big end up mold is shown in upside down position with small hole in bottom, a pump sump is provided connected to the main tank.

Fig. 6 is a partial elevation taken on line 6—6 of Fig. 5 showing the quickly adjustable wler.

Fig. 7 is a partial plan view showing means whereby electrical contacts may be made between the controls in the craneman's cage and the circuit of the motor which operates the wler shown in Fig. 6.

Fig. 8 is a partial sectional elevation showing a pad or gasket on the top of the stand upon

which the mold is lowered preparatory to filling same with tar.

Referring now to the drawings more in detail wherein like numerals have been used to designate similar parts thruout the various figures, 1, Fig. 1 represents the ingot mold in position on base or stand 2. This base is provided with an opening 3 thru which hot tar is pumped up into the ingot mold by pump 4 and discharge pipe 5. Suction pipe 6 permits the tar 8 to flow from tar tank 7 to pump 4. Steam heating coils 9 are provided near the bottom of tank 7 to keep the tar 8 liquid so that it will pump readily and coat the inside of the mold uniformly. An overflow pipe 10 is provided and the mold is lowered down over this pipe and also an outside overflow pipe 11 with a removable wier 12 is provided. Wier 12 and overflow pipe 10 may be removed and replaced by similar parts to suit molds of different heights. The overflow pipe 10 serves, by taking up some of the interior volume of the mold, to reduce the amount of tar required to fill the mold to the required height. 13 and 14 are valves provided to shut off the tar when the pump is being repaired. Valve 15 and pipe 16 are used when it is desired to pump the tar from tank 7 when it has become too thick and heavy. Pipe 17 is used to refill tank 7 with fresh tar. The operation of these valves needs no explanation. 18 is the pump driving motor.

The operation of the mold coating system, starting with tank 7 partially filled with hot tar is as follows: Valves 13 and 14 are opened and the heated tar 8 flows into the pump 4 thru section pipe 6. The mold 1 has not been placed on stand 2. The motor 18 is started and tar is forced thru discharge pipe 5 into chamber 19 in stand 2. The tar is then forced out of chamber 19 thru annular opening 3 where it strikes deflecting vanes 20 on interior overflow 10. The tar is then directed back on to the top of stand 2 and flushes off any particles such as scale or steel which may have dropped off of mold 1. Splash angle 21 is provided to prevent tar from being splashed out of the tar tank 7. The crane operator picks up mold 1 from the mold car stool, the crane and ingot buggy being well known are not shown, and lowers the mold down over interior overflow 10 and on to base 2. The tar will immediately raise in the mold and in the exterior overflow 11 until the tar flowing over wier 12 and into 10 plus what leakage may occur between the bottom of mold 1 and base 2, which may be as much as at the rate of 100 to 200 gallons per minute, equals the pumping capacity of the pump at that particular head. The tar that overflows wier 12 will flow into waste pipe 22 and return to tank 7. It is not necessary to use the interior overflow pipe 10, but, since this pipe reduces the volume of tar required to fill the mold 1, it speeds up the mold filling operation. A pump of about 1,000 to 2,000 gals. per minute capacity at about 15 to 20 foot head is required, depending on the size of the molds. The mold should be filled in about 10 to 15 seconds.

When the mold 1 after being filled with tar is lifted off base 2 the tar will rush out between the bottom of mold and base 2 and this together with the tar supplied by the pump 4, which is allowed to run steadily until a heat of molds, numbering frequently 24 to 40, are all tarred, causes a heavy flow of tar over top of base 2 which effectively flushes and cleans same of any particles which might prevent the mold from seating tightly on base 2. Top of base 2 is machined

and the bottom of mold is cast very true so that, from observation, cracks or spaces not more than $\frac{1}{16}$ " to $\frac{1}{8}$ " in height may occur around a portion of the bottom of the mold. From the preceding it is evident that the method and means described herein will coat the inside of the mold, completely, uninterruptedly and uniformly, except the top 4" or 5" which does not need to be coated.

By closing valves 13 and 14 and opening valve 15 the tar in tank 7 may be pumped into a tank car.

In Fig. 3 a simplified coating device is shown which does not require the use of a circulating pump. 23 is a displacement cylinder provided with a top 24, a hole 25 thru the center of the cylinder thru which the tar flows up into mold 1, a spring guide 26. Spring 27 supports the cylinder and spring guide 28 is provided on the bottom of tank 7. Guide 29 with seal rings 30 guides the displacement cylinder and prevents tar from escaping when the cylinder is forced down by the weight of the ingot. When the crane lowers the ingot down on to the displacement cylinder spring 27 is compressed, the tar flows up into hole 25 and into the mold 1. Check valve 32 is forced up against seat 54 and prevents the tar flowing out thru hole 31 and above plate 33. When the mold is lowered down until it is filled to within 4" or 5" of the top, the crane operator removes same and the displacement cylinder will be returned to the up position by spring 27, valve 32 will allow the tar which has been forced up into mold 1 to return to the space below seal plate 33. An outside overflow pipe similar to 11 in Fig. 1 may be provided if desired.

The coating device shown in Fig. 4 provides for filling the ingot mold from the top. The crane-man places mold 1 on base 2. Motor 18 is started and pump 4, which receives tar 8 from tank 7 thru suction pipe 6, forces tar thru discharge pipe 5 and into top of mold 1. A hole 3 is provided in base 2 leading to chamber 19 and piping 34 is provided connecting same to outside overflow 11 which determines the height to which the mold is filled. The pump is stopped before the mold is removed from base 2.

In Fig. 5 another modification of mold coating device is shown in which a vertical pump 35 driven by vertical motor 36 is used to circulate the tar from sump 37 which is connected to tank 7 by pipe 38 which permits the tar 8 to flow back to sump 37 and maintain the level in 7 and 37 substantially the same. The pump 35 takes the tar from the sump and forces it thru discharge pipe 5 into chamber 19 in stand or base 2 and out thru hole 3 and up into the ingot mold 1. The tar will also flow thru pipe 39 and up into overflow pipe 11 and up over adjustable wier 40 which controls the height to which tar will rise in the mold. During the coating of a series of molds the pump may be allowed to run continuously and, since some molds are made as shown with a small hole in the bottom in which the tar would rise rapidly, quick operation for wier 40 is provided by means of motor 41, worm 42, and worm gear 43. Electrical control and connections are provided so that the crane-man in crane cage 44 Fig. 7 may control motor 41 to raise or lower edge of wier 40 as required to prevent mold 1 from being over filled. 45 are crane runway columns, shoes 46 carried by crane cage make contact with conductors 47 when crane is in position to lower the mold down on to base 2. The conductors 47 are carried by beam 48 and are insulated therefrom.

Wire 49 is connected to a source of electrical energy, controller 50 makes and breaks the electrical circuit between wires 49 and 51. Wire 52 Fig. 5, is the return circuit from motor. The operation of coating the mold is substantially the same as described for Fig. 1.

Fig. 8 shows a soft mat 53 on top of base 2 which may be made of woven wire asbestos or other suitable material to form a better seal between the bottom of ingot and base.

In all of the mold coating devices shown the overflow pipes can be dispensed with and the crane operator may stop the tar rising in the mold by merely lifting same off of the seat or stand 2 or 24. However, this requires a skilled crane man and judging from our experience from watching the crane man handle molds, most crane men get into various troubles such as getting the lifting hooks unhooked from the lifting ears on the mold when he sets same down on stand by getting too much slack in the hoisting cables.

While several embodiments of my invention have been shown and described in comparative detail, for the purpose of adequate disclosure, the broader idea of my invention is not limited in any of the details disclosed herein, but instead, includes such embodiments thereof as are within the scope of the subjoined claims.

What I claim is:

1. A device for coating the interior surface of a hollow body comprising, a base adapted to receive said hollow body and having an opening therein communicating with the interior of said body while said body is on said base, a conduit system supplied with coating fluid under pressure connected to said port, an overflow pipe extending upward from said conduit system, an adjustable wiper in said overflow pipe which governs and limits the rise of coating fluid in said hollow body.

2. An apparatus for coating the interior of ingot molds, comprising, an open tank containing coating fluid, a base located inside said tank and adapted to receive an ingot mold, when lowered down on same, an orifice in the top surface of said base for delivering coating fluid from said tank into an ingot mold when placed thereon and for flowing coating fluid from said tank over the top of said base and back into said tank when said ingot mold has been removed therefrom, and means for pumping the coating fluid from said tank to said orifice.

3. An apparatus for coating the interior of ingot molds, comprising, a tank containing coating fluid, a base located inside said tank and adapted to receive an ingot mold when lowered down on same, an orifice in the top of said base for delivering coating fluid from said tank into an ingot mold placed thereon and for flowing coating fluid from said tank over the top of said base and back into said tank when said ingot mold has been removed therefrom, a conduit and pumping system for pumping the coating fluid from said tank

to said orifice, an overflow pipe to control the rise of coating fluid in said mold and so connected to said pumping system that the coating fluid rises in the ingot mold and the by-pass pipe simultaneously.

4. An apparatus for coating the interior of ingot molds, comprising, a tank containing coating fluid, a base located inside said tank and adapted to receive an ingot mold, an orifice in the top surface of said base for delivering coating fluid from said tank into an ingot mold placed thereon and for flowing coating fluid from said tank over the top of said base and back into said tank when said ingot mold has been removed therefrom, deflecting surfaces to direct the coating fluid flowing from said orifice outwardly therefrom and on to said base, and means for pumping the coating fluid from said tank to said orifice.

5. A device for coating the interior surface of a hollow body comprising, a base adapted to receive said hollow body and having an opening therein communicating with the interior of said body while said body is on said base, a conduit system supplied with coating fluid under pressure connected to said port, an overflow pipe extending upward from said conduit system said overflow pipe having its horizontal cross sectional area increased at the top.

6. An apparatus for coating the interior of ingot molds, comprising, a tank containing coating fluid, a base located inside said tank and adapted to receive an ingot mold, an orifice in the top surface of said base for delivering coating fluid from said tank into an ingot mold when placed thereon and for flowing coating fluid from said tank over the top of said base and back into said tank when said ingot mold has been removed therefrom, a conduit and pumping system for pumping the coating fluid from said tank to said orifice, an overflow pipe connected to said conduit system, and means for varying the height of said overflow.

7. An apparatus for coating the interior of ingot molds, comprising, an open tank containing coating fluid, a base located inside said tank and adapted to receive an ingot mold when lowered down on to same, an orifice in the said base for delivering coating fluid from said tank into an ingot mold when lowered down thereon and for flowing coating fluid from said tank over the top of said base and back into said tank when said ingot mold has been removed therefrom, a conduit and pumping system for pumping the coating fluid from said tank to said orifice, a riser connected to said conduit system to control the rate of rise of coating fluid in said mold while pump is discharging at its regular capacity and also to maintain a pressure head on orifice when mold is removed from base to permit ample flushing of said base.

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