

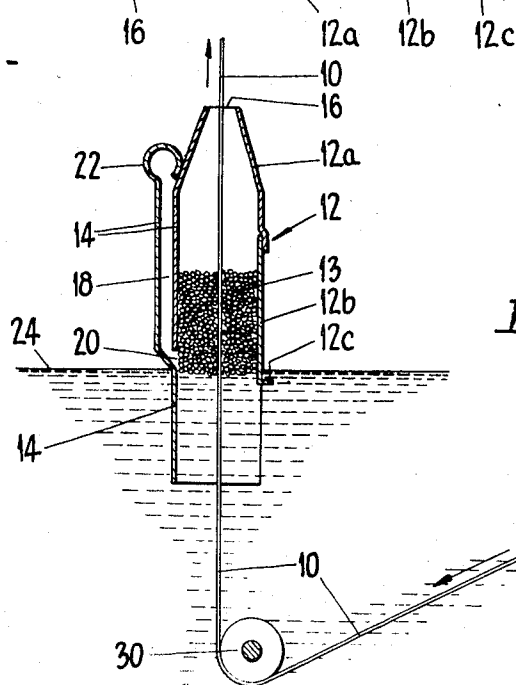
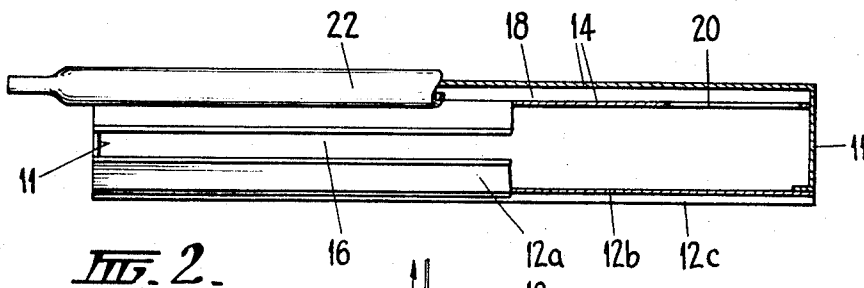
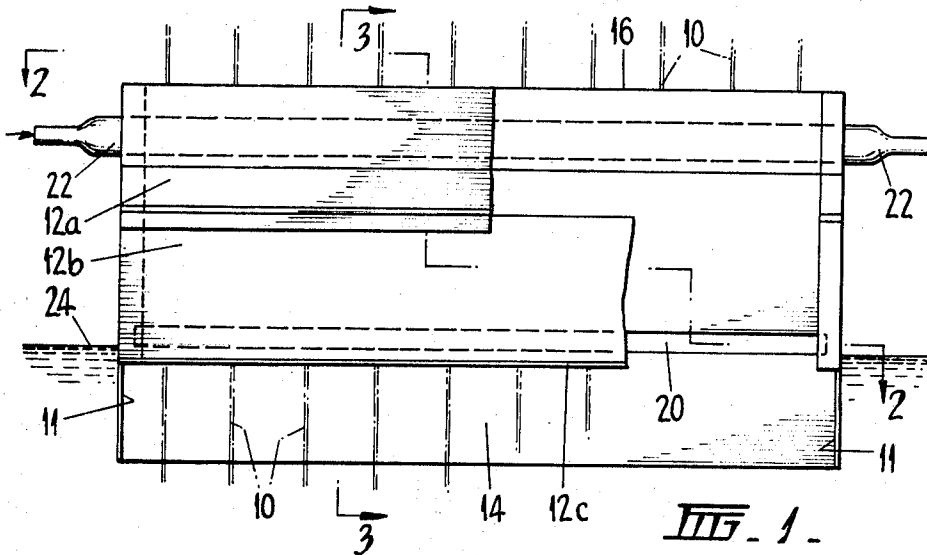
June 12, 1973

J. P. SCIFFER ET AL

3,738,861

METHOD OF WIPING GALVANISED WIRE OR STRIP

Filed March 7, 1969



INVENTORS

JACK PRYOR SCIFFER

HARRIE ROXBY

BY Young & Thompson

ATTYS.

1

3,738,861

METHOD OF WIPING GALVANISED WIRE OR STRIP

Jack Pryor Sciffer, New Lambton, New South Wales,
and Harrie Roxby, Kotara South, New South Wales,
Australia, assignors to Australian Wire Industries Pty.
Ltd., Melbourne, Victoria, Australia

Filed Mar. 7, 1969, Ser. No. 805,145

Claims priority, application Australia, Mar. 8, 1968,
34,755/68

Int. Cl. B05c 11/02; C23c 1/02

U.S. Cl. 117—102 M

2 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to the operation of wiping galvanised wires or strips immediately after they are withdrawn from the galvanising bath.

For this purpose, the wires or strips are drawn upwardly through a bed of washed and graded river gravel or of nodules or like bodies composed of other suitable inert material having a specific gravity lower than that of molten zinc.

The bed is preferably contained within a chamber which is open at its upper and lower ends and the latter preferably projects into the molten zinc bath.

The interstices of the bed and the space immediately above it are filled with a non-oxidising gas which excludes air and this gas preferably contains H_2S . This gas enters the chamber close to the surface of the molten metal and is preferably preheated by heat exchange from the interior of the chamber before it enters the latter.

It is found that a wiping bed according to the invention, requires replacement less frequently than the conventional charcoal bed so that labour costs are reduced and also that the throughput speeds of the wires or strips may be substantially increased.

This invention relates to the continuous galvanising of wire or strip by the hot dip process and more particularly to the operation of wiping the wire or strip immediately following its withdrawal from the bath of molten zinc in order to ensure that the zinc coating is continuous, uniform and smooth.

This wiping operation is usually effected by passing the wire or strip vertically upwards through a bed of powdered charcoal which floats on the surface of the molten zinc bath and which usually requires to be replaced at intervals of about two to four hours.

It is the general object of this invention to provide an improved method of and means for the continuous wiping of galvanised wire, or the like strip while one specific object is to provide a method and apparatus which permits of, or facilitates, the formation of thicker zinc coatings than are obtainable conveniently, if at all, by existing hot dip procedures.

Another specific object is to provide an improved wiping method and apparatus which permit of a significantly increased speed of operation.

Accordingly the invention includes the method of continuously wiping hot dipped galvanised wire, strip or the like, comprising passing the latter immediately following its withdrawal from the bath of molten zinc, through a bed comprising relatively movable nodules, granules or other like bodies composed of hard, substantially inert material which is substantially unaffected by temperatures up to about 450° – 500° C. and has a lower specific gravity than molten zinc.

In addition, the material is preferably of a composition such that it is not wetted by molten zinc, its specific grav-

2

ity is preferably within the range 2.0 to 4.5, and the nodules, granules or the like are preferably within the size range of about one eighth to one quarter of an inch, though the invention is not limited to nodules or granules of this order of size. Preferably the material is approximately spherical in form, but washed and graded river gravel has proved to be very satisfactory for the purpose and is relatively inexpensive and readily obtainable.

The higher the specific gravity of the material used to form the bed, the lower is the weight or thickness of the zinc coating formed, while again as the depth of the bed is increased, so is the coating weight reduced. While granule size appears to exercise some control over coating weight or thickness, it has been found that a gravel bed composed of granules between one eighth of an inch and one quarter of an inch in size is satisfactory for the full normal range of wire sizes and coating weights, especially as the throughput speed of the wire or strip exercises a greater influence on coating weight than the other factors referred to.

According to another aspect of the invention, a suitable non-oxidising gas, and preferably an appropriate reducing gas, such as a suitable town gas, liquid petroleum gas, blast furnace gas or annealing furnace atmosphere gas, is continuously passed through the wiping bed so as to fill the interstices thereof.

For this purpose the said wiping bed is confined within a chamber which preferably dips at its lower end into the bath of molten metal and which is provided, near its lower end with a gas inlet opening, and at or near its upper end, with a discharge opening through which the galvanised wires or strips emerge and where the escaping gas is preferably burned.

An important feature of the preferred form of the invention resides in using a reducing gas containing a suitable proportion of hydrogen sulphide, for example between 100 and 1000 grains (sulphur content) per 100 cubic feet of gas at atmospheric pressure through the invention is not limited to proportions of this order.

Wiping apparatus according to the invention comprises a generally vertical chamber open at its upper and lower ends and arranged with its lower end dipping into the surface of a bath of molten zinc, and a bed of graded gravel or other suitable inert material in nodular or similar form in the chamber, said bed forming material having a lower specific gravity than zinc whereby the bed floats on the molten metal, and means for moving the wire strip or the like upwardly through the chamber from the bath.

Provision is also preferably made for supplying a reducing gas to the chamber immediately above the surface of the molten zinc.

The gas is preferably, but not necessarily, preheated before it enters the chamber and for this purpose one side wall of the latter may be hollow and the cavity therein forms a gas passage in which the gas is preheated by heat exchange from the inner section of that wall. The upper end portion of the said cavity is formed with a gas inlet opening, while the lower part of the inner wall section is formed with an elongated horizontal slot or equivalent holes through which the heated gas passes from the cavity into the bottom of the chamber as close as is practicable to the point where the wires emerge from the surface of the zinc.

The opposite side of the chamber preferably comprises at least one detachable plate which forms a gas-tight seal with the body of the chamber and which, when detached, permits of the insertion and removal of the wiping bed. Preferably two such detachable plates are provided, with the one arranged above the other.

The bed does not fill the chamber, so that a free gas space is provided within the latter and above the bed and this upper portion of the chamber is preferably upwardly convergent and has a relatively narrow slot in its upper end for the emergence of the wires or strips and the discharge of the gas.

As the wires or strips move upwardly above the chamber, they preferably pass through a jet of water in the usual way in order to solidify the zinc without deformation of the coatings formed thereby.

The invention may be used in conjunction with existing continuous hot dip galvanising plants.

In such existing plants the strip or wire is usually continuously subjected to a series of pretreatment operations before it passes into the bath of molten zinc, such pretreatment operations usually comprising heat treatment, acid cleaning, water washing and fluxing while some plants employ the well known Sendzimir process.

Following the fluxing operation, the wire or strip is directed to and around a roller submerged in the bath of molten zinc and then passes vertically upwards from this roller through the surface of the molten metal and then through the aforesaid charcoal wiping bed and a water spray, to and around steadying and tension rolls from which it extends more or less horizontally to a winding or take-up frame.

Usually a plurality of wires or strips are coated simultaneously, such wires or strips being arranged side-by-side in spaced parallel relationship.

As previously explained the present invention is concerned primarily with the substitution of an improved wiping bed of discrete inert material for the usual charcoal wiping bed and with the exclusion of air therefrom by continuously passing therethrough a non-oxidising gas which preferably contains a small proportion of hydrogen sulphide.

In order that the invention may be more fully understood, one particular application thereof is described below with reference to the accompanying drawings in which:

FIG. 1 is a partly broken-away view in front elevation of a wiping chamber according to the invention,

FIG. 2 is a view in plan and is partly a section on the line 2—2 of FIG. 1, and

FIG. 3 is a view in sectional end elevation taken on the line 3—3 of FIG. 1.

The illustrated wiping chamber or box is of relatively long and narrow rectangular shape when viewed in plan, and is arranged transversely or at right angles to the several wires or strips 10 so that its length is determined by the number of wires or strips which simultaneously pass upwards through it.

The chamber, which is conveniently fabricated from sheet steel, is open at its upper and lower ends and may conveniently be of the order of fifteen to twenty-four inches in height. The end walls 11 of this chamber are disposed vertically, as also are its front and back walls 12 and 14 respectively with the exception of their upper portions which preferably converge upwardly and inwardly as shown, whereby the chamber is of reduced width at its open upper end which thus has the form of a narrow slot 16 which may for example be about one and a half inches in width.

The chamber may be about four inches in width below its converging upper portion, and its lower end dips into the molten zinc bath 24. More particularly, the back wall 14, i.e. that wall which is more remote from the winding frame, and also the two end walls 11 preferably extend down into the bath for a depth of the order of six inches to serve as baffles which minimise the effect of surging of the molten metal in the bath and also hold back oxide and fluxing products.

On the other hand the front wall 12 preferably projects only a short distance, e.g. a distance of about one quarter of an inch, into the molten metal in order to permit accumulated dross to be readily scraped out from below

the wiping bed together with dross-entangled gravel from the latter. As this wall extends only a short distance into the molten metal, it is necessary to maintain the level of the bath substantially constant.

The said front wall 12 preferably consists of two detachable plates 12a and 12b arranged, the one above the other, and which when secured in position, form substantially gastight seals with each other and with the end walls 11. The lower end portion of the lower plate 12b is preferably bent horizontally outwards to form a flange 12c. These plates are detachable primarily for the purpose of facilitating the insertion and removal of the gravel or other bed 13 though they also facilitate the setting-up operation which involves passing the several wires upwardly from rollers 30 submerged in the bath and then through the chamber from which they pass in succession to the steadying rollers and the take-up or winding frame which are not shown.

The bed may for example consist of washed river gravel which has been graded by passing it through a one-quarter inch screen and by then discarding the grains which pass through a one-eighth of an inch screen.

After the several wires or strips have been led upwardly through the chamber, the gravel is inserted into the latter through the front opening formed preferably by the removal of the upper detachable plate 12a only. When a bed 13 of the required depth has been formed this plate is replaced.

As the specific gravity of gravel is considerably less than that of zinc, the bed thereof floats on the molten zinc bath, the depth of this bed being conveniently about six to twelve inches so that a free gas space of substantial depth remains within the chamber above the bed.

When it is required to remove the wiping bed from the chamber, both of the plates 12a and 12b are preferably detached.

The back wall 14 of the chamber is hollow and the lower end of the cavity 18 therein communicates with the interior of the chamber immediately above the surface of the molten zinc, by means of a slot 20 which extends substantially the full length of the wall.

The upper end of the cavity 18 is connected, e.g. by a pipe 22, to a source of a suitable reducing gas, e.g. coke oven gas, containing a small proportion of hydrogen sulphide. If desired, the ends of the pipe 22 may be connected to alternative gas supplies, both to ensure continuity in the event that one supply should be interrupted and to obtain more uniform distribution of gas within the chamber. The gas is preheated as it flows downwardly through the hollow back wall from which it passes through the slot 20 into the bottom of the chamber and is uniformly distributed along the full length thereof. This gas then flows upwardly through the interstices of the gravel bed and through the free space thereabove, and is finally discharged through the aforesaid narrow slot 16 at the top of the chamber, where it is preferably burned.

The pressure and rate of flow of the gas do not appear to be important though the flow should be steady and uniform and sufficient to exclude all air. The wiping bed ensures that the gas is uniformly distributed over the area of the chamber and in conjunction with the narrow discharge slot at the top of the chamber, it restricts the rate of flow. It has been found unnecessary to install apparatus to measure or control the gas flow, as with experience, the height and character of the exhaust flame provides an effective indication of uniformity of flow and distribution though suitable flow control apparatus may be used to obtain more constant operating conditions.

The wiping bed of gravel or the like not only serves to form a continuously self-adjusting and infinitely variable orifice for each wire or strip which extends there-through, but also it acts as an efficient vibration damper and so permits of higher throughput speeds than are

normally possible without detriment to the quality and uniformity of the zinc coating.

As previously mentioned, the wiping bed may be formed of gravel or any other suitable material in discrete condition.

The preferred characteristics of such material are that it has a specific gravity lower than molten zinc and it should be hard but not so brittle as to powder under the conditions of use and it should be non-wettable and unaffected by molten zinc. Also this material should be unaffected by strongly reducing atmospheres and the granules should have little or no tendency to stick together but should remain free to tumble under the conditions of use.

While ideally the granules would be spherical in shape, less regular forms have been found effective though sharply angular shapes are undesirable because although they may be free-tumbling to some extent, they tend to bind and tumble spasmodically.

Finally, the material is preferably one which is readily available in moderate quantities at a relatively low cost as is usually the case with water washed gravel which satisfies all of the foregoing requirements.

It is desirable that the free gas space above the wiping bed should be as high as possible consistent with adequate control of vibration in order to allow sufficient time for the reflow of the zinc to produce a uniform coating.

The presence of at least a small proportion of hydrogen sulphide in the gas appears to be essential for optimum results and although its function is not at present fully understood, it is considered probable that under the conditions obtaining in the gravel-gas chamber, H_2S is a more effective reducing agent than hydrogen, methane and carbon dioxide, and also that it favourably affects the surface tension of molten zinc.

In the course of experimental work it has been found that a gravel wiping bed as herein disclosed may normally be used for as much as one week or more with the periodic in-process removal of foreign accumulations from the bottom of the bed and its replacement by clean gravel at the top of the bed, whereas it is usually necessary for a charcoal bed to be adjusted or replaced every two to four hours so that labour costs are significantly reduced by the present invention while also it has been

found that throughput speeds may be substantially increased as compared with charcoal beds.

We claim:

1. The method of continuously wiping hot dipped galvanized wire or strip by continuously withdrawing said wire or strip vertically upwards from a bath of molten zinc through a wiping bed of discrete material which floats thereon, wherein a non-oxidizing gas which is non-reactive with said bed-forming material is passed continuously through the bed at a rate which is sufficient to exclude air from the bed, said gas containing hydrogen sulfide in an amount between about 100 and about 1,000 grains, sulfur content, per 100 cubic feet of gas at atmospheric pressure.

2. The method of continuously wiping hot dipped galvanized wire or strip by continuously withdrawing said wire or strip vertically upwards from a bath of molten zinc through a wiping bed which floats thereon, wherein, the said bed consists of free tumbling bodies composed of material which is hard, inert, substantially unaffected by temperatures up to 500° C., non-wettable by molten zinc and which has a specific gravity substantially less than that of molten zinc, and wherein a non-oxidizing gas which is non-reactive with said bed-forming material is passed continuously through the bed at a rate which is sufficient to exclude air from the bed and said non-oxidizing gas contains hydrogen sulfide in an amount between about 100 and about 1,000 grains, sulfur content, per 100 cubic feet of gas at atmospheric pressure.

References Cited

UNITED STATES PATENTS

264,535	9/1882	Hill	117—102 M
361,550	4/1887	Scarles	117—102 M X
1,773,495	8/1930	Newhall et al.	117—119 X
2,933,410	4/1960	Brightly, Jr.	117—66 X
3,513,018	5/1970	Taylor	117—102 M

ALFRED L. LEAVITT, Primary Examiner

J. R. BATTEN, JR., Assistant Examiner

U.S. Cl. X.R.

117—114 A, 119, 128; 118—123; 134—15