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2,333,579

FURNACE MUFFLE CONSTRUCTION

Filed May 26, 1942

2 Sheets-Sheet 1

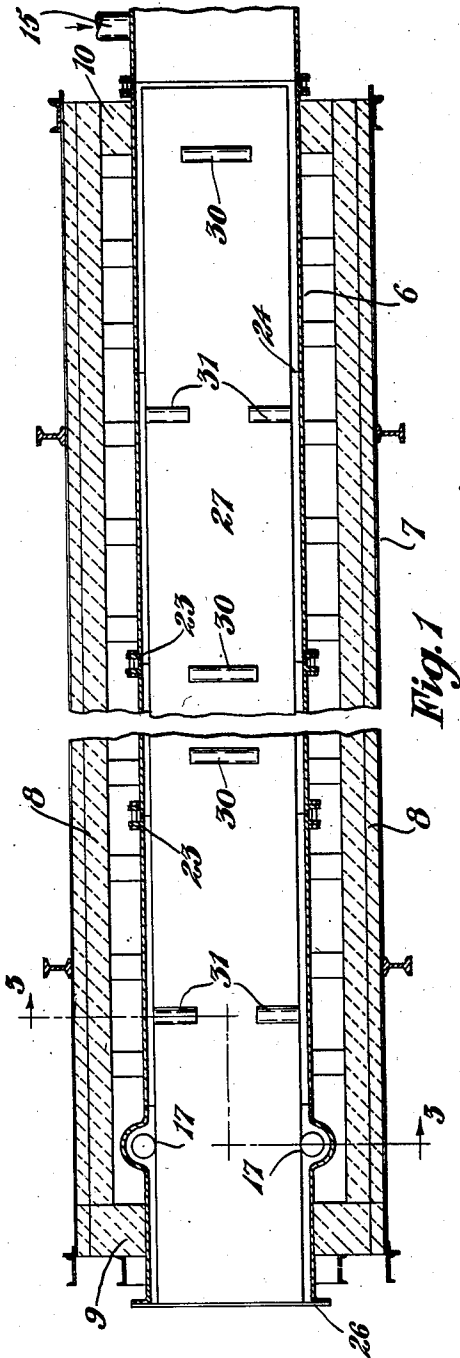


Fig. 1

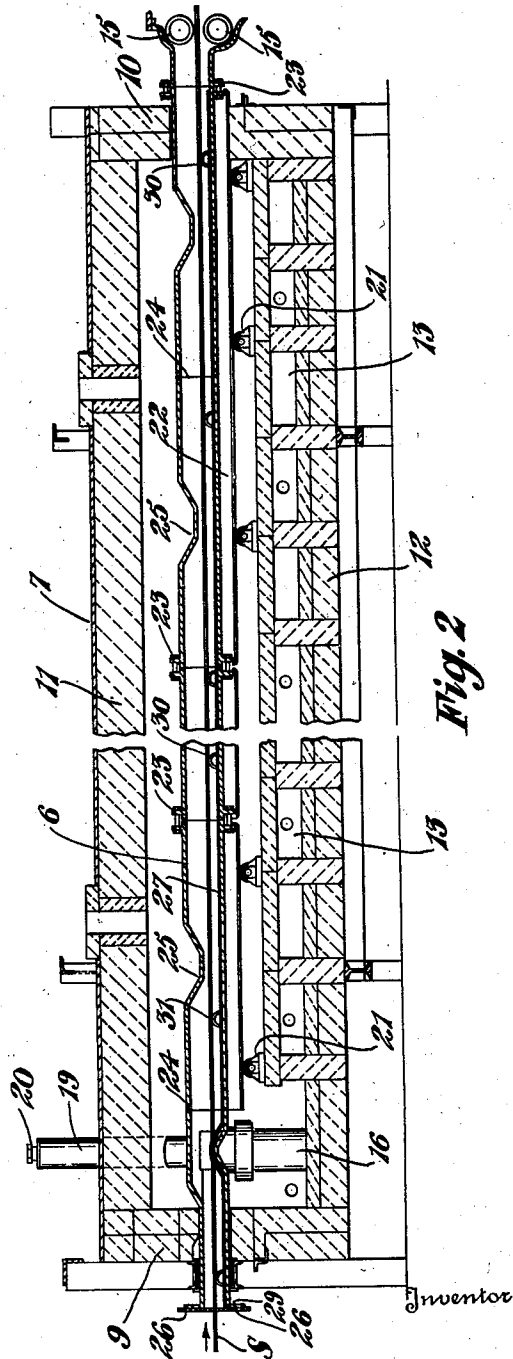


Fig. 2

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Fig. 3

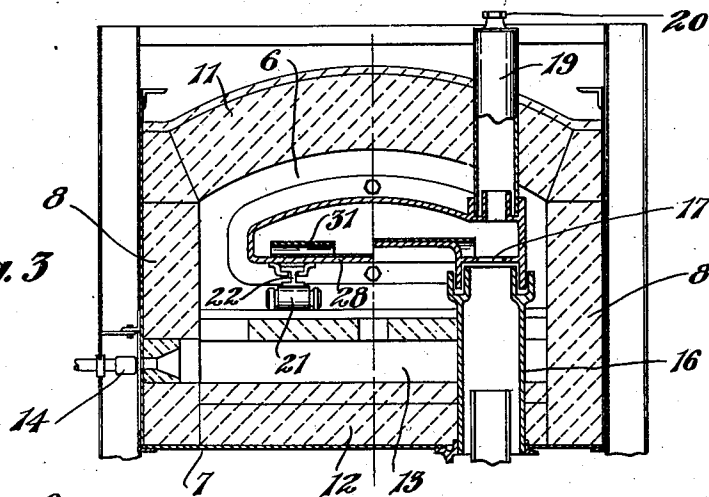
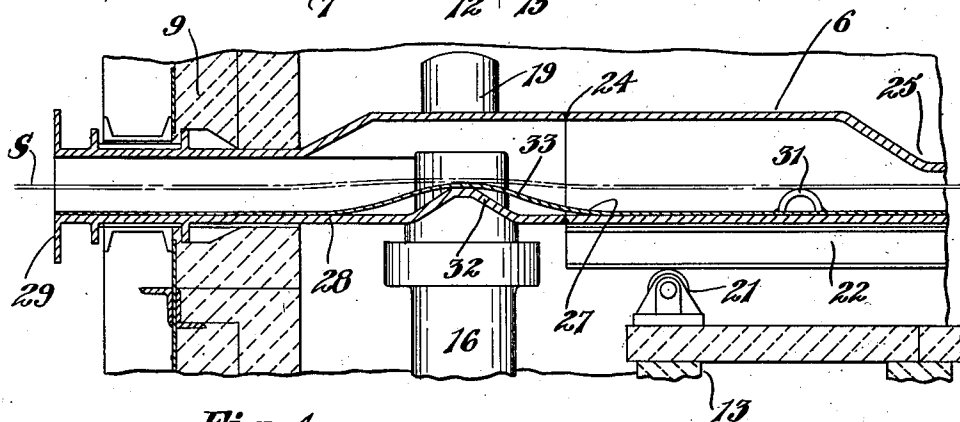


Fig. 4

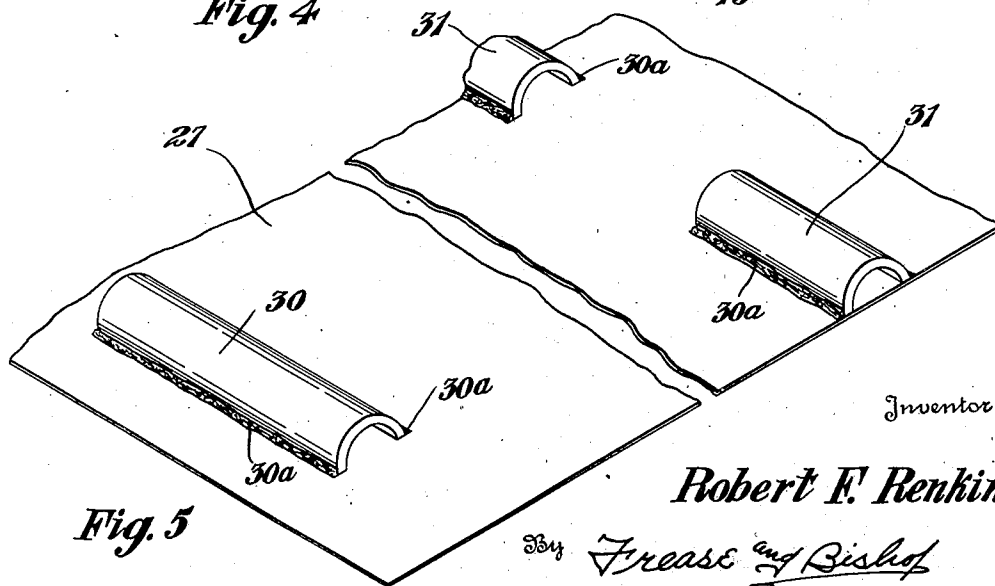


Fig. 5

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UNITED STATES PATENT OFFICE

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FURNACE MUFFLE CONSTRUCTION

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4 Claims. (Cl. 266—3)

The invention relates generally to an improved construction for an elongated furnace muffle, and more particularly to removable means for supporting a continuous steel strip or the like passing through the muffle of a gas pickling furnace.

In coating steel products, and more particularly, in coating steel strips, wire and the like with zinc, tin and other metals of low melting point, it is necessary to clean the surface of the steel product to prepare it for coating. The ordinary method of cleaning is to wet pickle the product in an acid bath, but it has been found desirable to effect the cleaning by means of a "dry pickle" treatment instead of the ordinary wet pickle treatment. A method of coating steel wire or strips including such "dry pickle" treatment is set forth in my prior Patent No. 2,245,225, issued June 10, 1941.

In subjecting the product (for example steel strip) to be coated to this "dry pickle" treatment, it is passed through a long closed muffle tube located within a heating furnace, and a heated controlled active atmosphere or "pickling gas" is passed through the muffle tube, preferably in a direction counter to the travel of the strip. This pickling gas is adapted for reacting with the scale and other surface impurities on the strip to form gases or vapors which are carried off with the pickling gas passing through the muffle. However, a certain proportion of these reaction products form a deposit which accumulates on the bottom of the muffle tube and which must be removed at intervals.

The muffle tube must be of low height so that the pickling gas passing therethrough will be kept close to the strip, and preferably baffles or deflectors depend at intervals from the top of the muffle tube and terminate close to the top surface of the strip for directing the pickling gas against the top of the strip. Also spacer supports must be provided on the bottom of the muffle tube for raising the strip above the bottom of the muffle tube to allow the pickling gas to circulate freely under the strip and in contact with its under surface.

In prior gas pickling furnace constructions known to me, these spacer supports have been in the form of longitudinally spaced transverse rows of fingers secured to and projecting upwardly from the bottom of the muffle tube, the fingers of each row being desirably staggered with respect to the fingers of adjoining rows.

Such fingers function very well at first to keep the strip raised and allow the gas to circulate

thereunder, but in a relatively short time the reaction products of the gas with the scale and impurities removed from the strip accumulate on the bottom of the muffle tube to such an extent as to require cleaning out.

Due to the fact that a typical muffle tube for a gas pickling furnace may be upwards of fifty feet long with a maximum inside height of about six inches for an inside width of about thirty inches and with the depending baffles terminating about one inch above the tops of the spacer fingers, it is almost impossible to clean out the accumulated deposit on the bottom of the muffle and between the fingers without removing the muffle tube from the furnace and tearing it down, and this condition is all the more aggravated because of the fingers being staggered.

Consequently, in order to thoroughly clean out the muffle in such a furnace, it is necessary to remove it entirely from the furnace and to tear it down, and even though the muffle is made up of sections bolted together and supported in the furnace on rollers, the sections are necessarily heavy castings of heat resistant metal, so that their removal from and replacement in a furnace fifty feet or more long is an extremely laborious and expensive operation involving tearing out one or both end walls of the furnace.

Accordingly, it is an object of the present invention to provide a novel and improved construction for an elongated furnace muffle, which permits cleaning out the muffle without disturbing its position in the furnace.

Another and more specific object is to provide novel means removable as a unit, for supporting a strip in spaced relation to the bottom of an elongated muffle.

A further object is to provide a novel removable bottom for an elongated muffle.

A still further object is to provide a novel removable bottom plate substantially coextensive in width and length with the muffle, and having spacer supports secured thereto for supporting the strip in spaced relation to said plate.

And finally, it is an object to provide a simple and inexpensive construction which accomplishes all of the foregoing objectives and which reduces to a minimum the time and labor involved in cleaning out a muffle.

These and other objects are accomplished by the parts, structures, arrangements and combinations comprising the present invention, a preferred embodiment of which is disclosed in the accompanying drawings and hereinafter described in detail.

While I have shown the invention as applied to the coating of strip steel, by way of example, it will be understood that the invention includes a construction to be used in the coating of other steel products such as sheets, strip sheets, rods or wires, without departing from the scope of the appended claims.

Referring to the drawings forming part hereof, Figure 1 is a fragmentary plan sectional view of a gas pickling muffle furnace embodying the present invention;

Fig. 2 is a longitudinal sectional view thereof;

Fig. 3 is a fragmentary enlarged transverse sectional view as on line 3—3, Fig. 1;

Fig. 4 is an enlarged fragmentary view similar to Fig. 2; and

Fig. 5 is a further enlarged fragmentary detached isometric view of the improved removable bottom plate for the muffle.

Similar numerals refer to similar parts throughout the several views of the drawings.

The gas pickling furnace shown by way of example in the accompanying drawings is adapted to continuously clean the surface of steel strip to prepare it for being coated with zinc after it passes through the pickling furnace.

Referring to Fig. 2, the steel strip 8 is shown passing through the gas pickling furnace in the direction of the arrow, and the strip is enclosed during all of its travel through the furnace by an elongated muffle tube indicated generally at 6.

The furnace is indicated generally at 7 and is of usual construction having the refractory side walls 9, end walls 10 and 11, and arched roof wall 12. The furnace hearth is made up of refractory checker work supported on the bottom wall 13 of the furnace, and forming a series of transverse heating chambers indicated at 14 into which suitable burners 15 (Fig. 3) are directed, preferably at opposite ends of alternate chambers, for heating the interior of the furnace.

In order to obtain the most effective cleaning or pickling action from the gas circulated within the muffle tube 6, the furnace should be maintained at a temperature of about 1200° to 1250° F. The pickling gas is preferably a mixture of gases including air, natural gas and chlorine in certain definite proportions, depending upon the capacity of the furnace, and the pickling gas is preferably circulated through the muffle in a direction counter to the flow of the strip.

As shown in the drawings, the pickling gas is introduced into the discharge end of the muffle through the inlet pipes 16 and is discharged from the muffle through the downtake outlet pipes 17 communicating with the sides of the muffle near its entrance end by means of ports indicated at 18. Preferably the outlet pipes 16 extend downwardly through the furnace and through a water seal (not shown), and a vertical pipe 19 is preferably provided extending upwardly from the muffle above each outlet pipe 16, and provided with a peep hole 20 at the top thereof.

The elongated muffle tube is preferably supported within the furnace chamber at longitudinal intervals by means of rollers 21, which rollably support beams 22 carried on the underside of the muffle tube. The muffle tube 6 is preferably made up of a number of tubular sections, which are bolted together at joints 23 and welded together at other joints 24.

Preferably, the elongated muffle tube is provided with depending baffle portions indicated at 25, at longitudinal intervals, for deflecting the pickling gas flowing through the muffle tube

downwardly against the upper surface of strip 8 passing in the opposite direction therethrough. As shown in Fig. 2, sealing plates 26 may be secured to the entrance end of the muffle above and below the strip in any suitable manner in order to prevent leakage of the pickling gas at that point. Suitable sealing means may also be provided beyond the gas inlet pipes 16 to prevent the escape of the pickling gas at the discharge end of the muffle.

The improved removable bottom plate for the elongated muffle is best shown in Figs. 4 and 5, the sealing plates 26 having been removed in Fig. 4. The bottom plate 27 is preferably 18-32 stainless strip about .05" thick, and is substantially co-extensive with the bottom wall 28 of the muffle. As shown in Figs. 1, 2 and 4, the bottom plate 27 extends from the entrance end 29 of the muffle tube to a point adjacent to the inlet pipes 16 at the discharge end of the muffle. The bottom plate 27 is provided with rounded spacer supports 30 and 31 secured as by welding indicated at 32a to its upper surface, and preferably staggered longitudinally of the bottom plate. These supports may be half sections of nickel-chrome cast pipe in order to be heat resistant, and support the moving strip 8 in spaced relation to the bottom plate with a minimum of friction.

As shown in the drawings, the bottom wall of the muffle tube 6 is provided at the outlet ports 17 with an upwardly projecting hump or raised portion 32, but the bottom plate 27 is of such thin flexible material as to easily curve over the hump 32, as indicated at 33 in Fig. 4.

Thus, as the pickling gas enters the muffle tube 6 through the inlet pipes 16, it is deflected downwardly onto the top surface of the strip at each of the depending baffles 25, so as to follow a somewhat sinuous path between the top wall of the muffle tube and the strip, and the gas passing under the strip between the strip undersurface and the bottom plate 27, follows a somewhat sinuous path through the staggered spacer supports 30 and 31 to the discharge ports 17.

After the strip has been run through the muffle 6 for some time, the reaction products of the pickling gas with the iron oxide scale and other impurities such as oil, dirt, lime and grease on the surface of the strip, gradually form an accumulated deposit on the bottom plate 27, which must be cleaned out from time to time in order to have the gas circulate properly. If the removable bottom plate 27 were not present and the spacer supports were secured directly to the bottom wall 28 of the muffle, as is the case with prior constructions, the only way the muffle tube could be cleaned out would be to reach in with an extremely long handled tool and pull or scrape out the foreign matter. However, if such spacer supports were staggered, as is customary and desirable, such method of cleaning out is precluded and the only thing left to do is to completely remove the muffle tube from the furnace and take it apart to clean the same.

With the present improved construction, all that is necessary to completely clean out the muffle tube is to remove the sealing plates 26, take hold of the end of the bottom plate 27, which is then easily accessible as shown in Fig. 4, and then pull out the whole bottom plate endwise with its spacer supports secured thereon, through the entrance end of the muffle tube. The bottom plate 27 collects substantially all of the accumulated foreign matter in the muffle and is easily

removed, cleaned, and then replaced in the same manner as it was removed.

Thus the improved construction is extremely simple and inexpensive and provides for entirely cleaning out the muffle with a minimum of time and labor.

I claim:

1. Muffle construction for a gas pickling furnace including an elongated muffle tube of low height extending continuously through the furnace and adapted for enclosing a metal strip passing therethrough, baffles depending at intervals from the top of said muffle tube and terminating closely adjacent to said strip, and an endwise removable bottom plate carried on and substantially coextensive with the bottom wall of said muffle tube, said bottom plate having upwardly projecting longitudinally staggered spacer supports for supporting the strip in spaced relation to said bottom plate.

2. Muffle construction for a gas pickling furnace including an elongated muffle tube of low height extending continuously through the furnace and adapted for enclosing a metal strip passing therethrough, and an endwise removable bottom plate carried on and substantially coextensive with the bottom wall of said muffle tube, said bottom plate having upwardly projecting longi-

tudinally staggered spacer supports for supporting the strip in spaced relation to said bottom plate.

3. Muffle construction for a gas pickling furnace including an elongated muffle tube of low height extending continuously through the furnace and adapted for enclosing a metal strip passing therethrough, baffles depending at intervals from the top of said muffle tube and terminating closely adjacent to said strip, and an endwise removable bottom plate carried on and substantially coextensive with the bottom wall of said muffle tube, and rounded spacer supports secured to the upper surface of said bottom plate at longitudinally staggered locations for supporting the strip in spaced relation to said bottom plate while permitting gas to circulate between the bottom plate and the strip.

4. In an elongated tubular muffle for gas treating a strip enclosed therein, a bottom plate movably supported on the bottom wall of the muffle and removable endwise therefrom, said bottom plate having upstanding supports secured thereto at longitudinal intervals for supporting said strip and permitting gas to circulate thereunder between said strip and said bottom plate.

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