April 22, 1930. F. J. WINDER 1,755,755

APPARATUS FOR NORMALIZING AND PICKLING METALS

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Fig. 1.

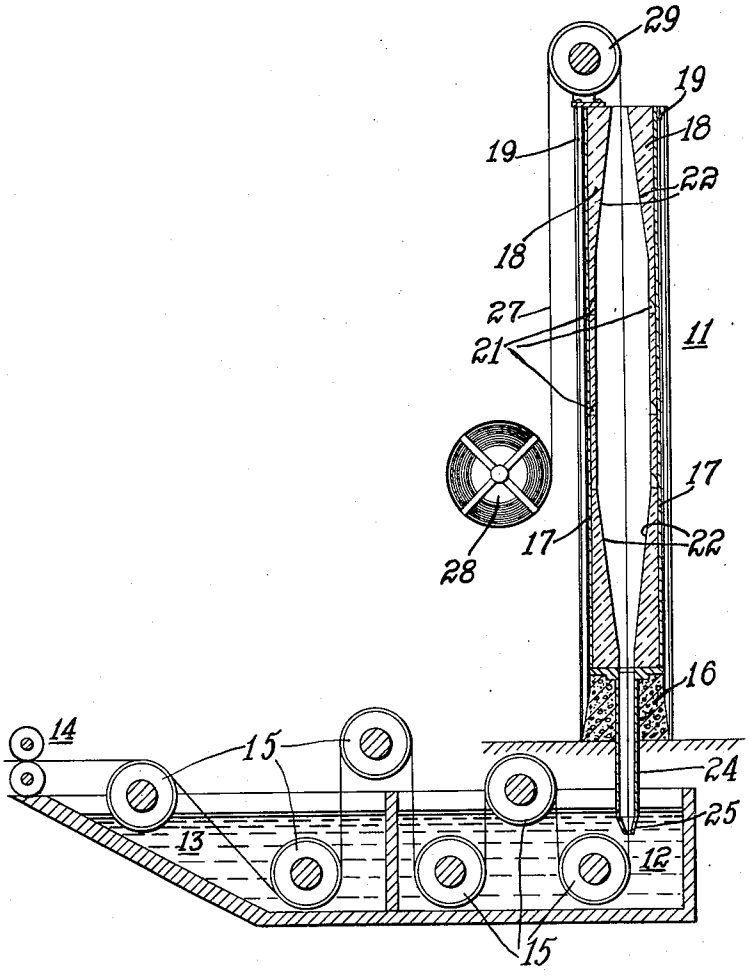
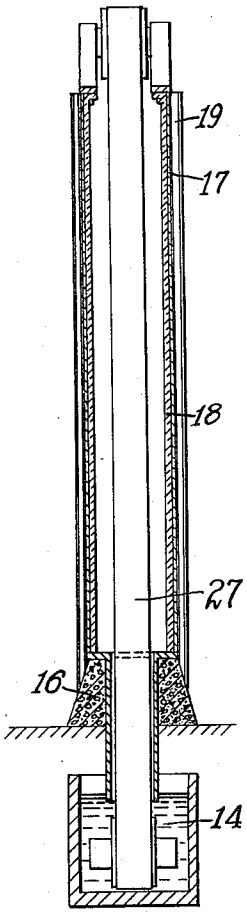


Fig. 2.



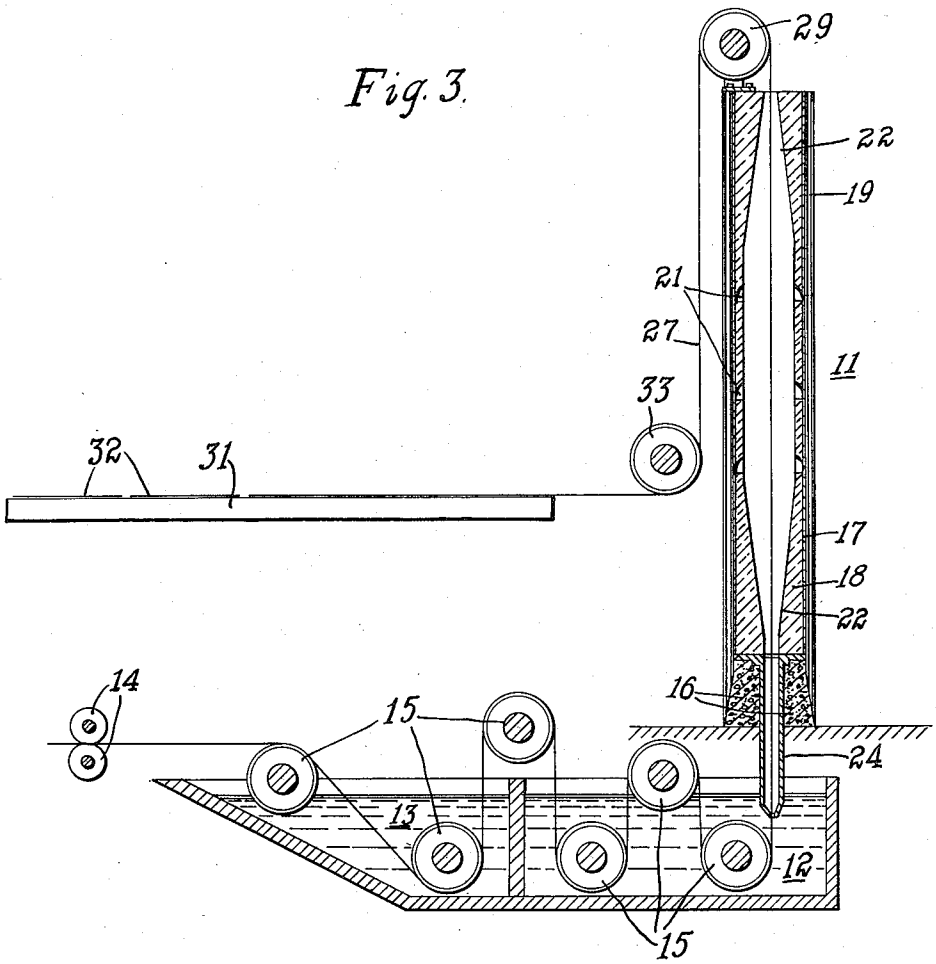
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Fig. 3.



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UNITED STATES PATENT OFFICE

FRANK J. WINDER, OF BRACKENRIDGE, PENNSYLVANIA, ASSIGNOR TO ALLEGHENY STEEL COMPANY, A CORPORATION OF PENNSYLVANIA

APPARATUS FOR NORMALIZING AND PICKLING METALS

Application filed March 16, 1926. Serial No. 262,082.

This invention relates to treating metals and more particularly to a continuous process and apparatus for normalizing and pickling metals.

An object of this invention is to provide a continuous process and apparatus for normalizing and pickling metals that shall render the production of such metals less expensive.

Another object of this invention is to provide a continuous process and apparatus for normalizing and pickling metals that shall be simple, rugged and so arranged as to occupy considerably less space than has heretofore been required by such an apparatus.

A further object of this invention is to provide a continuous process and apparatus for normalizing and pickling metals, wherein the normalizing apparatus is so constructed as to permit the metal being treated to pass therethrough by means of its own weight, eliminating the need of conveyors for drawing the metal through the normalizing apparatus and thereby preventing undesirable marking of such metals as is the case where conveyors are employed.

A still further object of this invention is to provide a normalizing apparatus having a plurality of zones of different temperatures that shall heat metals to be treated sufficient to normalize such metals and to reduce the temperature of such metals after the same has been normalized during the passage of the metals through the normalizing apparatus.

Other objects lie in the novel manner in which both the normalizing and pickling apparatus are positioned for carrying out a continuous process in a comparatively small space by a continuous mechanical means and thereby eliminating manual labor that has been heretofore required for carrying out a number of the operations.

In the drawings, Figure 1 is a sectional view of an apparatus embodying the invention, Fig. 2 is a sectional view taken along the longitudinal medial line of Fig. 1 and Fig. 3 is a sectional view similar to Fig. 1 showing a slightly different embodiment of the invention.

The invention comprises in general a normalizing apparatus 11, a pickling bath 12, a washing bath 13 and means 14 for drawing sheets or strips to be treated through the normalizing apparatus 11 and baths 12 and 13.

The normalizing apparatus comprises a vertical stack or furnace designated in its entirety by 11. The stack is supported by suitable concrete blocks 16 and comprises outer steel walls 17 and an inner lining of any suitable refractory material, as shown at 18. The outer walls 17 are provided with suitable supports or buck-stays 19, the lower ends of which are embedded in the concrete blocks 16 and which extend upwardly therefrom, the entire height of the walls.

The inner intermediate portion of the furnace is provided with a plurality of spaced recesses 21 for receiving gas burners, not shown. The burners are positioned within the recesses 21 so as to produce radiant heat instead of the usual flame heat. The upper and lower portions of the furnace are tapered, as shown at 22. The upper tapered surface 22 will act in the manner of a chimney to draw the product of combustion upward and thereby produce an initial or pre-heating zone for heating the material passing therethrough to the heating or normalizing zone adjacent the burners which are placed in recesses 21.

The bottom of the furnace or normalizing apparatus 11 is connected with a pickling bath 12 disposed therebelow by means of a suitable boxing 24 constructed from an alloy having the necessary characteristics to withstand the action of the bath 12. This boxing 24 extends into the bath 12 forming a seal and preventing the passage of gases into the bottom of the furnace. The lower tapered portions 22 of the furnace will tend to act in reverse to the upper-tapered portions 22 and reduce the tendency of the moving gases to cause a pull or vacuum at this point. The seal formed by the boxing 24 prevents any appreciable amount of vapor in the pickle bath from rising. The lower end 25 of the boxing 24 is preferably tapered to reduce the cross sectional area of the opening therein.

It can be seen from the above that the bottom of the furnace is sealed and thereby the draft of the furnace is limited to the flow of

the gases through the furnace. This draft is sufficient to draw the burning gases upwardly to the zone formed by the upper tapered portions 22, initially heating or pre-heating the material passing therethrough, while the zone formed by the lower tapered portion 22 is substantially free from burning gases and serves as a cooling zone for the material as it passes from the heating or normalizing zone disposed within the intermediate portion between the tapered portions.

The pickle bath 12 and washing bath 13 are provided with a plurality of idle rollers 15 disposed in staggered relation for guiding the material being treated through the baths and since the rollers are in staggered relation, the material being treated passes under and over alternate rolls in such a manner as to bend the material in opposite directions for loosening scale thereon and assisting the pickle bath in removing such scale and assisting the washing bath in rinsing the acid from the material.

A suitable means such as press rolls 14 are provided for drawing the material through the normalizing apparatus and the pickle and washing baths.

In practicing one form of the invention, as illustrated by Fig. 1, a sheet or strip 27 disposed on a calender or supply roll 28 is positioned at some adjacent point convenient to handle and supported in any suitable manner, not shown, that will permit the calender 28 to rotate. The forward end of the sheet or strip is then drawn upward and passed over a friction drum 29 supported by the top of the normalizing apparatus adjacent the furnace inlet. The strip or sheet by virtue of its own weight will straighten out and suspend in the furnace continuing down through the pre-heating, heating and cooling zones and on through the sealing boxing 24 to the pickle bath 12. The sheet or strip is then positioned under and around the various idle rolls associated with the pickle bath and washing bath and between the press rolls 14. The press rolls 14 are provided with a power driven means, not shown, for drawing the material from the calender 28 over the friction roll 29 through the normalizing apparatus and the baths 12 and 13.

Fig. 3 illustrates a slightly different embodiment of the invention, wherein a table 31 is provided for pinning or welding sheets or strips to be treated, together. This embodiment provides means whereby sheets or strips coming from the rolling mill may continue on to the normalizing and pickling processes. As the sheets 32 pass on the table 31, they are either pinned together or welded together to form a continuous sheet or strip and are passed under an idle roll 33 up over a friction roll 29, which may or may not be power driven and continues into the normalizing apparatus in the same manner as that described by Fig. 1.

The sealing boxing 24, idle rolls 33 and bath containers are constructed from material capable of withstanding the action of the acid bath. Such material may be an alloy containing a high per cent of chromium such as that known in the trade as "ascoloy".

The normalizing apparatus may be of any predetermined height and preferably of such height that a sufficient preliminary or pre-heating zone between the upper tapered portions 22 is provided through which the sheets to be normalized must pass before being subjected to the normalizing temperature and to provide a relatively cool zone through which the sheets must pass before being subjected to the pickle bath; in other words, the furnace is preferably of a height sufficient to allow the sheets or strips to pass therethrough to be pre-heated therein, then pass to the normalizing temperature, maintained at that temperature the required length of time and then cooled within the furnace and sealing boxing therebelow before being subjected to the pickle bath.

It will be seen from the above that I have provided an apparatus for continuously normalizing and pickling sheets or strips; that such apparatus is simple and rugged and requires less floor space than any other type of furnace measured in terms of square feet of floor per tons of sheets treated; that this apparatus is simple in design eliminating the hazard, expense and undesirable marking from moving conveyors through the normalizing apparatus; that a more efficient fuel consumption is obtained by virtue of the natural tendency of gases to rise when hot, thereby effecting better preliminary or pre-heating than would a horizontal furnace; that the present furnace may be built for much less cost per ton of material heated; that the present apparatus eliminates the necessity of labor to handle the complete unit more so than is now possible with other types of furnaces, all handling in pickle house, labor and transportation being eliminated; and that the depreciation of the present equipment is considerably less than the existing types. Other advantages will be apparent to those skilled in the art such as bending the sheets in one way and then the other during the passage of such sheets through the pickle bath and thereby loosening the scale thereon. Other changes, modifications, substitutions, additions and omissions may be made in the invention without departing from the spirit and scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In an apparatus of the character described, a normalizing furnace consisting of a base, outer metal walls secured to said base,

an inner refractory lining for said walls, said lining being constructed to provide a central portion having burner receiving recesses and upper and lower tapering extremities, whereby an incoming metal sheet is successively per-heated, fully heated and partially cooled.

2. In an apparatus of the character described, a normalizing furnace consisting of a base, outer metal walls secured to said base, an inner refractory lining for said walls, said lining being constructed to provide a central parallel furnace portion having burner receiving recesses and upper and lower tapering furnace portions, whereby an incoming metal sheet is successively pre-heated, fully heated and partially cooled during its passage through the furnace.

3. In an apparatus of the character described, a normalizing furnace consisting of a base, outer metal walls secured to said base, an inner refractory lining for said walls, said lining being constructed to provide a central portion having burner receiving recesses and upper and lower tapering extremities, whereby an incoming metal sheet is successively pre-heated, fully heated and partially cooled, and a sealing boxing extending from the lowermost part of the furnace for maintaining said furnace free from exterior rising gases.

4. In an apparatus of the character described, a normalizing furnace consisting of a base, outer metal walls secured to said base, an inner refractory lining for said walls, said lining being constructed to provide a central parallel furnace portion having burner receiving recesses and upper and lower tapering furnace portions, whereby an incoming metal sheet is successively pre-heated, fully heated and partially cooled during its passage through the furnace, and a sealing boxing extending from the lower tapered furnace portion into a subjacent bath, whereby said furnace is maintained free from the entrance of gases formed beyond its limits.

5. An apparatus for normalizing sheet metal including a vertical furnace having an outer metal wall and an inner lining of refractory material, the inner portion of the said normalizing apparatus terminating at each of its ends in a tapered reduced portion, a plurality of spaced recesses in the refractory lining between the said tapered reduced portions for the reception of burners therein and a sealing boxing for the end of the lower reduced portion.

In testimony whereof, I have hereunto subscribed my name this 24th day of February, 1928.

FRANK J. WINDER.