

Aug. 25, 1942.

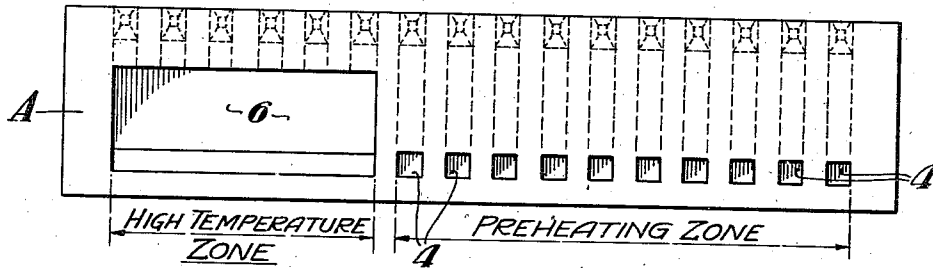
W. J. BOYLE

2,294,019

METHOD OF HEATING TUBES AND THE LIKE FOR UPSETTING

Filed Nov. 22, 1941

FIG. 1.



TO UPSETTING PRESS

FIG. 2.

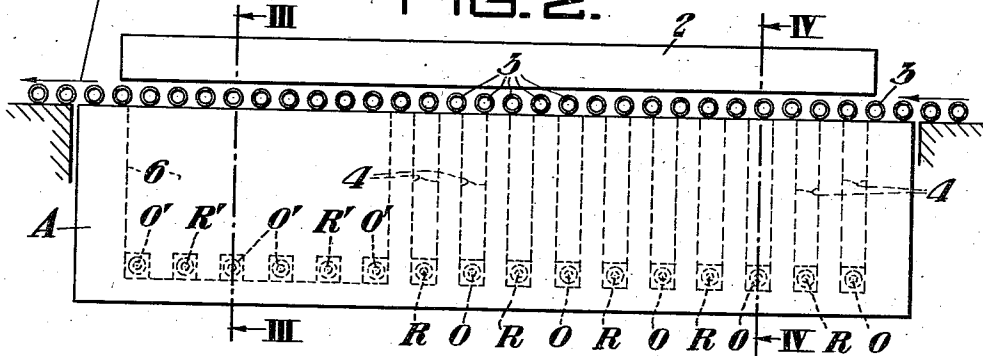


FIG. 3.

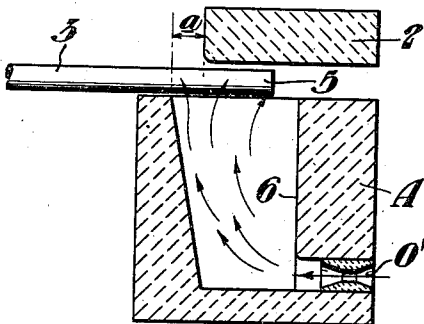


FIG. 4.

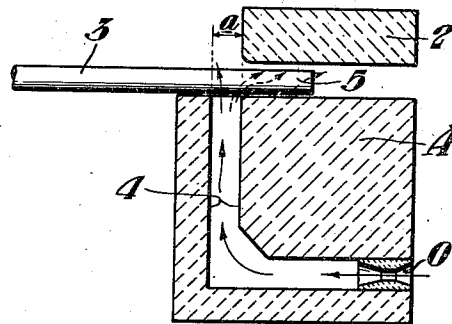
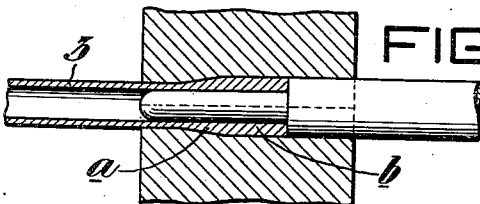


FIG. 5.



Inventor:
WALTER J. BOYLE,
by: John E. Jackson
his Attorney.

UNITED STATES PATENT OFFICE

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METHOD OF HEATING TUBES AND THE
LIKE FOR UPSETTINGWalter J. Boyle, McKeesport, Pa., assignor to
National Tube Company, a corporation of New
Jersey

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6 Claims. (Cl. 263—52)

This invention relates to improvements in the art of upsetting pipes, tubes and the like, and more particularly to the method of heating the same prior to the upsetting operations.

Such tubes and the like are usually upset at their ends, as in the manufacture of oil well drill tubing and casing, and for such operations, the tubes are heated for predetermined portions of their lengths to a forging temperature and then subjected to the action of an upsetting press. It is desired to heat the tube with substantial uniformity over the length thereof required for the upset, including the fadeaway portion between the enlargement and the remainder of the tube body.

The method of heating usually employed has been found objectionable, first, because of the production of a hard tight scale on the tube, and second, because of the difficulty encountered in obtaining uniformity of heating. If the flame is intense enough to adequately heat the enlarging portion being upset, it is too severe and burns the outer thinner end of the tube, and if of proper intensity to correctly heat the end portion, it is inadequate to heat the fadeaway and thicker portions to a sufficient degree.

Such prior practice generally comprised heating the tube end including the fadeaway portion at the same time, but failed to attain uniformity and the hard scale formation was not avoided, and the resulting upset portion of the tube too frequently had a creased and cracked fadeaway portion with scale inclusions which seriously impaired the strength and prevented the production of a homogeneous internal metal structure. Such practices result in many rejections which are only salvaged by reheating and reworking, and result in materially increased production costs.

It is a prime object of my invention to heat the tubes and the like by initially and separately heating the fadeaway portion, and then heating the remainder of the tube end and said fadeaway simultaneously, whereby I am enabled to produce uniform heating throughout and thereby improve the subsequent upsetting operation as well as the structure of the final product.

I also contemplate in such a process, the heating of said tubes by means of both oxidizing and reducing flames, in such a manner as to prevent the formation of hard tight scale at the upsetting portion including the fadeaway portion, thereby enabling the forging of the upset without included scale.

Additional objects and advantages will become

apparent from the following description taken in connection with the accompanying drawing, wherein:

Fig. 1 is a top plan view of a heating furnace which may be employed in the practice of my invention, with the cover thereof removed;

Fig. 2 is a front elevational view thereof;

Figs. 3 and 4 are enlarged cross sections taken on the line III—III and IV—IV of Fig. 2, respectively illustrating the heating means of the furnace; and

Fig. 5 is a sectional view showing the final upsetting operation on a tube heated in the manner of the present invention.

Referring to the drawing, A designates a furnace of the open type, having a plurality of flues or risers opening in the upper or top face of the furnace, said flues each having a burner connected with the usual supply of air and fuel, and being so regulated as to produce the desired heat for the furnace.

A cover 2 is spaced above the upper face of the furnace for the passage of tubes or pipes 3 between said cover and furnace, said tubes or pipes being conveyed through the furnace by any suitable conveyor means, and being supported to have the ends thereof pass over the series of aligned heating flues.

In order to provide uniform heating of the tube portions to be upset, my improved method includes the steps of first heating the fadeaway portions thereof, followed by the application of a high heat to the entire tube end portions to be upset, including said fadeaways. The fadeaway portion *a* of the tube is the region of emergence of the upset portion *b* of the tube into the body of the tube of original or lesser thickness, the final upsetting operation being illustrated in Fig. 5.

In the furnace A illustrated, 4 designates a series of aligned vertical heating flues disposed along the front wall of the furnace over which the fadeaway portions *a* of the tubes 3 pass during their conveyance through said furnace. The length of the tube end portions 5 extending into the furnace is regulated in any suitable manner in accordance with the predetermined tube length necessary for the subsequent upset.

Upon firing the flues 4 by suitable burners or the like, the heat therefrom is applied directly and primarily to the fadeaway portions *a* of tubes 3, as indicated by the full-line arrows of Fig. 4, and said heating will be accompanied by a secondary heating of somewhat lesser degree of the end portions 5 of said tubes, as in-

indicated by the dotted-line arrows of Fig. 4. As a result of said heating, the fadeaway portions *a* are brought up to an initial preheat or temperature higher than that of the end portions 5, but preferably less than forging temperature, during the travel of the tubes through the preheating zone comprising said flues 4, as indicated in Fig. 1.

The tube ends and fadeaways next pass into the high temperature zone of the furnace as shown in Fig. 1, said zone having one or more vertical flues 6 fired by suitable burners or the like to simultaneously heat the fadeaway *a* and end portions 5 to forging temperature, the residual temperature in the preheated fadeaways enabling the final uniform heating of the entire tube ends to be upset. Since the extreme ends of the tubes heat more rapidly than other tube portions, the proper preheating of the fadeaways makes it possible to bring the said extreme ends and fadeaways up to final temperature together to provide the desired substantial uniformity. The application of the final heating step is particularly shown by the arrows of Fig. 3, following which the tubes pass to an upsetting press as indicated at the left-hand side of Fig. 2.

A further and important feature of my invention has to do with the prevention of the formation of tight hard scale during the said heating of the tubes. In former heating practices, oxidizing heat or flame was used to secure complete penetration and heating, and such conditions produced scale which interfered with upsetting operations and equipment. The presence of such scale at the fadeaway portions of the tubes is particularly bad, since the same becomes included and embedded in the metal upon upsetting, producing surface and other defects which must be removed by grinding, reheating and reupsetting. Further, in some upsetting operations it is necessary to reheat and upset several times before the final product is produced, and under the hard scale-forming practices heretofore, scale was added to scale during each reheat, building up to a point where the upsetting operation became too costly if not impossible.

Under my improved method, the preheating of the fadeaway portions *a* is accomplished without such undesirable scale formation by passing the fadeaway alternately through reducing and oxidizing flames or atmospheres. For example, the furnace A may have burners O and R, as shown in Fig. 2, firing alternate flues 4 while regulated to supply oxidizing and reducing flames or atmospheres respectively.

The action thus provided results in the formation of a softer less adherent scale by the reducing flame or atmosphere of the alternate burners R, followed by frequent subjection of the tubes to oxidizing flames or atmospheres, function to blow off and remove the loose scale by pressure and by the differences in heat conductivity of the scale and the metal of the tubes. Likewise, the final heating in the high temperature zone includes a series of oxidizing burners O' with at least one reducing burner R', whereby the desired scale removal is maintained for the fadeaways, and any scale tending to form on the tube ends 5 will be similarly treated.

The elimination of hard tight scale formation, which commonly accompanied the heating of the tube by the former practice has been found to increase the life of the upsetting dies

as much as 200-percent over the life thereof under the said former heating practice. Further, the scale checks or formations accompanying the former heating practice necessitated grinding to remove the same, and in many instances it was necessary to remove an appreciable portion of the tube wall, making it necessary to reheat and again upset the tube in order to restore the desired wall thickness and diameter. It has been found in practice that under the prior manner of heating, as high as 50-percent of the upsetting operations required reheating and further upsetting in order to eliminate the said scale checks and defects.

Under the practice of my invention, the necessity for such reheating and further upsetting by reason of scale checks has been entirely eliminated, and hence I have materially decreased the cost of production, increased the life of the upsetting dies, and increased the production rate of upset tubes and the like.

Various changes and modifications are contemplated within the scope of the following claims.

I claim:

1. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof, and then simultaneously heating the end portion including the preheated fadeaway, whereby the entire tube end portion to be upset is heated to substantially uniform temperature.

2. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof to less than forging temperature, and then simultaneously heating the end portion including the preheated fadeaway to a forging temperature, whereby the entire tube end portion to be upset is heated to substantially uniform temperature.

3. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof by the application of heat primarily to said fadeaway accompanied by a secondary heating of the tube end portion to a lesser degree, and then simultaneously heating the end portion including the fadeaway, whereby the entire tube end portion to be upset is heated to substantially uniform temperature.

4. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof in an atmosphere which is alternately oxidizing and reducing in character, and then simultaneously heating the end portion including the preheated fadeaway in a similar atmosphere, whereby the entire tube end portion to be upset is heated to substantially uniform temperature without hard scale adhering thereto, particularly at said fadeaway portion.

5. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof to less than forging temperature in an atmosphere which is alternately oxidizing and reducing in character, and then simultaneously heating the end portion including the preheated fadeaway to a forging temperature in a similar atmosphere, whereby the entire tube end portion to be upset is heated to substantially uniform temperature without hard

scale adhering thereto, particularly at said fadeaway portion.

6. The herein described method of heating tubes and the like prior to upsetting an end portion thereof, consisting in preheating the fadeaway portions thereof to less than forging temperature by the alternate application of a reducing flame followed by an oxidizing flame, applying said heating directly to said fadeaway and for a secondary heating of the tube end portion 10

to a lesser degree, and then simultaneously heating the end portion including the fadeaway to a forging temperature by the application of oxidizing heat in the presence of at least one reducing flame, whereby the entire tube end portion to be upset is heated to substantially uniform temperature without hard scale adhering thereto, particularly at said fadeaway portion.

WALTER J. BOYLE.