Jan. 15, 1957 V. H. FERGUSON 2,777,684

HEAT TREATING APPARATUS

Filed July 13, 1953 2 Sheets-Sheet 1

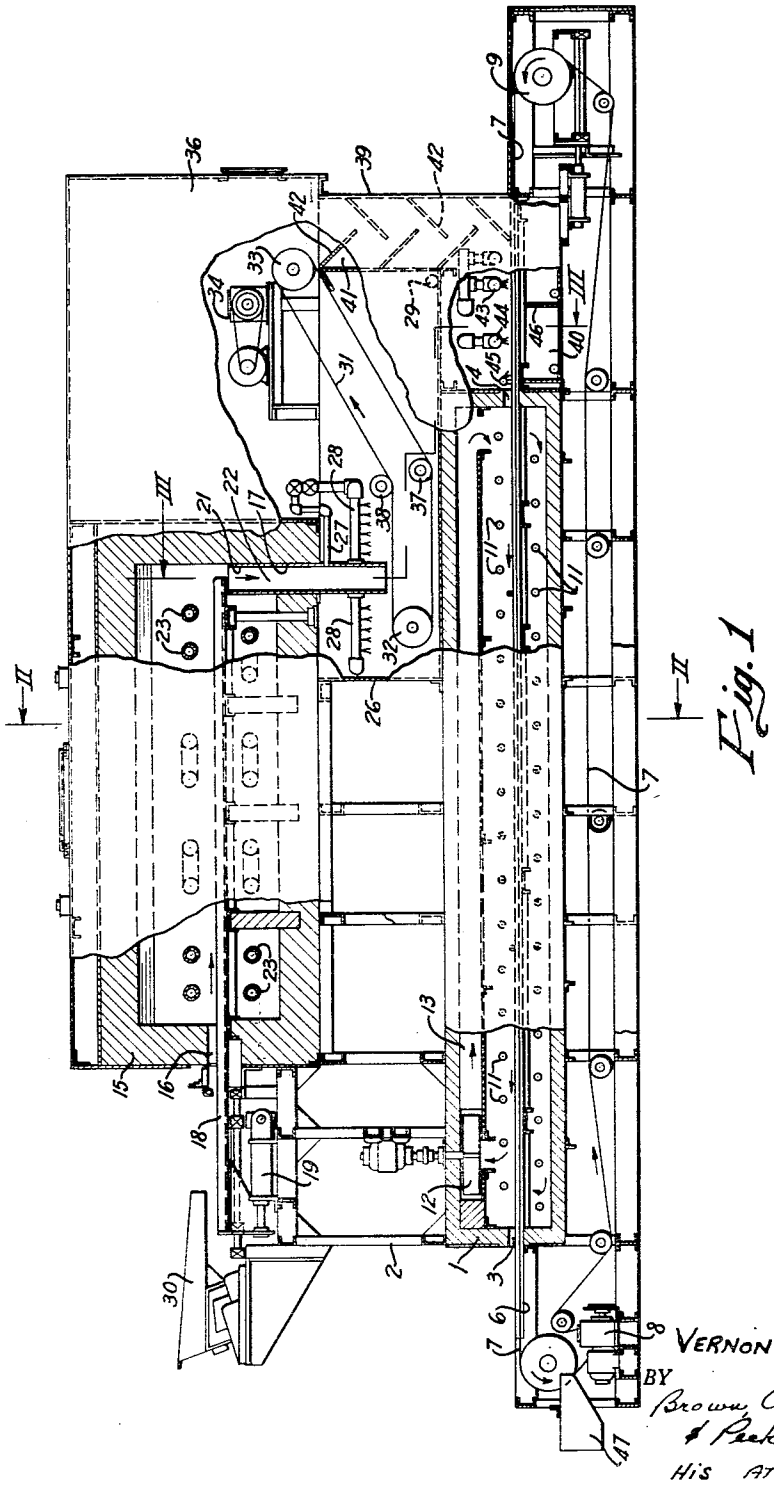


Fig. 1

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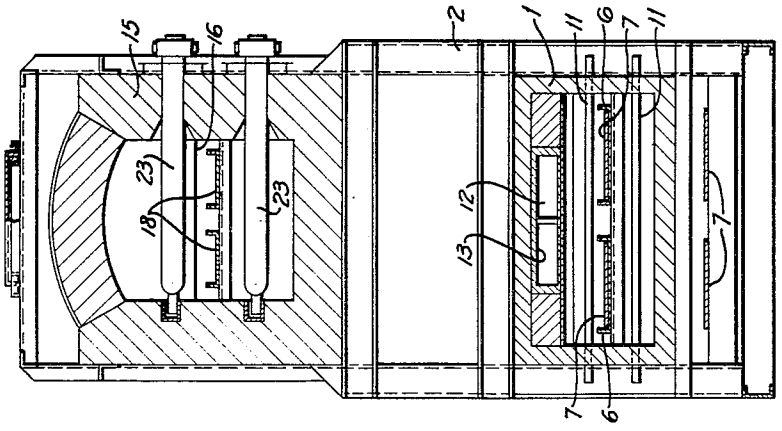


Fig. 2

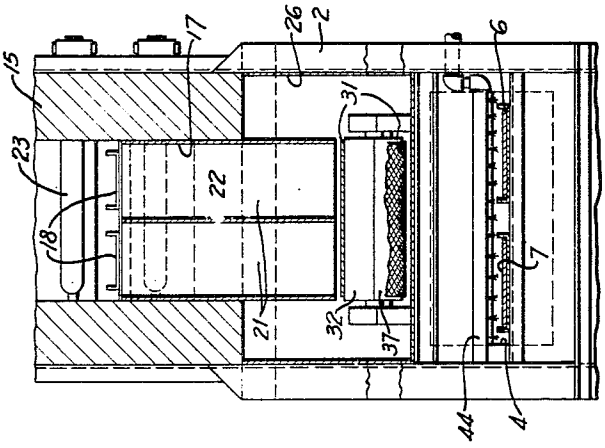


Fig. 3

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HEAT TREATING APPARATUS

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Application July 13, 1953, Serial No. 367,417

1 Claim. (Cl. 266—4)

This invention relates to heat treating apparatus for metal articles.

It is among the objects of this invention to provide such apparatus which can be loaded and unloaded from the same end, which is compact and requires a minimum of floor space, which is entirely automatic in operation, and in which a plurality of different types of articles can be heat treated simultaneously if desired but without mixing.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is a side view of the apparatus, with parts broken away to show the inside; and

Figs. 2 and 3 are vertical cross sections taken on the lines II—II and III—III respectively, of Fig. 1.

Referring to the drawings, a tunnel type tempering furnace 1 is mounted in the lower part of a structural steel framework 2. The furnace has an exit 3 at the front end of the apparatus and an entrance 4 at the rear end. A conveyor of any suitable form is provided for transporting articles through the furnace. For example, extending through the entrance and exit openings and the furnace there may be a pair of parallel horizontal channels 6, in each of which there is an endless conveyor belt 7 of metal mesh. The belts are moved forward through the furnace by any suitable driving mechanism 8 supported in an extension of the framework 2 in front of the furnace. The lower lengths of the belts travel back beneath the furnace and up around takeup drum 9 mounted in the framework some distance behind the furnace. The inside of the furnace is heated in any convenient manner, such as by electric heaters 11. An electric fan 12, inside the front part of the furnace near its roof, draws the furnace atmosphere up to it and then forces it back through a duct 13 to the back of the furnace for recirculation.

Mounted in the framework 2 some distance above the furnace is a tunnel type hardening furnace 15, which has an entrance 16 at its front end and an exit 17 at its rear end, preferably extending through the bottom of the furnace. The conveyor in the upper furnace preferably is shown as a shuffle conveyor formed from two parallel elongated trays 18 that are connected at their front ends to a fluid pressure operated reciprocating mechanism 19 carried by the framework in front of the upper furnace. The trays are moved slowly to the rear and then jerked forward. The inner or rear ends of the trays terminate above a chute 21 that extends down through the furnace exit and is divided into two parts by a central vertical partition 22. The partition keeps the metal articles from the two trays from mixing together as they fall through the chute. The furnace is heated in any suitable way, such as by U-shape radiant tubes 23, to which burners and outlet pipes (not shown) are connected in a conventional manner.

Mounted on top of the rear end portion of the lower furnace 1 is a quenching tank 26 that extends forward beneath the back portion of the upper furnace and rearwardly behind the lower furnace. The tank is kept nearly full of quenching liquid, and the lower end of chute 21 extends down into the liquid. Between the liquid and the upper furnace, the side of the chute may be provided with openings connected to a pipe 27 that delivers to the chute the particular atmosphere that it may be desired to maintain in this apparatus. In some cases, if desired, pipe 27 can be used for withdrawing from the chute any vapors rising from the liquid in the quenching tank. At opposite sides of the tank there also are perforated pipes 28, through which the quenching liquid is expelled for moving the hot liquid away from the lower end of the chute and for circulating the liquid in the tank. Liquid is drawn out of the opposite end of the tank through outlet 29 for delivery to pipes 28.

Articles to be heat treated can be fed to the upper conveyor in any suitable way, such as by vibrating feeders 30. These articles are carried through the upper furnace 15 by the reciprocating trays 18. When they reach the inner ends of the trays, they fall through chute 21 into the liquid in quenching tank 26, where they land on a conveyor, such as an endless mesh belt 31 that passes around a drum 32 journaled in the bottom of the front part of the tank and also around a driving drum 33 mounted above the back wall of the tank. This upper drum is rotated by drive mechanism 34 mounted above the tank in a housing 36 that separates the tank from the outside atmosphere. A length of the belt is maintained horizontal in the tank by means of a small drum 37 that engages the top of the lower portion of the belt, and by means of small rollers 38 that engage the top of the belt at its opposite sides.

The quenched articles fall off the upper or rear end of the tank conveyor and through an opening in the bottom of housing 36 into a vertical chute 39, the front wall of which is formed by the rear wall of tank 26. The chute extends down into the back part of a small cleaning tank 40 behind the lower furnace and below the projecting rear end of the quenching tank. The chute is divided centrally by a vertical partition 41, since the apparatus illustrated is capable of treating two different types of articles simultaneously. The articles falling down the chute land on the conveyor belts 7 that travel forward through the lower furnace. To break the fall of the articles in order to prevent them from bouncing around and off the conveyor, staggered inclined baffles 42 may be mounted in the chute. As these articles are carried forward toward the furnace by the conveyor, they are first cleaned, such as by vapor or by a suitable cleaning liquid. Thus, they may be given an alkali wash from spray pipes 43 above them and then be washed with hot water from another spray pipe 44 close to the furnace. A small perforated pipe 45 extends across the conveyor just before it enters the furnace, and jets of compressed air issuing from this pipe blow much of the water off the washed metal articles. The bottom of the cleaning tank is divided by a transverse partition 46 into two compartments, one for receiving the alkali wash water and the other for receiving the hot water. If the articles are water quenched, the cleaning operation in tank 40 may be omitted.

It will be seen that with this apparatus only one attendant is required, who could look after several of these units. He can stand at the front of the apparatus and watch the feeding of articles to the upper furnace and the delivery of them from the lower furnace into discharge chutes 47 beneath the front ends of the lower conveyor belts 7. Since everything is enclosed, a controlled atmosphere throughout the apparatus or only in the hardening furnace is possible. By placing one or

more furnaces above one another, considerable floor space is saved, and more is saved by having the quenching tank overlie part of the wash tank and extend between the upper and lower furnaces. As a result, it is convenient to place this apparatus in a production line where the articles being produced can be carried from one machine or unit to another by mechanical conveyors.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claim, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

An integral compact heat treating unit for metal articles, comprising a horizontally rectangular flat base frame having front and rear ends, a framework mounted on the base frame between said ends, a lower tunnel furnace mounted in the lower part of said framework longitudinally thereof and having an entrance near the rear end of the framework and an exit at its opposite end, an endless conveyor extending through the furnace, conveyor-supporting means rotatably mounted in the opposite ends of the framework beyond the furnace, an upper tunnel furnace supported by the upper part of the framework directly above the lower furnace and having at its opposite ends an entrance and an exit with the entrance located above said lower furnace exit, a conveyor in the upper furnace, an enclosed quenching tank mounted between the two furnaces below the exit of the upper furnace, a conveyor in the tank positioned to receive heated articles from the upper furnace exit and to carry them back through the tank and out of its rear end, an enclosed cleaning tank supported by said framework directly behind the lower furnace between it and said rear conveyor-supporting means, said endless conveyor extending through the cleaning tank, a chute behind the quenching tank extending from the rear end of said quenching tank conveyor down to the cleaning tank to deliver quenched articles to the endless conveyor in the cleaning tank, and means in the cleaning tank for cleaning said articles as they are carried toward the lower furnace entrance by said endless conveyor.

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