May 24, 1932. C. T. WILLARD ET AL 1,860,065

METAL TREATING FURNACE

Filed Nov. 25, 1930 4 Sheets-Sheet 1

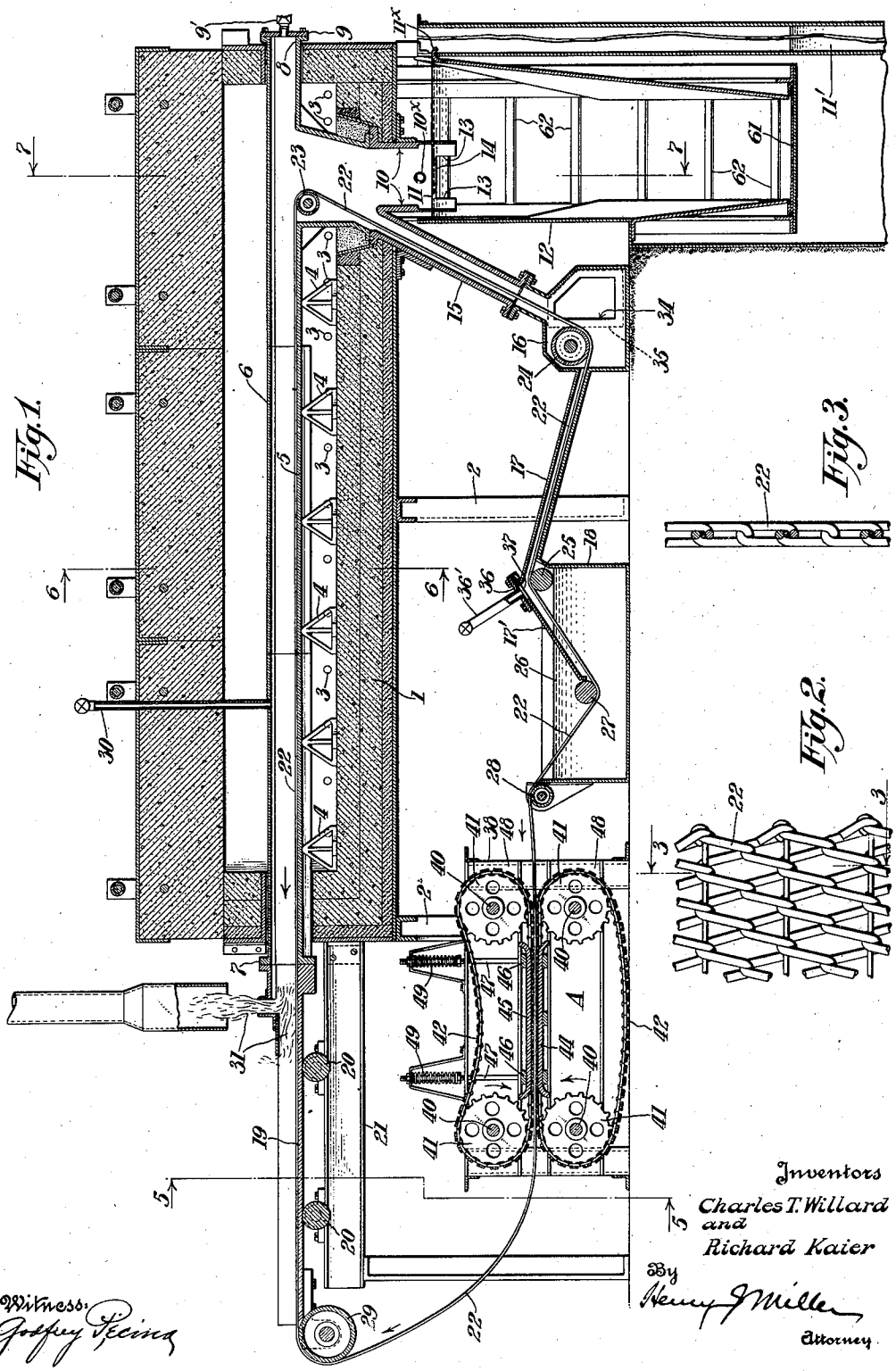


Fig. 1.

Fig. 3.

Fig. 2.

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METAL TREATING FURNACE

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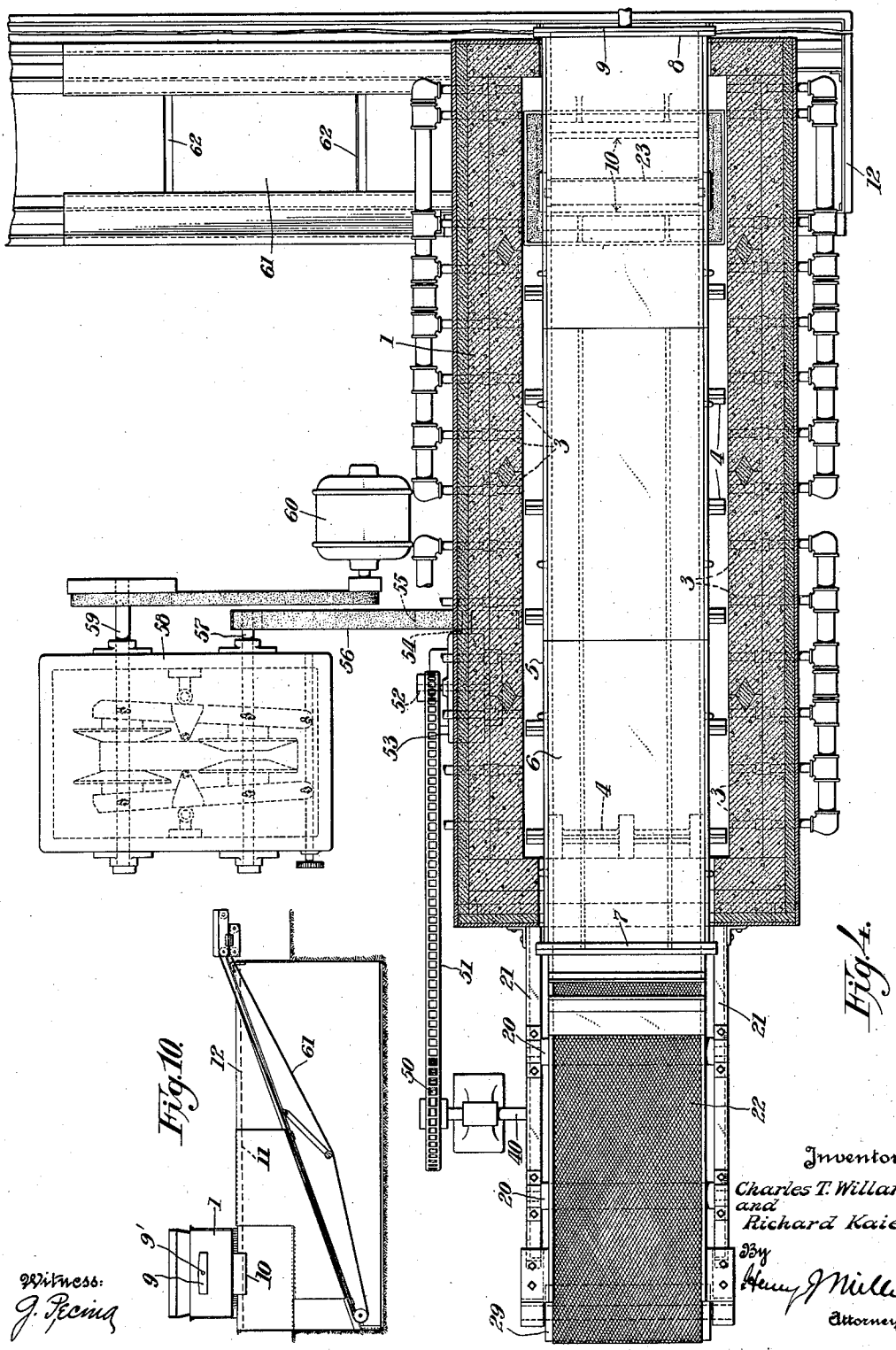


Fig. 4.

Fig. 10

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METAL TREATING FURNACE

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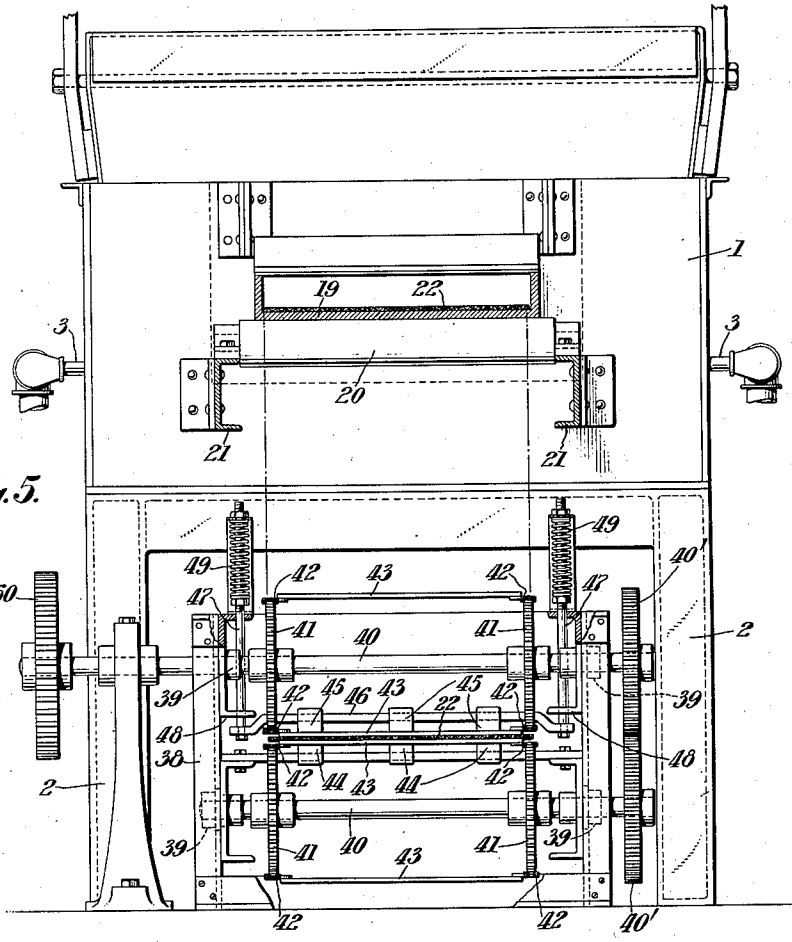


Fig. 5.

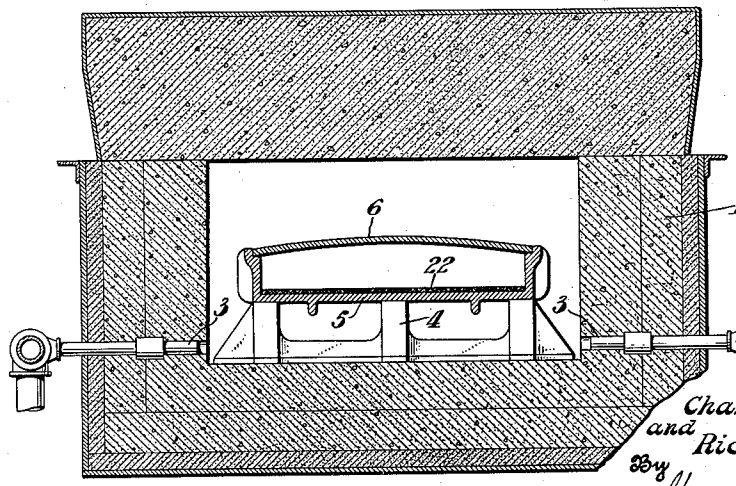


Fig. 6.

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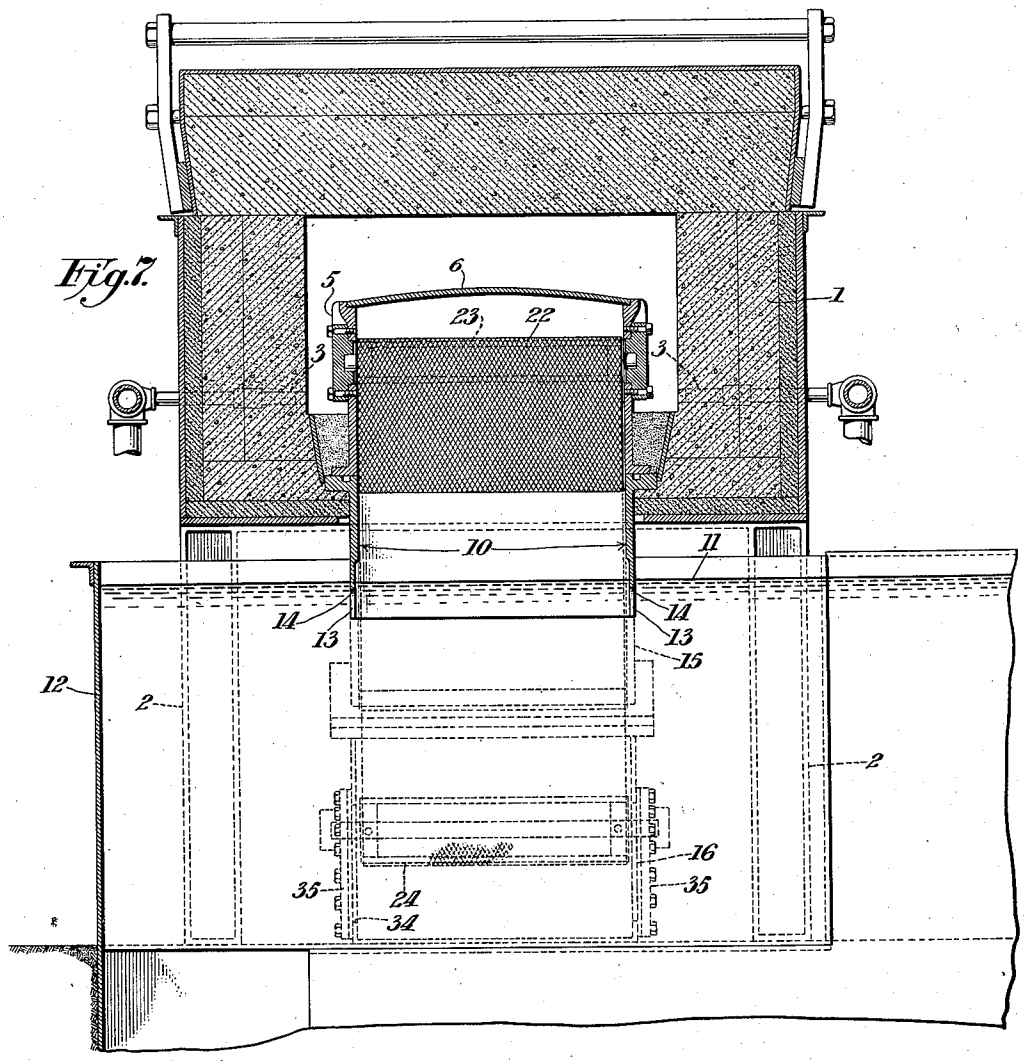
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METAL TREATING FURNACE

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Fig. 7.



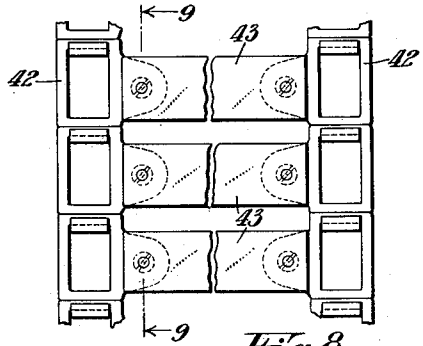


Fig. 8.

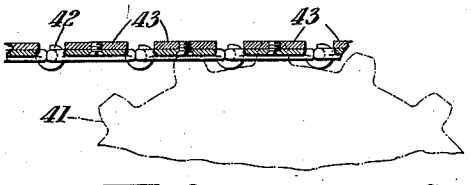


Fig. 9.

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Patented May 24, 1932 1,860,065

UNITED STATES PATENT OFFICE

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METAL TREATING FURNACE

Application filed November 25, 1930. Serial No. 498,102.

This invention relates to a metal treating furnace and has for an object to provide a furnace equipment suitable for the heating of metal parts to any desired temperature in any desired atmosphere while said parts are being carried through the furnace on a conveyor passing into and out of the latter.

More specifically, the invention has for an object to provide an improved continuously operable furnace equipment suitable for the scale-free hardening of steel parts.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter described and claimed.

The features of the invention and the advantages attained thereby will be readily understood by those skilled in the art from the following detailed description of a preferred embodiment of the invention taken in connection with the accompanying drawings, in which Fig. 1 is a longitudinal vertical section through the furnace. Fig. 2 is a plan view of a fragment of the conveyor-belt. Fig. 3 is a sectional view on the line 3—3, Fig. 2. Fig. 4 is a horizontal section through the furnace. Fig. 5 is a front end elevation of the furnace with the loading platform in section on the line 5—5, Fig. 1. Fig. 6 is a transverse vertical section through the furnace on the line 6—6, Fig. 1. Fig. 7 is a section on the line 7—7, Fig. 1. Fig. 8 is a plan view of one of a pair of tractor-belt members of the conveyor driving mechanism. Fig. 9 is a section through the tractor-belt shown in Fig. 8, and Fig. 10 is a rear end elevation of the furnace on a reduced scale, showing the quenching tank in vertical longitudinal section.

1 represents an elongated box-like heating chamber of refractory heat-insulating material supported on legs 2 and heated internally by suitable gas-burners 3. Supported within the furnace on stilts 4 is the flat rectangular taubular retort 5 including the tight cover 6. The receiving end 7 of the retort extends out through the front wall of the furnace chamber 1 and the rear end 8 of the retort is continued through the rear end wall of the furnace chamber 1 where it is tightly closed by a removable cover plate 9 which may be fitted with a sight-cock 9′ through which the interior of the retort 5 may be observed under working conditions.

The bottom wall of the retort 5 is formed at the delivery end of the latter with an opening from which extends downwardly a vertical passageway 10 the lower end of which dips below the surface of, and is sealed by, a quenching bath 11 of oil or other suitable liquid in the quenching tank 12. The lower end of the wall of the passageway 10 is formed with cut-outs 13 the upper edges 14 of which are positioned but slightly below the constant oil level of the quenching bath 11 for a purpose to be explained. Extending downwardly and forwardly from the front wall of the vertical passageway 10 is an inclined branch passageway 15 leading to a tightly closed pulley-box 16 from which the passageway 17 leads to a conveyor-seal 18.

A loading or receiving platform 19 is connected to the receiving end 7 of the retort and rests upon supporting rolls 20 carried by the suitable supported angle-irons 21. The bottom wall of the loading platform 19 is even and continuous with the bottom wall of the retort 5.

A conveyor-belt 22, preferably of woven wire such as shown in Figs. 2 and 3, passes over the loading platform 19 and through the retort 5 to the discharge passageway 10 where it passes downwardly over the pulley 23 and through the inclined branch passageway 15 to the pulley-box 16; thence under the pulley 24 and through the cooling passageway 17 to the conveyor-seal 18.

At the seal 18, which is preferably a water seal, the conveyor-belt 22 passes over the pul-

ley 25 and then dips into the water or liquid 26 and passes under the submerged pulley 27 from which it emerges from the liquid 26 and passes over the pulley 28 to the conveyor driving mechanism A from which it passes upwardly and over the pulley 29 to the receiving platform 19 in an endless circuit.

The conveyor-seal 18 consists of an open-topped tank in which the pulley-rolls 25, 27 and 28 are journaled, as shown in Fig. 1. The bottom wall of the passageway 17 joins one end wall of the tank 18 and the upper wall of the passageway 17 is extended downwardly at 17′ and caused to dip below the surface 26 of the liquid in the tank 18.

It will be understood that when the furnace is in operation say for scale-free hardening, a suitable non-oxidizing gas, such as ordinary illuminating gas, is admitted to the retort 5 through the gas-inlet 30. The gas fills the retort 5 and passageways 10, 15, 16 and 17, but can escape from none of these as they are all substantially gas-tight. A flow of gas, indicated by the arrow in the retort in Fig. 1, is maintained toward the mouth of the retort, counter to the direction of movement of the work, to prevent the entrance of air to the retort. The gas escaping from the mouth of the retort may conveniently be disposed of by being burned at 31.

The pulley-box 16 is provided with clean-out openings 34 closed by suitable covers 35. A removable cover-plate 36 is also provided to close the aperture 37 in the wall 17′ through which access may be had to the pulley-roll 25.

The conveyor-driving device A is constructed with a frame 38 formed of angle-irons and carrying bearings 39 for the upper and lower pairs of sprocket-shafts 40 to which are fixed the sprockets 41 connected by the upper and lower pairs of sprocket-chains 42. The sprocket-chains 42 of each pair are connected by the transverse slats 43 which, together with the chains 42, constitute two endless tractor-belts, the lower of which runs over the stationary rests 44 and the upper of which runs under the spring-pressed presser-bars 45 and is pressed downwardly into operative gripping engagement with the conveyor-belt 22 upon the slats 43 of the lower belt.

The presser-bars 45 are fixed to the transverse supporting bars 46 to the ends of which are fixed the vertical rods 47 slidably mounted in the angle-irons 48, Fig. 5, and pressed downwardly by the springs 49. One each of the upper and lower shafts 40 are connected together by a pair of spur gears 40′ and one of the upper shafts 40 carries a sprocket 50 by which the entire conveyor-driving mechanism A is operated from a driving chain 51, Fig. 4, receiving power from the output shaft 52 of a standard speed-reducer 53 the input shaft 54 of which carries a belt-pulley 55 and is driven by the belt 56 from the output shaft 57 of a second standard adjustable form of speed-reducer 58, the input shaft 59 of which is driven by the electric motor 60. By means of the driving mechanism described, the necessary traction may be applied to the conveyor-belt 22 to move the latter without slippage or injury, even though it be heavily loaded.

In the operation of the furnace, the parts to be treated are placed upon the conveyor 22 at the loading platform 19 from which they pass through the flame 31 and into the retort 5 where they are heated up to the requisite temperature in an oxygen-free atmosphere. When the work-pieces pass over the roller 23 they fall downwardly through the vertical passageway 10, still in an oxygen-free atmosphere, and into the quenching bath 11 in the tank 12 from which they are removed by a suitable canvas conveyor-belt 61 reinforced by transverse strips 62. The main conveyor-belt 22 does not enter the quenching bath 11 but passes downwardly through the branch passageways 15 and 17 from which the outside air is excluded, as previously described.

The hot articles falling into the quenching bath 11 soon heat the upper layers of the latter and generate a certain amount of vapor within the submerged lower end of the passageway 10. The cut-outs 13 are provided for the circulation and escape of these heated upper layers from the submerged lower end of the passageway 10; the upper edges 14 of the cut-outs 13 being maintained only a slight distance below the constant level of the surface of the quenching bath. A vapor exhaust outlet pipe 10^x is connected between the lower end of the passageway 10 and the retort 5 proper. A suitable suction is applied to the pipe 10^x to remove any vapors generated at the surface of the bath 11 and prevent such vapors from rising into the retort through the passageway 10. Where an oil quenching bath is used, the hot oil vapors, if not disposed of, might cause a sooty deposit on the work.

There is disposed alongside the quenching tank 12, a sump-tank 11′ which receives oil passing out of the quenching tank 12 through the overflow 11^x. The provision of the overflow 11^x insures maintenance of a constant oil-level slightly above the upper edges 14 of the cut-outs 13. It is understood that the oil is to be continuously pumped out of the sump-tank 11′ and through suitable cooling coils (not shown) and returned to the quenching tank 12. The furnace is thus adapted for continuous operation and will produce hardened steel articles which are, for all practical purposes, as bright in color and free from scale as when they entered the furnace. In starting up the furnace, gas may be admitted through the pipe 36′ to purge the various passageways of air, after

which the flow of gas through the pipe 36' may be shut off.

The conveyor-driving mechanism herein disclosed is not herein claimed as it is considered to be an independent invention of general application and is covered by the sole application of Richard Kaier, Serial No. 498,101 filed herewith.

The invention is not to be understood as limited to its use for hardening steel parts as it is obviously adapted broadly for continuously processing metal parts in any desired atmosphere at any desired temperature.

Having thus set forth the nature of the invention, what we claim herein is:—

1. A metal treating furnace comprising a gas-tight retort having an open receiving end and a delivery end, a loading platform in advance of said open receiving end, a quenching bath in gas-tight communication with said delivery end, means for maintaining a flow of gas within said retort toward said receiving end, and an endless belt-conveyor passing through and out of said retort to the external atmosphere and over said loading platform into said open receiving end.

2. A furnace having a heated retort, said retort having an open receiving end and a delivery end, a liquid seal at the delivery end of said retort, a branch passageway leading from said retort above said liquid seal, an endless conveyor passing through said retort and out through said branch passageway, a conveyor seal at the end of said branch passageway, a loading platform in advance of the open end of said retort over which said conveyor runs, and means for maintaining a flow of gas within and toward the open receiving end of said retort.

3. A metal treating furnace comprising a horizontally disposed retort having an open receiving end and a delivery end, a quenching tank at the delivery end of said retort, a work-discharge passageway, extending from said retort to said quenching tank, a liquid seal at the lower end of said work-discharge passageway, a branch passageway leading from one side of said work-discharge passageway, an endless conveyor-belt passing through said retort and out through said branch passageway, a conveyor-seal at the end of said branch passageway from which the conveyor-belt emerges to the outside atmosphere, and means applied to the portion of said conveyor-belt in the outside atmosphere for pulling the latter through said retort.

4. A metal treating furnace comprising a tubular retort having an open receiving end and formed at its delivery end with main and branch passageways, independent seals at the ends of said passageways, an endless belt-conveyor passing through said retort and out of the latter to the external atmosphere through the seal at the end of said branch passageway, a quenching tank into which the work is discharged through said main passageway, means for maintaining a flow of gas within and toward the receiving end of said retort, and conveyor driving means operating upon that portion of the belt-conveyor in the external atmosphere.

5. A furnace having a retort the bottom wall of which is provided with a work-discharge opening, a quenching tank disposed below said opening, a gas-tight work-discharge passageway connecting said opening to said quenching tank, a belt-conveyor passing through said retort and downwardly through said opening, a gas-tight conveyor passageway branching from said work-discharge passageway above said quenching tank, and a heating chamber substantially enveloping said retort and work-discharge opening.

6. A furnace having a closed horizontal heating chamber constructed with an inlet at one end and an outlet in its bottom wall adjacent its opposite end, an endless belt-conveyor having an upper run passing through said chamber and a return run disposed below said chamber, a gas-tight conveyor passageway connected to the outlet of said heating chamber, a seal at the end of said conveyor passageway through which said conveyor emerges to the outside atmosphere, and work-cooling means in gas-tight communication with the outlet of said heating chamber and spaced from said seal.

7. A furnace having a heating chamber formed at its delivery end with a downwardly extending gas-tight work-discharge passageway, and a liquid quenching tank into which the lower end of said passageway dips, the side walls of said passageway having cut-away portions below the level of the liquid in the quenching tank, said cut-away portions permitting circulation of hot liquid away from the space within the submerged lower end of said passageway.

8. A metal treating furnace having a laterally closed, heated, tubular retort disposed substantially horizontally and having a receiving mouth at one end and a discharge opening adjacent its opposite end, a quenching tank containing a quenching liquid in gas-tight communication with said discharge opening, means for feeding work through said retort, and means for supplying a desired gas to said retort in such manner as to maintain a continuous flow of gas toward the mouth of said retort.

9. A metal treating furnace including a tubular retort having at its delivery end a work-discharge opening, a quenching bath in gas-tight communication with said opening, and exhaust means between said opening and said quenching bath for removing vapors generated by the heated parts falling into the quenching bath.

10. A metal treating furnace including a

substantially horizontal tubular retort having an open receiving end and a discharge opening in its bottom wall at its discharge end, a quenching bath disposed below said discharge opening and in gas-tight communication with the latter, means for supplying a gas to said retort intermediate its ends, and a vapor exhaust means between said discharge opening and said quenching bath.

In testimony whereof we have signed our names to this specification.

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