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HEAT TREATING FURNACE

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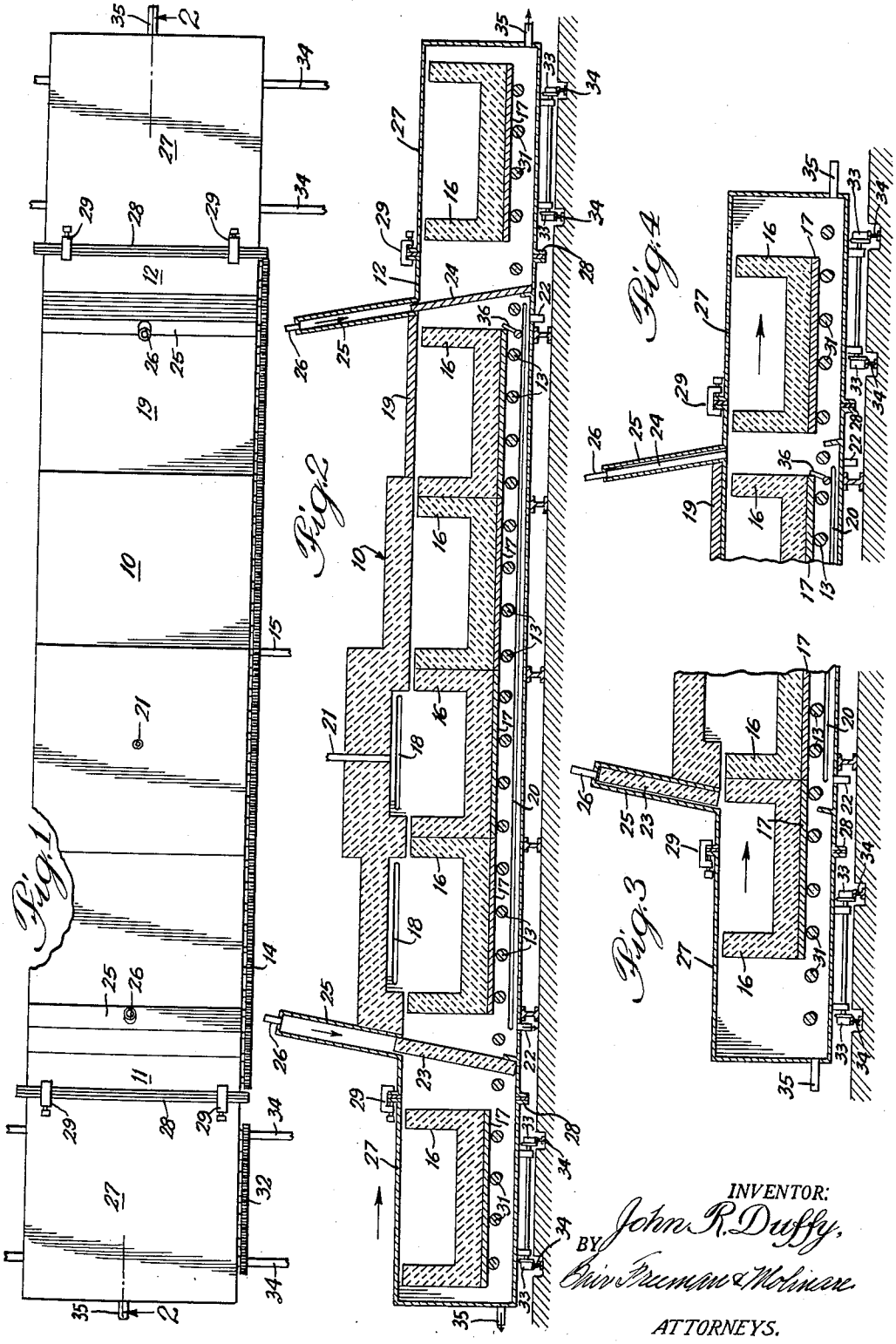


Fig. 1

Fig. 2

Fig. 3

Fig. 4

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HEAT TREATING FURNACE

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This invention relates to heat treating furnaces and more particularly to a furnace for treating relatively heavy masses of material at high temperature under prepared atmosphere.

In heat treating furnaces for handling heavy masses of material three general types of handling means have been employed. In one type, the material is carried through the furnace on wheeled cars rolling on rails. In a second type the material is pushed through the furnace on skid rails or roller rails. In the third type the material is carried through the furnace on a traveling conveyor, ordinarily a driven roll conveyor. None of these types is satisfactory for high temperature operations where the temperature may exceed 3000 degrees F. and special atmospheres are required.

The car type furnace is satisfactory as far as the temperature is concerned but no method has previously been developed to satisfactorily seal in and to prevent contamination of the furnace atmospheres, always either toxic or explosive such as hydrogen, argon, carbon monoxide, etc. In the case of dry hydrogen, often used for sintering, any minute leakage of air would result in formation of H_2O, thereby raising the moisture content of the hydrogen.

The pusher furnace is relatively satisfactory from the standpoint of atmosphere, but is unsatisfactory at high temperatures because of the loss of strength in the rails and the work containers, plus the tendency for the materials of the rails and containers to fuse together when exposed to high temperatures and pressure.

The traveling or driven roll conveyors are impractical because of the weakness of these mechanical parts at high temperatures and the impossibility of maintaining bearing action at the high temperatures.

It is accordingly one of the objects of the present invention to provide a heat treating furnace in which the material to be treated is carried on a support similar to a car body which is moved through the furnace by conveyor means, the support serving to insulate the conveyor means from the heating means in the furnace, thereby enabling it to function properly.

According to a feature of the invention, the conveyor means is formed by spaced parallel driven rollers on which insulated supports carrying the work are supported in end-to-end relationship substantially to cover the rollers and to insulate them from the heated portion of the furnace.

Where the heating cycle may be unusually long or the temperature unusually high, cooling coils may be installed below the conveyor to reduce the temperature around the conveyor and beneath the insulated material carrying bodies without affecting the efficiency of the furnace or the temperature in the heating zone.

Another problem in heat treating furnaces is the supply of material to, and discharge of material from the furnace without contaminating the non-reactive atmosphere maintained in the furnace. With furnaces of the type heretofore known for handling heavy masses, this has been extremely difficult of accomplishment without excessive wasting or contamination of the non-reactive atmosphere gas.

It is, accordingly, a further object of the present invention to provide a heat treating furnace in which material

may be supplied to and discharged from the furnace without contaminating the non-reactive atmosphere therein and with a minimum wastage of the non-reactive atmosphere gas.

According to a feature of the invention the supports for the material are carried in open-ended housings or bells which are sealed against the ends of the furnace and which are purged by supplying non-reactive gas thereto before being opened to the furnace.

The above and other objects and features of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which:

FIGURE 1 is a top plan view of a heat treating furnace embodying the invention;

FIGURE 2 is a longitudinal central view through the furnace; and

FIGURES 3 and 4 are partial sections showing the supplying and discharging operations, respectively.

The furnace, as shown, comprises an elongated hollow furnace body indicated generally at 10 which is open at its opposite ends and which preferably terminates in rectangular sleeve portions 11 and 12 flanged at their outer ends and defining the ends of the furnace. Conveyor means, shown as a plurality of spaced parallel driven rollers 13, is mounted in the lower part of the furnace to carry supports for the material to be treated and to advance the supports through the furnace from end to end thereof. Other means, such as chain conveyors, may be used.

The conveyor rollers 13 are adapted to be driven in the same direction through a system of gears indicated generally at 14 and which may be external to the furnace body with their shafts passing through the furnace body and connected to the rollers 13, as shown, or which could, if desired, be inside of the furnace body. The gears 14 are adapted to be driven by a driving shaft 15 driven by any suitable motor (not shown) and controlled to drive the gears and the rollers periodically when it is desired to advance material through the furnace.

A plurality of open topped supports 16 which may be generally similar to car bodies and which are adapted to hold the material to be treated are carried on the conveyor rollers 13 in end-to-end relationship, as shown in FIGURE 2. Preferably the supports 16 are formed of a refractory material with metal bottom plates 17 which rest on the rollers and may be moved by the rollers. The supports 16 may be open at their sides but have upstanding ends to separate adjacent supports so that the material on different supports may be at different temperatures. The supports 16 are of a size to fit within the furnace body and preferably span substantially the full width thereof so that they cover the rollers completely or substantially completely to shield them and the bearings therefor. Cooling coils 20 may be mounted below the level of the supports 16 and adjacent to the conveyor to cool the conveyor if desired.

The material on the supports is adapted to be heated by any desired type of heating means which is mounted in the upper part of the furnace. The heating means, as shown, may take the form of electrical heating elements 18 mounted in the top part and possibly also on the upper side walls of the furnace throughout at least a portion of the furnace length sufficent to bring the material on the supports up to the desired temperature. Preferably, the heating elements are mounted adjacent to the supply end of the furnace with the discharge end of the furnace, which functions to bring the material to a cooler temperature, being defined by a thinner top plate 19 as compared to the top refractory plates defining the major portion of the furnace length. If preferred, the top plate 19 may be water cooled to lower the tempera-

ture of the charge so that it will not react with the air after being removed from the furnace atmosphere.

During heat treatment, the furnace is closed and is filled with a non-reactive atmosphere. The composition of the atmosphere is selected in accordance with the material to be treated so that it will be non-reactive with respect thereto. For example, in utilizing the furnace for sintering molybdenum, a dry hydrogen atmosphere is maintained in the furnace. The atmosphere gas may be supplied to the furnace centrally of its length through an inlet conduit **21**, it being understood that a plurality of such inlet conduits could be provided if desired. A continuous circulation of the atmosphere gas may be maintained through the furnace with the gas being discharged near the ends of the furnace through discharge conduits **22**.

During the heat treating operation, the ends of the furnace are closed by closure plates **23** and **24**, respectively, each of which in its closed position spans the full width and height of the furnace body and effectively closes one end thereof. Each of the plates **23** and **24** is adapted to be raised to an open position to permit material to be supplied to or discharged from the furnace. For this purpose a rectangular casing extension **25** is provided above and in alignment with each of the closure plates into which the closure plate may move when in its opened position. Preferably atmosphere gas may be supplied to the upper end of each of the casing extensions **25** through a conduit **26** for purposes to appear more fully hereinafter.

For supplying supports **16** to the furnace and for discharging the supports therefrom at the end of a heat treating operation, open ended housings or bells **27** are provided which are adapted to fit sealingly against the open ends of the furnace. As shown, each of the housings is provided at its open end with an outwardly extending flange **28** to fit tightly against the corresponding flange on the end of the adjacent sleeve **11** or **12**. When in registering position, the flanges may be secured together by releasable clamps **29** to seal the flanges of the housing **27** against the ends of the furnace body to minimize or eliminate leakage of gas therebetween.

The housings **27** have conveyor means in the form of driven rollers **31** in their lower portions which align with the driven rollers **13** when the housings are secured to the furnace body. The rollers **31** may be driven periodically as desired through gearing **32** as shown in FIGURE 1 which is in turn driven through any desired type of motor (not shown). The housings **27** are supported for movement transversely of the furnace body on wheels **33** which travel on rails **34**, the rails extending across the ends of the furnace body, as shown. In this way the housings **27** can be moved easily into and out of registry with the ends of the furnace body for loading or unloading. Each housing is of a size to receive on the conveyor rollers **31** therein a single support **16** as shown in FIGURE 3.

The housings are adapted to be purged by the non-reactive atmosphere gas to remove any air or other contaminating gas therefrom before they are opened to the furnace body. For this purpose each housing is provided with a vent **35** at the outer closed end thereof. With the housings clamped to the ends of the furnace body, atmosphere gas forced through the conduits **26** and the extensions **25** will flow over the outer surfaces of closure plates **24** and through the housings **27** to purge them. After sufficient purging to remove air and other contaminating gases from the housings and the material therein, the closure plates **23** and **24** may be raised as shown in FIGURES 3 ad 4 to open the housings **27** to the furnace body. At this time, the conveyor rollers may be driven to move the support **16** in the housing **27** at the left end of the furnace into contact with the adjacent support in

the furnace and to advance all of the supports to the right. The endmost support **16** will be moved into the housing **27** at the right end of the furnace and the following supports will be stopped in the desired position within the furnace body by a movable stop member **36**. in this way proper positioning of the supports in the furnace body is insured.

After a fresh support has been moved into the furnace body and the endmost support previously therein has been moved into the housing **27** at the right end of the furnace body, the closure plates **23** and **24** may again be moved down to their closed positions, as shown in FIGURE 2, and the housings **27** may be disconnected from the furnace body and moved away from the ends of the furnace body on the rails ready for a subsequent operation.

With the construction as herein described, it will be seen that heavy masses of material can be handled easily and quickly and that the supports for the material can be moved into and out of the furnace itself with a minimum of effort and with a minimum wasting of the atmosphere gas. Heavy masses of material can be treated at extremely high temperatures for sintering and similar operations with the conveyor means on which the masses are moved being effectively insulated from the heat source so that it can function properly even at the high temperature involved.

While one embodiment of the invention has been shown and described in detail, it will be understood that this is for the purpose of illustration only and is not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. A heat treating furnace comprising an elongated hollow furnace body open at its ends, movable closures for the ends of the furnace body, driven conveyor means in the lower part of the furnace body, heating means in the upper part of the furnace body, means to supply a non-reactive gas to the furnace body, a series of supports for material to be treated fitting end-to-end on the conveyor means to be moved through the furnace body thereby, tracks extending transversely of the furnace body at the ends thereof, a pair of open ended housings movable respectively along said tracks into and out of alignment with the ends of the furnace body, means to seal the open ends of the housings against the open ends of the furnace body, conveyor means in the housings aligned with the conveyor means in the furnace body to carry a support, and means to circulate a purging gas through the housings when they are sealed against the ends of the furnace body, the closures being openable to permit movement of supports between the housings and the furnace body without opening the furnace body to atmosphere.

2. The furnace of claim 1 in which the movable closures are flat plates slidable upwardly into recesses projecting above the furnace body and spaced inwardly from the ends of the furnace body and the purging gas is supplied through the recesses.

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