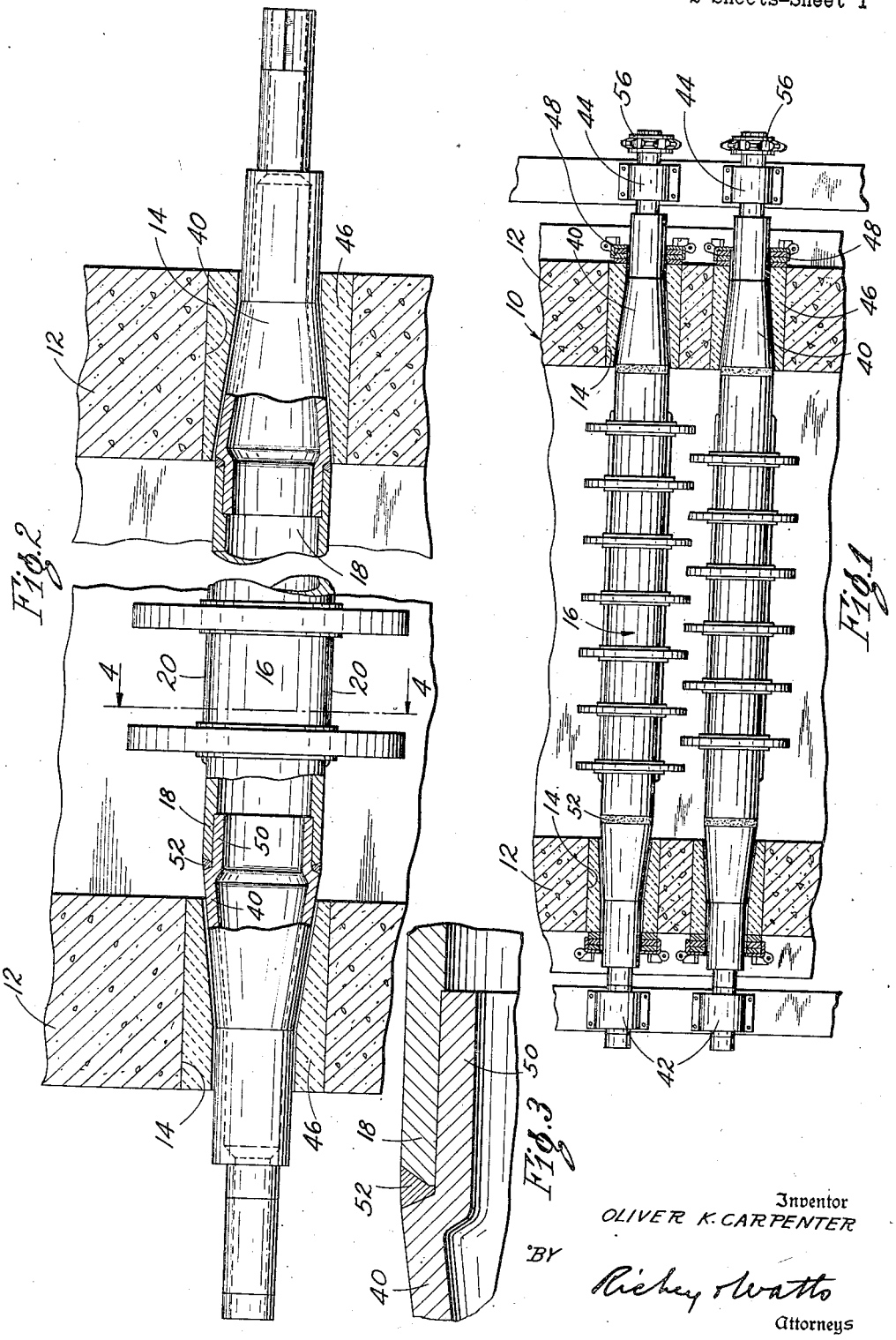
Dec. 10, 1935. O. K. CARPENTER 2,024,024

FURNACE CONVEYER SHAFT

Filed March 5, 1934 2 Sheets-Sheet 1



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FURNACE CONVEYER SHAFT

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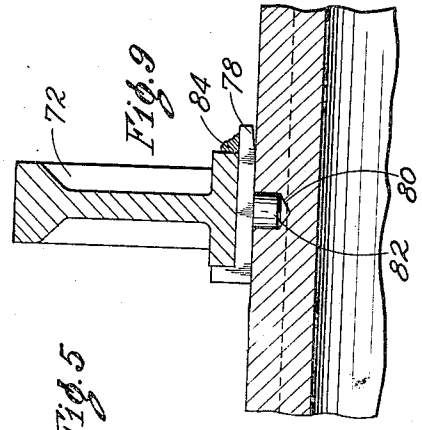


Fig. 9

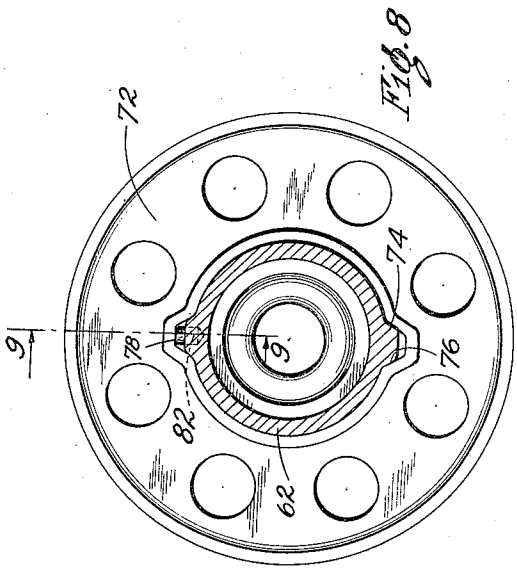


Fig. 8

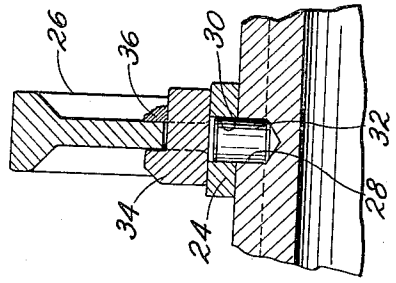


Fig. 5

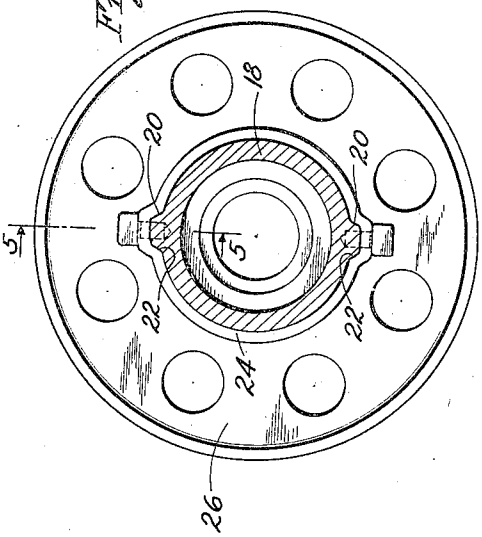


Fig. 4

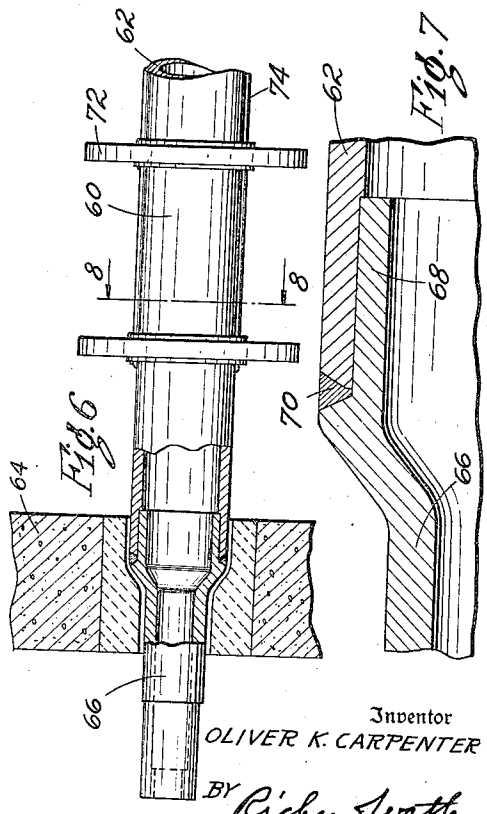


Fig. 6

Fig. 7

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FURNACE CONVEYER SHAFT

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Application March 5, 1934, Serial No. 714,092

5 Claims. (Cl. 263—6)

This invention relates to conveyer mechanism and more particularly to hollow roller conveyers such as are employed in high temperature furnaces for annealing or heat treating metal or the like.

Heretofore, heat treating furnaces have been constructed in the form of long kiln-like structures provided with a plurality of roller shafts extending transversely of the furnace to carry the metal being treated from one end to the other of the furnace. The temperatures employed in these furnaces, particularly for normalizing low carbon steel, range up to 2000° F. and sometimes more. As a result of subjecting the rollers to such severe operating conditions the rollers often sag, or warp. The discs often become loose on the shafts due to oxidation or wear of the set screws, wedges and the like used to secure the discs in place on the shafts. Discs or wheels formed integrally with the shaft do not have the disadvantage of loosening on the shaft but increase the cost of making and assembling the shafts in the furnaces.

By the present invention the foregoing and other difficulties and disadvantages of prior known roller conveyers have been overcome. The improved conveying means of the present invention provides a shaft strongly resistant to warpage and highly heat resistant with discs or wheels which are independently and positively secured on the dry shaft. The shaft part exposed to high temperatures may be centrifugally cast so as to eliminate all ordinary casting defects such as shrinkage cavities, lesions, gas pockets, sand inclusions and internal strains. Moreover, the walls of the centrifugally cast shaft can be made of uniform thickness between the strengthening parts and of remarkable density so that unequal expansion and other strains in the shaft are avoided. The shaft preferably is made with separate end pieces or trunnions which are welded to the middle portion of the shaft and which extend through the furnace walls to journal and support the shaft in externally disposed bearing means. The end pieces or trunnions may be cast from somewhat less expensive material which is satisfactory for bearings and supports without being particularly resistant to heat.

Likewise by the present invention the wheel discs are mounted on the shaft in a new and novel manner by a positive keying construction with additional locking means so that the wheels are positively positioned to prevent relative circumferential or longitudinal movement upon the shaft.

The foregoing and other advantages of the present invention are achieved by embodiments of the invention described hereafter and illustrated in the accompanying drawings wherein:

Figure 1 is a plan view partly in horizontal section of one embodiment of the present invention.

Figure 2 is an enlarged view of a portion of Figure 1 which better illustrates the construction of the dry shaft of the conveying mechanism.

Figure 3 is an enlarged view of a portion of the shaft illustrated in Figure 2.

Figure 4 is a cross sectional view taken on line 4—4 of Figure 2 and illustrates the manner in which the metal carrying wheels are secured to the shaft.

Figure 5 is a cross sectional view taken on line 5—5 of Figure 4 and illustrates the keying of the wheels on the shaft.

Figure 6 is a view somewhat similar to Figure 2, although more diagrammatic, of another embodiment of the invention.

Figure 7 is an enlarged view of a portion of Figure 6 illustrating how the trunnions are secured to the main portion of the shaft.

Figure 8 is a cross sectional view taken on line 8—8 of Figure 6 and illustrates another manner of securing the metal wheels on the shaft.

Figure 9 is a cross sectional view taken on line 9—9 of Figure 8 and illustrates how the wheels are fastened securely but removably on the shaft.

Referring to the drawings and particularly to Figures 1 and 2 thereof, the numeral 10 indicates generally a heat treating furnace having vertical side walls 12 provided with a series of openings 14 through which extend conveyer means or shafts of the present invention, these being indicated generally at 16. Each shaft 16 comprises a main central portion 18 which is formed of high heat resisting material and which is preferably cast by a centrifugal casting operation to form a cylindrical member of very fine grained, dense, uniform character. The centrifugal casting operation insures the absense of uneven wall thickness, shrinkage cavities, gas pockets, sand or slag inclusions and internal strains. The central portion of the shaft 18 is preferably formed with one or more integral, longitudinally extending splines 20 as best seen in Figures 2 and 4. These splines 20 are adapted to co-operate with lateral key ways 22 formed in the hubs 24 of wheels 26 which are adapted to be mounted on the shaft 16.

The wheels 26 are preferably removably secured on the main portion 18 of the shaft so that they cannot have relative longitudinal

movement thereon and to this end the splines 20 are provided with spaced recesses 28 while the hubs 24 of the wheels 26 are provided with apertures 30 so that locking pins 32 may be utilized to secure the wheels axially of the shaft. Removable bars 34 serve to lock the pins 32 in position. The bars 34 can be welded as at 36 to the wheel 26 to prevent removal.

Welded to the ends of the main portion 18 of the drive shaft 16 are trunnions 40 which are preferably formed of heat resisting metal in this embodiment of the invention in view of the fact that they extend somewhat into the furnace area. The trunnions protrude through the furnace walls 12 and which are journalled at their ends by suitable bearings 42 and 44. Refractory bushings 46 are ordinarily provided between the trunnions 40 and the apertures 14 of the furnace walls 12 and these bushings serve to substantially fill the apertures while still allowing movement of the trunnions therein. Further sealing of the trunnions in the furnace wall to prevent a dissipation from heat from the furnace may be accomplished by providing sealing means 48 around the trunnions at the outer sides of the furnace wall.

Referring particularly to Figures 2 and 3 it will be seen that the trunnions 40 are secured to the main portion 18 of the shaft by forming a reduced end 50 on the trunnion 40 with the reduced end being adapted to extend inside the end of the main portion 18 of the shaft. The diameter of the main portion 18 and the mating end portion of the trunnion 40 is substantially the same so that when the portions are welded together as at 52 a shaft with a smooth outer surface will be provided.

The trunnions are preferably tapered where they pass through the furnace walls in order to reduce the size of the trunnions so that the journalled means can be made smaller and therefore less expensive. Either bearing 42 or 44, but not both, is adapted to prevent lateral or axial play of the shaft carried thereby; however, the other end of the shaft is allowed to have free axial movement in its bearing so that the shaft is free to expand and contract axially during temperature changes. The shafts may be driven in any suitable manner as for example by securing sprockets 56 to the ends of the shafts and providing a chain drive (not shown) for the sprockets.

In order to reduce as far as possible the expense of conveyer equipment for metal treating furnaces, the present invention contemplates employing shaft parts composed of heat resisting metals only in the positions in which they are subjected to high temperatures. Other portions of the shaft are composed of less expensive metal whereby the total cost of the conveying equipment is reduced without sacrificing its efficiency and long life. Thus in the embodiment of the invention illustrated in Figures 6, 7, 8, and 9 the numeral 60 indicates generally a shaft which has a main or central cylindrical portion 62 which is centrifugally cast to insure uniform wall thickness and absence of imperfections. The portion 62 is adapted to extend at least part way through the side walls of the furnace indicated diagrammatically at 64. The cylindrical portion 62 of the dry shaft is of metal which is resistant to heat and oxidation and is, therefore, relatively expensive. Secured to the ends of the cylindrical or main portion 62 of the dry shaft 60 are trunnions 66 which may be of ordinary metal not particularly adapted to resist heat inasmuch as the trunnions are away from the furnace area so that they are not subjected to the high heat of the interior of the furnace. This construction is less expensive than constructions in which high heat resisting material is employed throughout. Referring to Figure 7, it will be seen that the cylindrical portion 63 of the dry shaft 60 is adapted to receive the telescoping ends 68 of the trunnions 66 with the pieces being welded together as at 70 so that together they form a smooth continuous outer surface. The trunnions 66 are preferably reduced in diameter at their ends so that they can be more readily journalled and driven by means similar to those illustrated in Figure 1 and discussed above.

Wheels 72 are preferably secured on the cylindrical portion 62 of the dry shaft 60 and this is accomplished by providing longitudinally extending splines 74 at a plurality of points on the cylindrical portion 62 of the dry shaft. Cooperating with the splines 74 are recesses 76 formed in the wheels 72 and suitable locking keys 78 may be utilized to axially position the wheels 72 on the shaft. This may be accomplished by providing recesses 80 at spaced points in the splines 76 which recesses are adapted to receive cylindrical bosses 82 formed on the keys 78. The keys 78 may be fastened in place in any known manner such as by welding indicated at 84.

In both types of shafts illustrated herein and described, it is possible if desired to circulate some cooling fluid through the interior of the shafts if this is found necessary or desirable.

The assembly or replacement of the dry shafts in the furnace can be readily accomplished by removing the tops of the journalling pillows, loosening the keying pins, and thereby loosening the wheels 72 or 26 on the shafts which will then allow the shafts to be slipped out of the furnace upon removal of the refractory bushing 46 and other sealing means 48 at one side of the furnace. New wheel discs can be readily placed on the shaft or the shaft can be repaired in any manner either with or without complete removal from the furnace. Reassembly embodies merely a reversal of the foregoing procedure.

From the foregoing it will be evident that a simplified practical dry shaft has been provided for use in high temperature furnaces in which assembly replacement is readily accomplished with a minimum of effort and expense. The shaft is adapted to stand up in use over long periods without warping or other undesirable results. The wheels or carrying discs are very firmly anchored both axially and circumferentially on the shafts which is quite desirable. The centrifugally cast main portion of the shafts eliminates substantially all air or slag inclusions and insures a very uniform wall thickness. The uniform wall thickness of the cylinder results in a very even expansion and contraction of the shaft with an absence of warping or stress formation. The elimination of slag and other impurities results in a stronger and longer-lived shaft in which cracking and failures of all characters are materially reduced. The longitudinal ribs afford resistance to warping while serving as means to prevent relative rotation between the shaft and discs.

It will be appreciated that several embodiments only of the invention have been illustrated and described in detail and that the principles of

the invention can be utilized in the production of shafts of various forms. Accordingly the invention is not to be limited or restricted to the types of conveyer mechanism shown and described but is defined by the appended claims.

I claim:

1. A shaft assembly for a high temperature furnace comprising a centrifugally cast cylindrical tube composed of high heat resisting metal having imperforate walls and having a longitudinally extending, integral, outwardly projecting rib, tapered trunnions of heat resisting material having reduced ends extending into the ends of the tube and having shoulders opposed to the end walls of the tube and welded thereto, discs on the shaft engaging opposite sides of said rib and means securing said discs in place against axial movement relative to the shaft.

2. A conveyer assembly for a high temperature furnace comprising a cylindrical tube of high heat resisting metal, trunnions extending into the ends of the tube and secured thereto, material carrying wheels on the shaft in axially spaced position, means removably securing the wheels in position comprising integrally cast longitudinal splines on the tube which are received in recesses formed in the hubs of the wheels, radially extending pins received in suitable recesses in the splines within the planes defined by the wheel hubs and means for holding the pins in place.

3. A conveyer assembly for a high temperature furnace comprising a centrifugally cast cylindrical tube of high heat resisting metal, trunnions extending into and secured to the ends of the tube, material carrying wheels on the shaft in axially spaced relation, means removably securing the wheels in position comprising integrally cast longitudinal splines on the tube which are received in recesses formed in the hubs of the wheels, and radially extending pins received in suitable recesses in the splines and wheel hubs for preventing axial movement of the wheels.

4. A conveyer assembly for a high temperature furnace comprising a cylindrical tube having opposite, integral, longitudinally extending splines, trunnions at the ends of the tube, material carrying wheels on the tube and having recesses formed in the hubs to receive the splines, radial pins in the spline and pin retaining means welded to the wheels.

5. A shaft assembly for a high temperature furnace, including a centrifugally cast cylindrical tube of high heat resisting metal, having imperforate walls and having an integral rib extending lengthwise on the outer surface thereof for a major portion of the length of said tube, trunnions projecting at their inner ends into the ends of said tube and having shoulders opposed and welded to the end surfaces of said tube, said trunnions tapering to smaller diameter at their outer ends, disks on said tube engaging opposite sides of said rib and prevented thereby from rotation relative to the tube, and means securing said disks against axial movement on said tube.

OLIVER K. CARPENTER.