May 31, 1927. 1,630,784

J. R. COE

ANNEALING OR HEATING FURNACE

Filed March 11, 1926 6 Sheets-Sheet 1

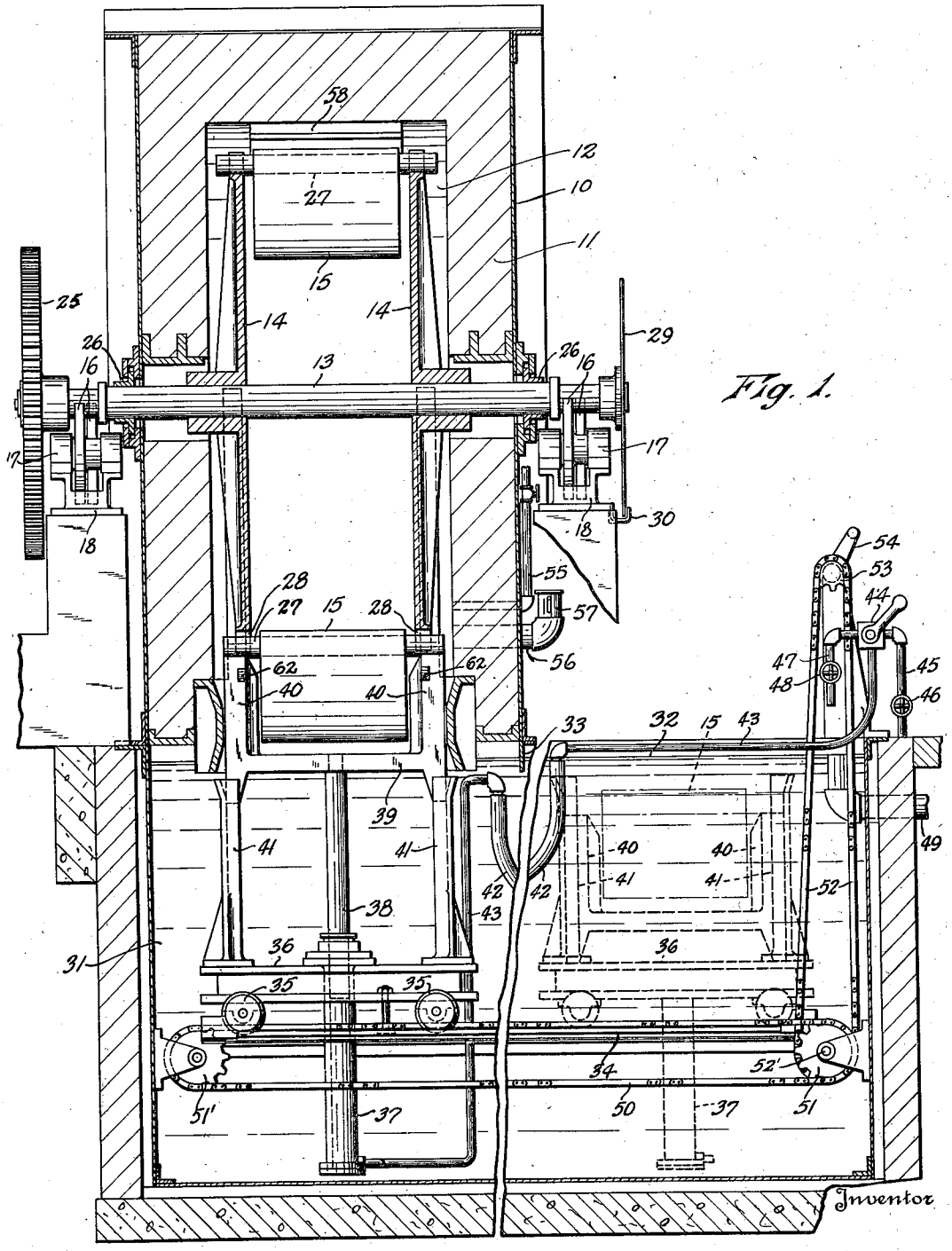


Fig. 1.

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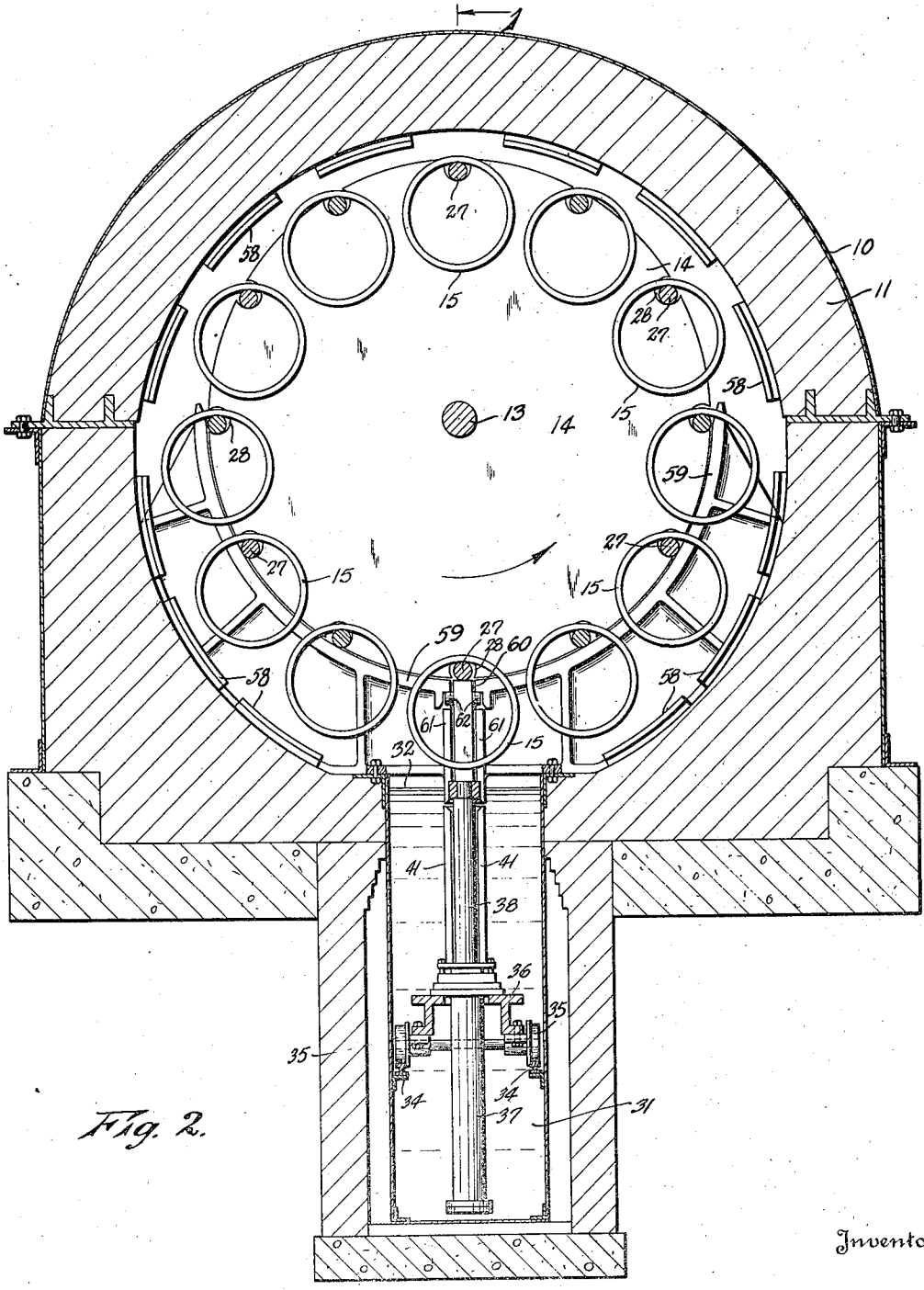


Fig. 2.

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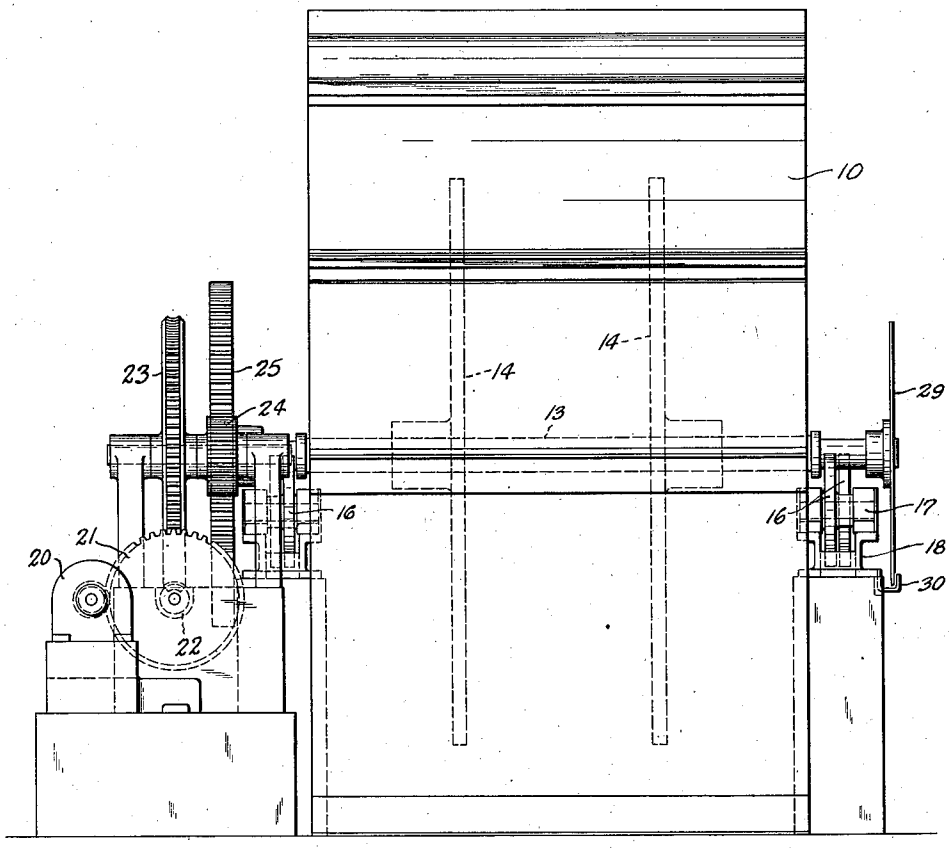


Fig. 3.

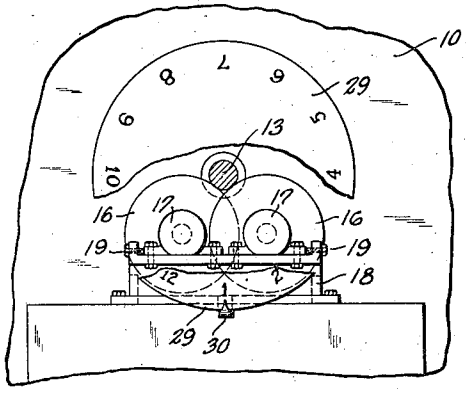


Fig. 4.

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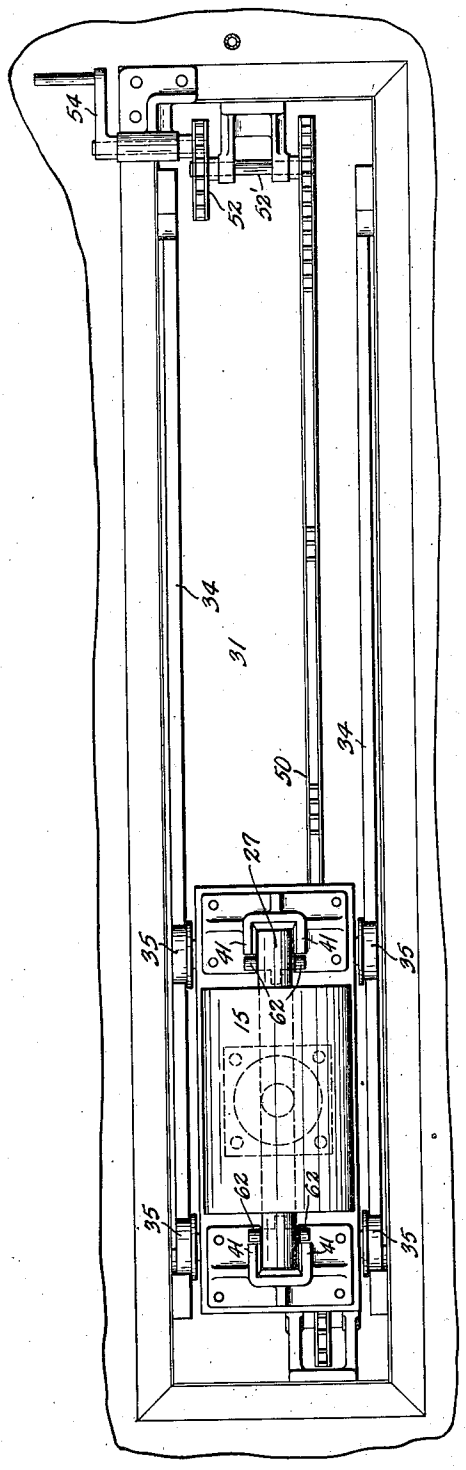


Fig. 5.

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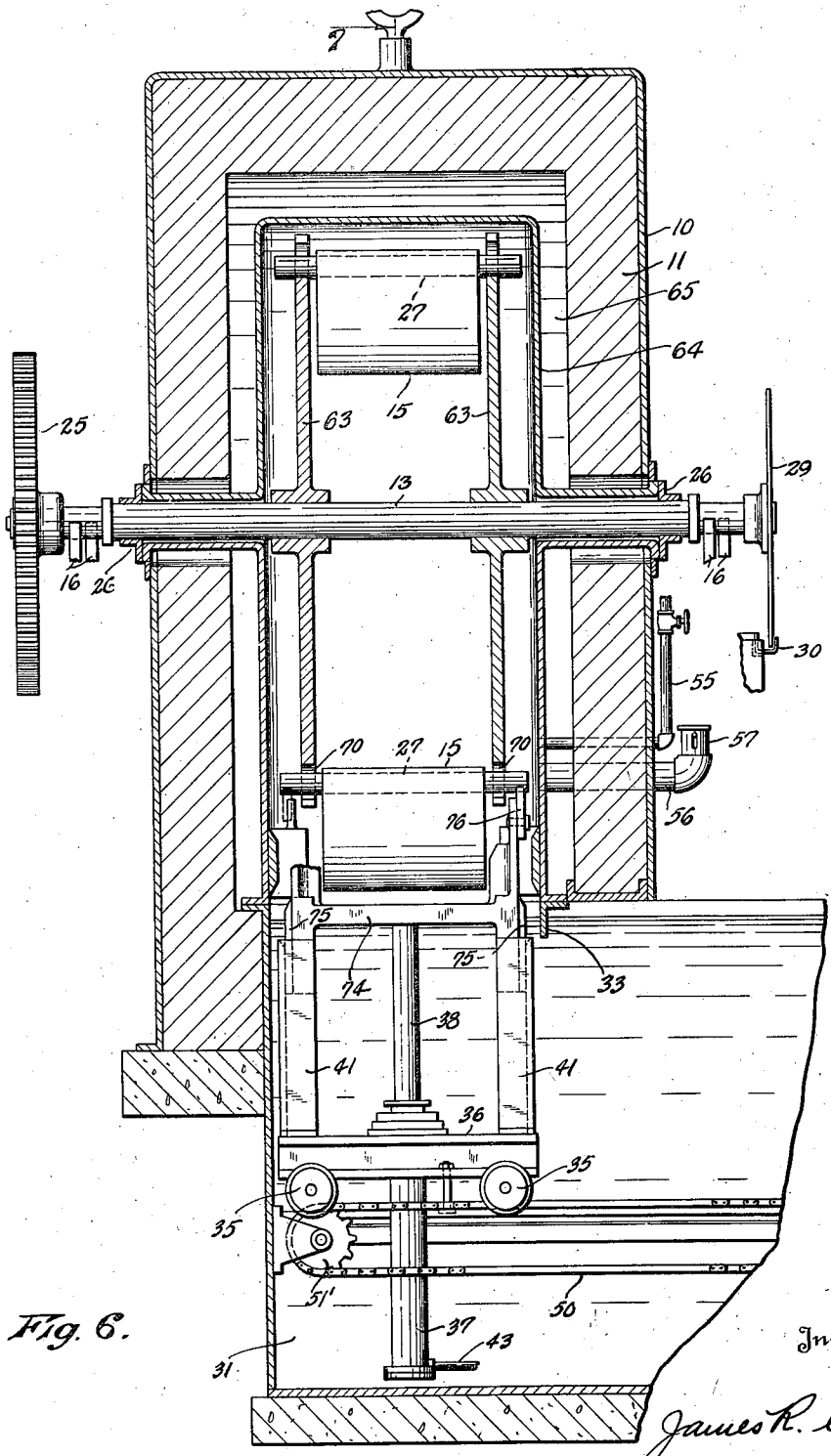


Fig. 6.

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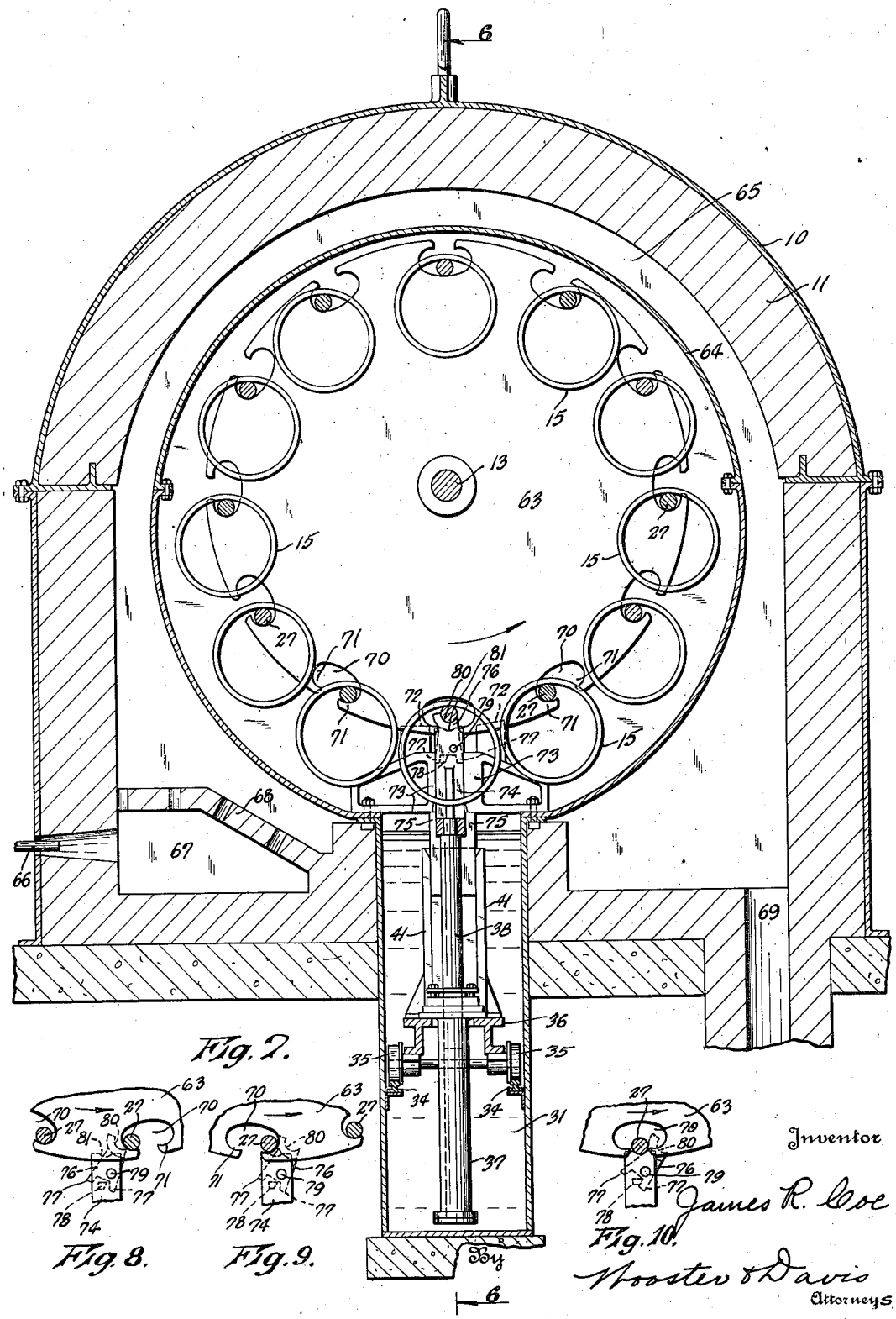


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE.

JAMES R. COE, OF WATERBURY, CONNECTICUT, ASSIGNOR TO THE AMERICAN BRASS COMPANY, OF WATERBURY, CONNECTICUT, A CORPORATION OF CONNECTICUT.

ANNEALING OR HEATING FURNACE.

Application filed March 11, 1926. Serial No. 93,970.

This invention relates to a heating or annealing furnace, and especially to an apparatus for heating materials which can be hung on or from a rod or the like, such for instance as coils of wire, rods, strips or sheets and the like.

It is an object of the invention to provide improved means for conveniently handling the material to be heated.

It is also an object of the invention to heat the material more uniformly than when handling larger groups, and when desired to control the atmosphere in which the material is heated and in which it remains until it is cooled.

It is a further object of the invention to provide improved means for charging the furnace with the material to be heated and removing it therefrom through a seal which will prevent entrance of atmospheric air to the heating chamber.

With the foregoing and other objects in view, I have devised the constructions shown in the accompanying drawings as illustrating how the invention may be carried out, similar reference characters being employed throughout the various figures to indicate corresponding elements. In these drawings,

Fig. 1 is a vertical section through a non-oxidizing annealing furnace embodying my invention, the section being substantially on line 1—1 of Fig. 2.

Fig. 2 is a vertical section through the furnace substantially on line 2—2 of Fig. 1.

Fig. 3 is a side elevation of the furnace showing the drive mechanism.

Fig. 4 is an end view of the mounting at one end of the main shaft with a portion of the index plate broken away to more clearly show the construction.

Fig. 5 is a top plan view of the water well showing a plan view of the charging mechanism.

Fig. 6 is a section of a furnace of a slightly different construction, the section being substantially on line 6—6 of Fig. 7.

Fig. 7 is a section substantially on line 7—7 of Fig. 6.

Fig. 8 is a detail view showing the method of removing of the charge from the charging mechanism in the form of device shown in Figs. 6 and 7, and

Figs. 9 and 10 are similar views showing the action of removing the charge from the carrier in the form shown in Figs. 6 and 7.

Referring to the form of the device shown in Figs. 1 to 5, the furnace comprises a metal casing 10 enclosing a refractory lining 11 forming the heating chamber 12. A shaft 13 extends transversely across this chamber and carries the upright wheels or discs 14 which form supports to carry the work, indicated by the cylinders 15, during the heating operation. The shaft is mounted on bearings shown as disc rollers 16 which are carried by bearings in the pillow blocks 17. These blocks are mounted for adjustment on their supports 18 so as to adjust the position of the shaft 13, the blocks being adjusted by means of the screws 19. The shaft is driven through suitable gearing from an electric motor 20 or other suitable source of power. The armature shaft of the motor drives the gear 21 which drives a worm 22 meshing with a worm gear 23 driving a pinion 24 meshing with a gear 25 on the shaft 13. The shaft is surrounded by suitable stuffing boxes 26 which prevent leakage of atmospheric air into the furnace. The work 15 to be heated is carried on holders 27 such as bars which rest loosely in notches or recesses 28 in the peripheries of the discs or carriers 14.

Carried on the shaft outside the furnace is an index plate 29 which carries numbers corresponding to the number of recesses or notches 28 in the work carrier. A pointer 30 cooperates with this disc to indicate when the recesses in the carrier are in alignment with the loading and unloading mechanism.

Mounted below the furnace is a tank 31 carrying water to form a liquid seal to prevent atmospheric air passing into the furnace. The level of the water is shown at 32 and the diaphragm 33 extends down below the water level to make this seal. In the tank are mounted a pair of rails 34, which in the present instance are secured to the sides of the tank, and the wheels 35 of the car 36 are mounted on these rails. This car carries a hydraulic cylinder 37 provided with a ram or plunger 38 which carries at its upper end a fork or support 39 for the work. This support has upright side members 40 guided for up and down movement in the guides 41 carried on the car. A flexible hose 42 and pipe 43 lead to the lower end of the cylinder and serve to connect this cylinder with a source of water under pressure. This hose is connected through a three-way valve

44 with a water supply pipe 45 provided with a regulating valve 46 and a discharge pipe 47 leading from the other side of this valve and discharging into the tank, this pipe also having a regulating valve 48. The water level in the tank is prevented from going above a certain limit by means of the overflow pipe 49. The regulating valves 46 and 48 provide means for regulating the speed of the ram or plunger 38. Mounted in the tank is a chain 50 connected to the car and running over a sprocket 51 and a sprocket or sheave 51′ mounted at the opposite ends of the tank, the sprocket at the outer end being mounted on a shaft 52′ driven by means of a chain 52 from a sprocket 53 operated by a hand crank 54. The operation of this chain through the hand crank moves the car 36 from the dotted line position in Fig. 1 in the outer open side of the tank to the full line or charging position under the furnace in the operation of charging work in the furnace, and also back to its original position in the operation of removing the work form the furnace.

A pipe 55 leads to the heating chamber and may supply steam or gas to maintain the atmosphere desired in this chamber. There is also a discharge pipe 56 carrying a safety valve 57 leading from the heating chamber to the outside of the furnace to relieve any excess pressure in the chamber.

The foregoing elements are common to both types of furnaces shown, that is, they are also used in the construction shown in Figs. 6 to 10.

In the form of furnace shown in Figs. 1 to 5 the heating chamber 12 is heated by means of electric heating elements 58. At the lower half of the upright discs or work carriers 14 are mounted guide rails 59 which operate to retain the work holding elements 27 in the notches 28 in the peripheries of the carriers when these notches are below the horizontal center line of these carriers. Between the two guide rails 59 at the lower part of the furnace is a gap 60 through which the ends of the holders 27 pass in inserting the work in these carriers or removing it therefrom. The frames of these guide rails 59 are provided with upright guides 61 forming continuations of the guides 41 on the car 36 when this car is in the position under the heating chamber, and the support 39 is provided with lugs 62 which when the support is in the upper position, as shown in Figs. 1 and 2, engage the under sides of the rails 59 to limit the upper movement of the support when its top is substantially flush with the top of the rails, so that the work holders 27 will roll directly onto or from the top of this support 39 from or to the top of the rails 59. As the bar or holder 27 rests on a substantially flat top of the fork or support 39 it is retained thereon during the up and down movements of this support by the guides 41 and 61.

The operation is as follows: The tank 31 is filled to the water line 32 and the furnace is heated to the required temperature. For convenience the shaft 13 is rotated until the pointer 30 indicates the position #1 on the index plate 29, and it also indicates that one set of the notches or recesses 28 in the rotatable carriers 14 is in alignment with the gap 60 in the rails 59 at the bottom of the furnace. The material 15 to be heated is placed on the work support 39 on the car in the tank when it is at the dotted line position shown in Fig. 1, the work being lowered into the tank by means of an overhead lift or crane not shown. By means of the hand crank 54 and the chains, shafts and sprockets 50—51—52—53 the car carrying this work is shifted to the full line position under the furnace shown in Figs. 1 and 2. The three-way valve 44 is then opened to the supply 45 and the water pressure acts to raise the ram 38 and the support 39 with the work thereon to the upper position shown in Figs. 1 and 2, this upper movement being limited by engagement of the lugs 62 on the under side of the rails 59. The water pressure is left on to hold this support in this position, and it will be apparent from Fig. 2 that the bar or work holder 27 is in the notches 28 which are in a position to receive it. The motor 20 is now started to revolve the upright carriers 14 until the pointer 30 indicates position #2 on the index plate. This movement of the upright carriers 14 will carry the work holder 27 onto the top of the rails 59 and will bring the next set of notches or recesses over the gaps 60 in which the fork 39 is located. The throwing of the valve 44 to the exhaust position will allow the water in the plunger to flow through the discharge pipe 47 and will allow the plunger 38 and the support 39 to drop to their lower position in the car 36. The car may now be returned to the outer or dotted line position shown in Fig. 1 to receive the next charge. After a suitable interval of time, depending upon the material to be heated and the temperature to which it is to be heated, the loading operation is repeated until all of the sets of recesses in the peripheries of the carriers 14 are filled as indicated in Fig. 2. It will be apparent that as the last load is taken or removed from the top of the support 39 by the rotation of the discs 14, the first load is by the same movement deposited on this support. Therefore, when this support and the plunger is lowered this charge is lowered with them from the heating chamber into the water tank. The speed of this downward movement is controlled by the regulating valve 48, and this is usu-

ally partially closed to give a slow downward movement to avoid the sudden increase in the volume of steam inside the furnace chamber which would result if the heated material were rapidly lowered into the water. The safety valve 57 provides for the escape of an excess of steam in the heating chamber.

In the form shown in Figs. 6 to 10 the supporting discs 63 on the shaft 13 are enclosed in a retort 64 which is attached to the top of the water tank 31, this retort being located in the chamber 65 enclosed by the refractory walls 11. The retort is heated from the outside by means of an oil or gas burner 66 discharging into a combustion chamber 67 covered by a perforated arch 68. The gases from this chamber pass into the chamber 65 about the retort and the waste gases are discharged into the flue 69. In this form of the device the notches or recesses 70 in the peripheries of the carrier discs 63 are elongated to provide hooks 71 at the opposite sides thereof which retain the work holders or supports 27 without the use of the stationary guards, other than the short guards 72, which are used in the first form. In this construction a pair of guide and stop brackets 73 are mounted under the carrier over the outlet from the liquid tank. These brackets form guides for the support 74 for the work on the ram of the lifting device, and the lower walls thereof form stops to engage the top of the guide ribs 75 to limit the upward movement of the support and position it in proper position to discharge or receive the work holder. At the top of each side of the fork or support 74 there is mounted a swinging load rest 76. This rest has spaced lugs 77 on opposite sides of a stud 78 which coact to limit the movements of this rest in opposite directions, the rest being pivoted to the support at point 79. At their upper ends these rests are provided with curved recesses 80 to form seats for the work holders 27. The pivot for these rests may be positioned to one side of the center as shown so as to overbalance them and cause them to tend to assume the upright position as shown in Fig. 7, or a counterweight or spring may be provided for this purpose.

This device operates as follows: The work holders or supports 27 are placed on the rest 76 on the car 36 in the outer portion of the liquid tank the same as in the first form and then the car is shifted to the position under the furnace. The work support or carrier 63 has been brought to a position where a pair of the notches 70 are above the space between the guides 73 as illustrated in Fig. 7, the work carriers being rotated by the same mechanism and located by the same indexing device as is used in the first form. Water under pressure is then fed to the lower end of the cylinder by the valve control 44 which raises the support 74 to the position shown in Fig. 7, the upward movement being determined by engagement of the ribs 75 with the under side of the brackets 73. In this position it will be noted that the work holder 27 is within one set of notches 70. If now the carrier discs 63 are rotated in the direction indicated by the arrow the rear wall of the notches will engage the holder 27 and carry it off the rests 76 by swinging these rests to the right as shown in Fig. 8, and the holder 27 will now rest in the left hand hooks 71 and it will be carried around the retort as the carriers 63 are rotated. As each individual holder 27 passes down on the opposite or left hand side of the carrier 63 as viewed in Fig. 7, the member 27 will pass to the other side of the notches and will rest in the hook 71 on the opposite sides of these notches as shown in Fig. 7. When it reaches the lowermost position as indicated in Fig. 9, the holder 27 will engage the rear side of the rests 76 and will swing them to the right till their movement is arrested by the studs 78, and then further movement of the discs 63 will cause these rests 76 to force the member 27 out of the hook and it will seat in the notches or recesses 81 in the top of the fork or support 74. Now as this support is lowered the work will be lowered into the liquid and will be removed as in the first form.

It will be obvious that the principles of my invention can be employed with other specific constructions than those shown and that it may also be used for the heating of other materials than metal, and also other than of cylindrical shape provided that the shape of the load is such that it may be circumscribed by the maximum cylinder which could be accommodated.

The work carrier part of my invention could be employed for instance in an oven for baking japanned metal articles by omitting the water tank and the car and by hanging the work on the work holders 27 or on smaller rods attached to them, or to a pair of trunnions taking their place. For instance, certain classes of work might be placed in barrels or boxes hanging on trunnions corresponding to the holders 27 and these barrels or boxes could be of perforated metal and this furnace could then be used for heating small articles.

By excluding air at the diaphragm seal 33 and the stuffing boxes 26 about the shaft, and by use of suitable gaskets at the joints in the casing or retort, atmospheric air can be practically excluded from the interior of the heating chamber to permit the maintenance of a non-oxidizing atmosphere, for instance, steam which may be to a great extent maintained by the action of the hot material entering the water chamber. The steam

pipe 55 provides for the use of steam from an independent source for the heating chamber, as for instance when the chilling effect of a charge of cold work is sufficient to reduce the pressure in the heating chamber to cause a suction which would draw in air through any leaky joints and cause trouble. It will also be obvious that an inert gas may be fed to the heating chamber through the pipe 55 instead of steam if desired. The safety valve 57 will permit escape of steam or gases in the heating chamber when the internal pressure rises appreciably above that of the outside atmosphere and will prevent its blowing out through the water seal at 33.

It will be apparent from the foregoing description that the operation of this furnace is continuous and the length of heating or the treatment of the work may be determined by the speed at which the carrier in the furnace is rotated and also by intervals between the feeding of a new charge and the removal of an old charge from the furnace. It will also be apparent that the operations of placing a new charge in the furnace and removing an old charge therefrom are performed practically simultaneously and with the same mechanism, thus reducing the number of separate mechanical devices required.

Throughout the specification and claims I have called the upright carrier members "discs" for convenience, but it will, of course, be understood that they are not necessarily made of closed flat plates but may be of other suitable structures, such as wheels with spokes or similar structures.

Having thus set forth the nature of my invention, what I claim is:

1. In a heating furnace, a heating chamber, a carrier in said chamber mounted to revolve in a vertical plane and having means at its periphery for carrying holders for the material to be heated, and mechanical means for inserting the holders in and removing them from the carrier.

2. In a heating furnace, a heating chamber, a carrier in said chamber mounted to revolve in a vertical plane and having means at its periphery for carrying holders for the material to be heated, a liquid seal for sealing said chamber from the outer atmosphere, and means for carrying the holders through said liquid seal and inserting them in and removing them from the first mentioned carrier.

3. In a heating furnace, a heating chamber, a work carrier mounted in said chamber to revolve in a vertical plane and adapted to carry adjacent its periphery the holders or containers of the material to be heated, means for inserting and removing said holders and material, means for excluding atmospheric air from the heating chamber, and means for maintaining in said chamber an atmosphere of other nature.

4. In a heating furnace, a plurality of spaced discs mounted to revolve in vertical planes and provided with recesses in their peripheries adapted to carry holders or containers of the material to be heated, and means for inserting and removing said holders or containers at a single location.

5. In a heating furnace, a plurality of spaced discs mounted to revolve in vertical planes and provided with recesses in their peripheries adapted to carry the holders or containers of the material to be heated, and a common means for inserting and removing said holders or containers.

6. In a heating furnace, a heating chamber, a horizontal shaft extending across said chamber, bearings for the shaft outside the chamber, and a carrier for the material to be heated mounted on said shaft within the chamber comprising spaced upright discs provided with recesses in their peripheries adapted to carry holders for the material to be heated, a loading station at one side of said carrier, and means at said station for inserting the holders in the said recesses.

7. In a heating furnace, a heating chamber, spaced upright discs mounted to rotate in said chamber and provided with means for carrying holders for the material to be heated, a charging device comprising a support for the holder arranged to pass through a wall of the furnace to said chamber and insert the holder in said carrying means, and means to rotate the carrier to remove the holder from the support.

8. In a heating furnace, a heating chamber, spaced upright discs mounted to rotate in said chamber and provided with spaced sets of recesses in their peripheries adapted to carry holders for the material to be heated, a charging device comprising a support for the holders mounted to move from below the furnace to a position to insert the holder in a set of said recesses, and means to rotate the disc to remove the holder from the support.

9. In a heating furnace, a heating chamber, a carrier mounted in said chamber to rotate in a vertical plane and provided with recesses opening through the periphery of the carrier adapted to receive holders for the material to be heated, means for inserting the holders in said recesses, and curved stationary guides to retain the holders in the recesses as the carrier rotates.

10. In a heating furnace, a heating chamber, a liquid tank mounted below said chamber and communicating with the chamber through the bottom thereof, a work carrier in the chamber mounted to revolve in an upright plane and having recesses to receive work holders, and loading means mounted

in the tank, said means comprising a support mounted to move laterally in the tank and vertically to insert the work holders in the carrier.

11. In a heating furnace, a heating chamber, a liquid tank below said chamber and communicating therewith, a movable work carrier in said chamber, a charging device in said tank comprising a car mounted on wheels, a track for said car, a lifting device carried on said car comprising a vertically movable work holder support, means for shifting the car in the tank to and from a position under the heating chamber, and means for lifting the support when under the chamber to insert the work holder in the carrier.

12. In a heating furnace, a heating chamber, a liquid tank below said chamber and communicating therewith, a movable work carrier in said chamber, a charging device in said tank comprising a car mounted to move laterally to and from a position under the chamber, upright guides on said car, a vertically movable work support mounted on said car having upright side members guided in said guides and adapted to carry a work holder in the upper ends thereof, and means on said car to raise said support to insert the holder in the carrier.

13. In a heating furnace, a heating chamber, a work carrier in said chamber comprising spaced discs mounted to rotate in vertical planes and provided with spaced recesses in their peripheries adapted to carry work holders, a liquid tank below said chamber and communicating therewith, a charging device in said tank comprising a car mounted to move laterally in the tank to and from a position under the heating chamber, upright guides on said car, a vertically movable work support mounted on the car having upright side members guided in said guides and adapted to carry a work holder on the upper ends thereof, and means on said car to raise said support to insert the holder in the recesses in the carrier.

14. In a heating furnace, a heating chamber, a shaft extending across said chamber, bearings for said shaft, upright carrier discs mounted on said shaft having recesses opening through their peripheries adapted to receive work holders, a vertically movable charging device below said chamber comprising a support for a work holder, upright guides for said holder, means for shifting the shaft bearings to adjust the position of the work carrier with respect to said guides, and means for raising the support to insert the holder in said notches.

15. In a heating furnace, a heating chamber, a horizontal shaft, bearings for the shaft, an upright carrier on said shaft having means adjacent its periphery adapted to carry holders for the material to be heated, charging means for inserting the holders in said means, and means for shifting the bearings to position the carrier with respect to the charging means.

16. In a heating furnace, a heating chamber, spaced discs mounted to rotate in vertical planes in said chamber provided with recesses opening through their peripheries adapted to carry holders for the material to be heated, curved guides adjacent the peripheries of said discs below the horizontal center line thereof to retain the holders in the recesses, said guides being each provided with a gap, a charging device comprising a support for a holder and movable to a position in said gaps to insert the holder in the recesses, and means for inserting the support in and removing it from the gaps.

17. In a heating furnace, a heating chamber, a work carrier in the chamber mounted to turn in an upright plane and having means to receive work holders, means for inserting work holders in said means, and stationary means for retaining the holders in the carrier.

18. In a heating furnace, a heating chamber, a work carrier in the chamber mounted to turn in an upright plane and having recesses to receive work holders, a stationary guide to retain the holders in the carrier and provided with a gap, a support for a holder, means for moving said support to and from a position in the gap to place a holder in the carrier, and means for turning the carrier.

In testimony whereof I affix my signature.

JAMES R. COE.