Nov. 20, 1956 F. O. HESS 2,771,056

APPARATUS FOR COATING PIPES

Filed June 6, 1951 2 Sheets-Sheet 1

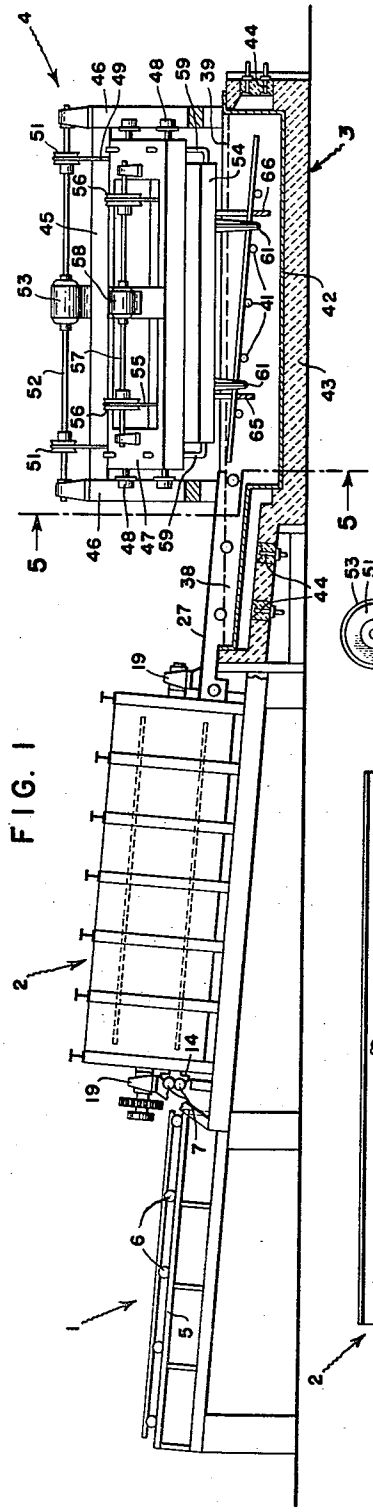


FIG. 1

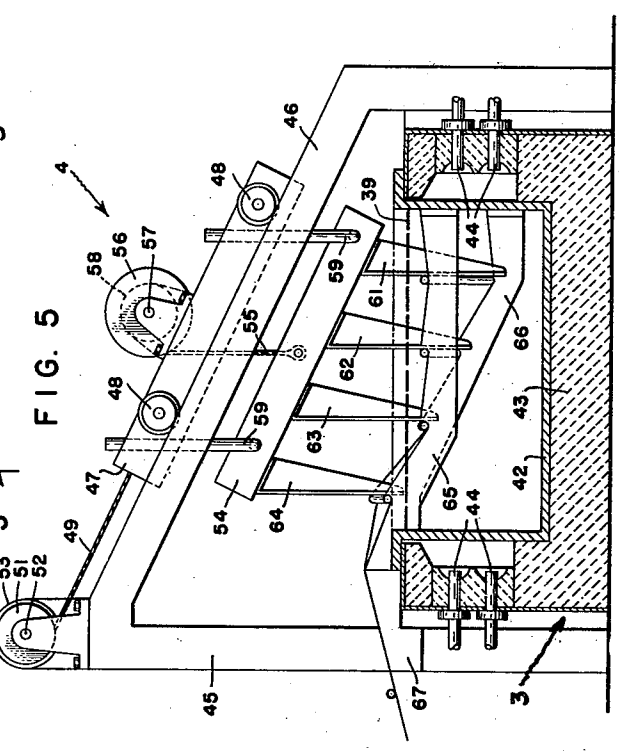


FIG. 5

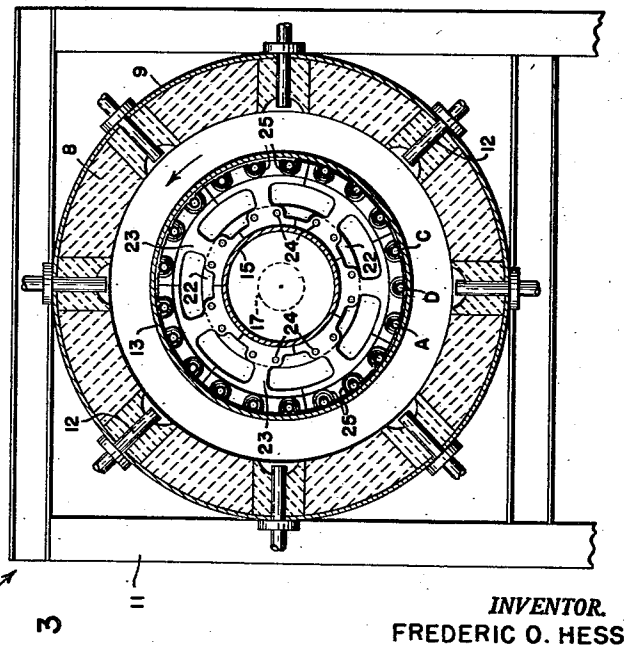


FIG. 3

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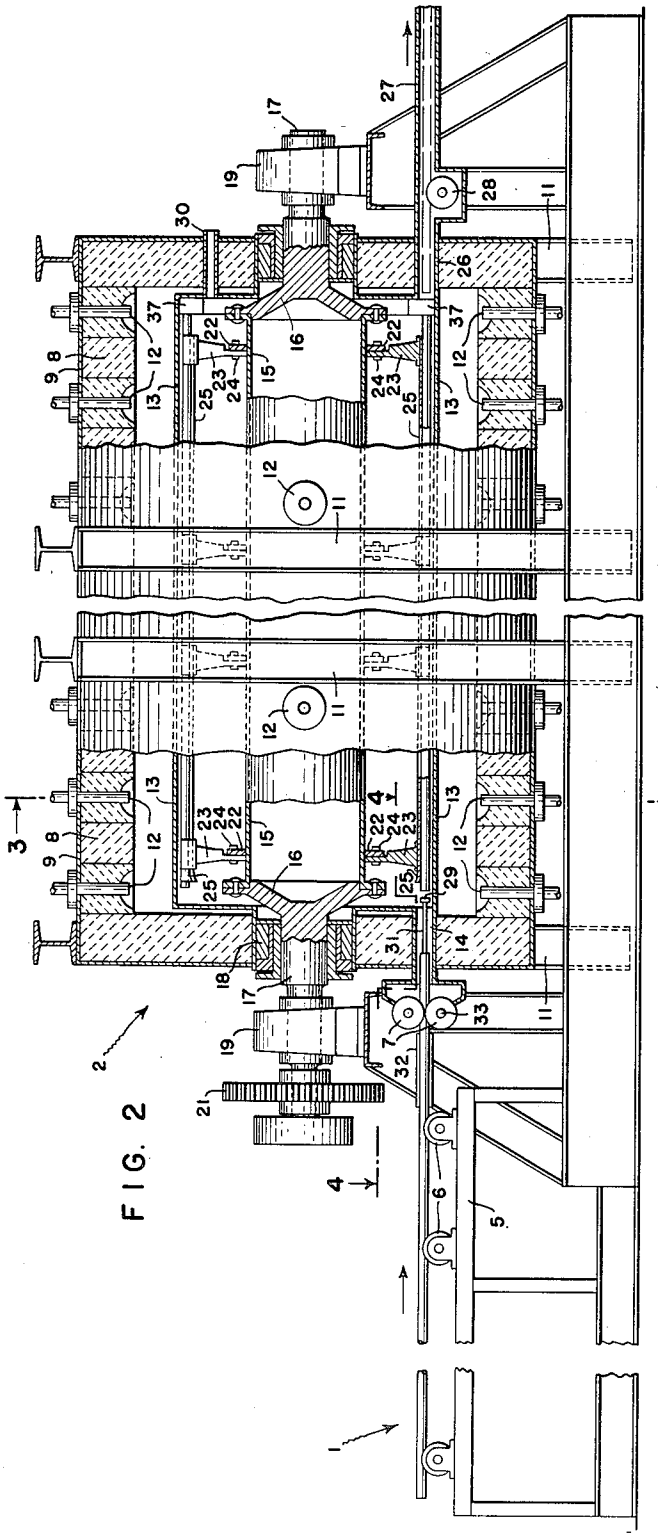


FIG. 2

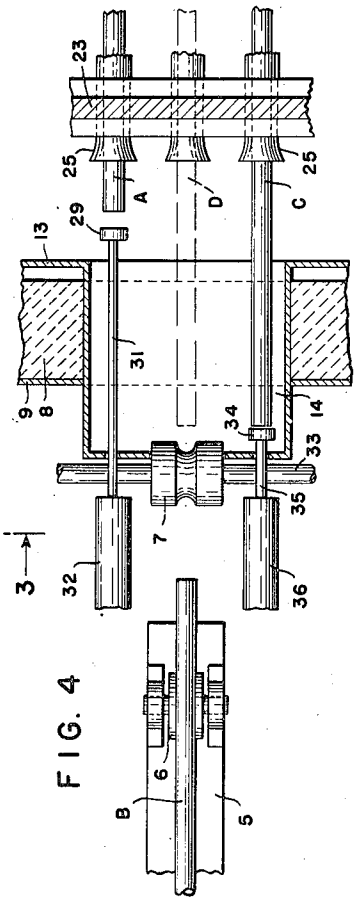


FIG. 4

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APPARATUS FOR COATING PIPES

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Application June 6, 1951, Serial No. 230,166

5 Claims. (Cl. 118—64)

The present invention relates to the coating of elongated metal bodies, and more particularly to the coating or galvanizing of pipes, tubes and the like. In describing the invention, reference will be made to the galvanizing of pipes, although it will be apparent to those skilled in the art that other elongated bodies can be coated, and that the coating treatment can be for processes other than galvanizing.

In the galvanizing of metal it is necessary to have a clean surface in order to obtain a good bond. It is also desirable, if not necessary, to have the metal to be coated at a temperature at least equal to the temperature of the coating bath.

It is an object of the present invention to provide a method and apparatus for galvanizing continuously pipe and the like. It is a further object of the invention to provide a method and apparatus for supplying pipes one after the other in end to end relation to a furnace in which they can be heated in an non-oxidizing atmosphere, and transferring the pipes one after the other from the furnace, through an enclosed passageway to the galvanizing bath. The pipes are removed from the bath either transversely or axially to a place of storage.

In practicing the invention, there is provided a supply table from which pipes are moved one after the other in an axial direction into a furnace. The furnace is of the muffle type in which there is a reel having portions at the periphery thereof to receive the individual pipes. This reel is rotated while the pipes are being heated in a non-oxidizing atmosphere, to move the pipes through substantially 360° from the receiving position to a discharge position from which they are removed axially in the same direction that they travelled into the furnace. The pipes move through an enclosed passage in which they are protected from the air directly into a galvanizing bath. Means are provided to remove the coated pipes from the bath to a point of storage.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific object attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described preferred embodiments of the invention.

In the drawings,

Figure 1 is a side view, partly in section, of the general arrangement of the galvanizing system,

Figure 2 is an enlarged side view of the furnace, partly in section,

Figure 3 is a sectional view of the furnace taken on line 3—3 of Figure 2,

Figure 4 is a section view showing the loading apparatus taken on line 4—4 of Figure 2, and

Figure 5 is a section taken on line 5—5 of Figure 1 to show apparatus for discharging the pipe from the galvanizing tank.

Referring to Figure 1, there is shown the general arrangement of the apparatus by means of which pipe, tubing, rods and the like, may be moved substantially continuously from a point of supply to a point of delivery at which the pipes are galvanized. There is shown a supply station 1 from which the pipes are fed to a furnace 2. As the pipes are discharged from the furnace, they are supplied to a galvanizing tank 3 having a discharge apparatus 4 cooperating therewith. The supply table and the furnace are shown as being at a slight angle to the horizontal. This arrangement permits the pipes to go in the galvanizing tank at an angle so that any gas in the interior of the pipes will be discharged as the galvanizing material flows upwardly through the bore of the pipe.

The supply station 1 consists of a table upon which the pipes are laid and includes a portion 5 that extends substantially to the entrance of the furnace. This portion is provided with a series of rollers 6 by means of which the pipe can be fed axially into a pair of continuously rotating pinch rollers 7 at the entrance of the furnace. The furnace itself includes a substantially cylindrical structure 8 made of refractory materials such as firebricks that are backed up with insulating material. Surrounding the refractory structure, in the usual manner, is a sheet metal backing 9. Also, in accordance with usual furnace practice, the entire furnace is supported rigidly in place by structural steel members 11. The refractory material 8 has located at spaced points along its length and around the interior thereof, a plurality of burners 12 by means of which the furnace is heated. These burners can be of any suitable type, but are shown herein as being of the type disclosed in Hess Patent 2,215,079, issued September 17, 1940. Each of these burners includes a refractory block that has a substantially cup-shaped opening in the face thereof. A combustible mixture of gas and air is supplied through suitable piping to the base of the cup where it is discharged in a series of substantially radially directed jets to be burned along the cup surface and heat the latter to incandescence. Radiant heat as well as convection heat from the hot gases of combustion bring the furnace to the desired temperature. The various burners are connected by suitable piping and manifolds (not shown) so that the burners can be controlled either singly or in groups to heat uniformly the entire area of the furnace chamber.

Located concentrically within the furnace chamber is a cylindrical muffle 13 made of suitable heat resisting alloy steel. This muffle is provided with an inlet corridor 14 leading from the feed roll 7 and through which the pipes are moved into the muffle where they are heated. The various pipes to be heated are moved into the muffle in an axial direction and are then moved transversely around the inner surface of the muffle while they are being heated. Thereafter, the pipes are moved axially from the furnace to the galvanizing bath. To this end, there is provided in the muffle, an elongated hollow shaft 15 the ends of which are closed by discs 16. Each of these discs has a projection 17 extending axially therefrom through an opening in the muffle. The openings in the ends of the muffle through which the projections extend are closed by stuffing boxes 18, and the ends of the projections 17 are received in bearings 19 in which they can rotate. Rotation is accomplished intermittently by any suitable means that is shown herein as including a gear 21 on the end of one of the trunnions 17 which gear is driven in any suitable manner.

The shaft 15 is used to support a reel that receives the pipes and moves them around the interior of the muffle. To this end, the shaft is provided with a plurality of radially extending flanges 22 to which are attached by bolts 24 a plurality of substantially T-shaped supporting members 23. Each of these members is provided on its

periphery with a plurality of notches that are aligned with similar notches on the other members. The aligned notches each receive a substantially semi-circular guiding and holding channel **25** into which the pipes are moved by the pinch roller **7**. The muffle **13** is provided at its opposite end, on the right end of Figure 2 of the drawing, with an outlet corridor **26** through which the pipes are discharged into an enclosed passageway **27** leading to the galvanizing bath. A means is provided at the entrance of the passageway **27** for moving the pipes axially into the galvanizing bath which my take the form of pinch rollers, but is shown herein as being a continuously driven magnetic roller **28**. During the time that the pipes are being heated, they are preferably protected from the effects of oxygen in the air by introducing into the muffle a suitable neutral or reducing atmosphere. To this end, there is provided a pipe **30** through which the atmosphere may be discharged into the muffle.

The inlet corridor **14** and the means for loading and unloading the pipes in the muffle are best shown in Figure 4. Referring to that figure, it will be seen that the shaft **15** has been rotated to a position in which one of the channels **25** is axially aligned with the pinch rollers **7**. There are also shown in this figure three of the pipes indicated at A, B and C. The pipe A is in the unloading position which is adjacent to and parallel to the position in which it was loaded into the muffle. The pipe is unloaded from the muffle by moving it while it is in the position A axially until the other end thereof is in engagement with the drive roller **28**. For this purpose there is provided a plunger **29** on the end of a piston rod **31** that is received in a cylinder **32**. When the piston rod is moved to the right in Figure 4, the pipe will be moved axially so that it can be removed by the roller **28** from the muffle. The pipe shown at B is in the loading position. This pipe is moved either manually or automatically until its right end is grasped by the pinch rollers **7**. The pinch rollers, driven by the shafts **33**, will then move the pipe axially into the channel **25** that is aligned therewith until the pipe is in the dotted line position indicated at D. The pipe shown at C is the pipe that was last moved into the muffle by the pinch rollers. It will be noted that the left end of this pipe is still in the corridor **14**, and that its end has not been moved far enough to clear the end of the muffle. The pipe is pushed further into the muffle until it is in an axial position corresponding to the position A by a means of a plunger **34** that is on the end of a piston rod **35** received in a cylinder **36**. The plunger **34** will move the pipe to the right until its right end hits a stop **37** which is shown in Figure 2 of the drawing. It is noted that this stop extends around the interior of the end of the muffle except across that portion of the muffle through which the outlet corridor **26** is formed.

In the operation of the system thus far described, the shaft **15** and the parts carried thereby are moved to a position in which the channels **25** are lined up as shown in Figure 4 of the drawing. The position that these channels assume with respect to the muffle is also shown in Figure 3 of the drawing. While the shaft **15** and the reel carried thereby are stationary in the position of Figure 4, fluid is permitted to flow into the cylinders **32** and **36**, thereby moving the plungers **29** and **34** respectively to the right in that figure. Simultaneously the pipe indicated at B is moved into the pinch rollers so that they can move it into the furnace. By the time the pipe B is completely in the furnace, the pipe at A will be removed from the furnace by roller **28**, and the pipe at C will have been moved up against the stop **37**. The plungers **29** and **34** are then retracted to the position shown in Figure 4 and the shaft **15** is again rotated to bring the parts carried thereby into a position for another pipe to be discharged from the furnace while a new pipe is being moved into the furnace. The intermittent rotation of the reel and the operation of the pipe moving plungers may be obtained by any suitable operating mechanism.

It will be noted that the muffle is closed except for the exit corridor **26** and the entrance corridor **14**. As will be pointed out below, none of the atmosphere introduced into the muffle can be lost through the passageway **27**. There is a continual leakage of the atmosphere, however, through the entrance corridor **14**, both between the pinch rollers **7** during the time that no pipe is between these rollers, and through the bore of the pipe itself as one is being moved into the muffle. This leakage, however, is necessary since the atmosphere within the muffle is used to purge the bore of the pipes so that any oxygen in the pipes will be removed before they are heated. This does away with the possibility of the interior of the pipes becoming oxidized.

As the pipes leave the furnace, they pass through the passage **27** into the galvanizing tank **3**. The tank, as shown in Figure 1, has a shallow portion **38** extending to the left in that figure, almost to the exit of the furnace. The level of the galvanizing bath is indicated at **39** and it will be seen that the pipes enter the bath prior to the time that they leave the passage **27**. In this way, the pipes are protected from the oxidizing effects of the air between the time they are heated until they are completely immersed in the bath. During their travel from the furnace to the bath, the pipes are guided on a series of rollers **41** so that each pipe moves through a path which is at an angle to the horizontal. In this fashion, any of the atmosphere from the furnace that remains in the pipe is forced out of the same as the galvanizing material flows through the center of the pipe, as well as along the surface thereof.

The galvanizing tank is shown as being constructed in accordance with usual furnace practice. There is provided a metal tank **42** in which the molten zinc for the bath is contained. Around this tank is the usual insulating refractory material **43**. It will be seen from an inspection of Figures 1 and 5 that portions of the refractory are spaced from the outer surface of the tank to form a combustion space into which burners **44** are directed. These burners are shown herein as being similar to the burners that were used in the furnace. The heat from these burners is used to melt and to maintain liquid the material with which the pipes are coated.

The pipes can be removed from the galvanizing bath in any desired fashion. If there is room enough, the pipes can be moved axially through and out of the bath to a point of storage. As shown herein, however, the pipes are moved transversely from the bath by apparatus, the details of which are shown more or less diagrammatically in Figure 5. There is provided a framework **45** extending above the galvanizing tank, the upper members on the ends of which form a pair of rails **46**. A carriage **47**, provided with rollers or wheels **48** riding on the rails **46**, is moved back and forth transversely of the tank **3** by means of cables **49** that are guided over pulleys **51**. These pulleys are mounted on a shaft **52** that is suitably journaled on the framework, and which is rotated periodically in opposite directions by means of a motor **53**. A second carriage **54** is carried by the carriage **47** and is movable vertically with respect thereto. The second carriage is supported by a pair of cables **55** that are guided over pulleys **56** on a shaft **57** that is journaled for rotation on the carriage **47**. The shaft is rotated periodically in opposite directions by means of a motor **58** to raise and lower the carriage **54**. Carriage **54** is guided for vertical movement with respect to the carriage **47** by a number of guide bars **59** that are fastened to the carriage **54** and which are received in suitable journals provided on the carriage **47**.

Depending from the lower carriage **54** are four pairs of pusher members **61**, **62**, **63** and **64**. These members serve to engage the pipes that are in the bath and move them periodically and in steps toward the left in Figure 5.

The pipes, as they move into the bath along rollers **41**, come to rest over a pair of supporting members **65** and **66** that extend across the galvanizing tank at spaced points therein. Each of these supporting members is provided with four transversely spaced stations into which the pipes are pushed as they move from the right hand position shown in Figure 5 to the discharge table **67**.

In the operation of the discharge mechanism, with the parts in the position shown in Figure 5 of the drawing, motor **53** will be rotated to move the carriages **47** and **54** to the left sufficiently to move each of the pipes in the tank one station to the left and to move the pipe in the last station on the left down the discharge table. Motor **58** will then be energized for rotation in a direction to raise carriage **54** so that the pusher members are above the levels of the pipe. Motor **53** will then be rotated in a direction to permit the carriage to move to the right until the pusher members are slightly to the right of the pipes or in a position above that shown in Figure 5, after which motor **58** is energized to lower carriage **54** so that the parts are in the position shown. This series of operations is repeated periodically. During the time that the carriages are in their right hand position, another pipe will have been discharged from the furnace into the galvanizing tank.

It will be noted from Figure 5 of the drawing that the supporting members **65** and **66** are so positioned in the tank that they will receive the pipes in their inclined position as they move into the tank. In the second station that the pipes are moved into, it will be noted that the pipes are at a smaller angle to the horizontal. In the third station, the pipes are substantially horizontal while in the last station, the pipes are above the level **39** of the bath and are moved so that they have been tilted slightly in the opposite direction. At this point, the galvanizing material in the interior of the pipe will flow therefrom so that the bore of the pipe is open. It may be necessary to use high pressure steam or air to blow the molten material from the center of the pipe. In the last position assumed by the pipe, it is horizontal and will roll down the slightly inclined discharge platform **67**.

In the arrangements shown, the burners are adjusted so that the furnace outside of the muffle is approximately 1200° F. The temperature in the muffle will be approximately 900° F. and the pipes will be in the furnace long enough to heat them to a temperature of approximately 850° F. This temperature is slightly above the melting point of the zinc in the galvanizing bath which is approximately 840° F. Therefore, it will be seen that the pipes are heated to a temperature substantially the same as, but slightly above, the temperature of the zinc so that they can impart a small amount of heat thereto, rather than remove heat from the bath. With an apparatus of this type, in which the rotating member will hold 42 pipes 21 feet long, approximately 630 pieces of pipe, ½" in diameter, can be heated per hour, or one piece every ten seconds.

From the above description, it will be seen that the invention shows a system wherein pipes to be galvanized are moved in an axial direction from a supply point into the galvanizing tank. Some place along this path of movement, the pipes are moved transversely while they are being heated. Means is provided to protect the pipes from the oxidizing effect of the atmosphere and, if necessary, to heat them in a reducing atmosphere in order to remove surface oxidation so that pipes are clean when they are moved into the galvanizing bath. This insures that there will be a good bond between the pipes and the zinc. The present arrangement is one in which the pipes may be handled conveniently and with a minimum amount of manipulation. Furthermore, the generally axial flow of the pipes requires less floor space for a given weight of pipe to be heated than is used or required by conventional galvanizing apparatus.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, as set worth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. Apparatus for galvanizing pipes comprising in combination a furnace having a substantially cylindrical closed chamber therein, means to heat said chamber located around the exterior thereof, means forming an entrance at one end of said chamber and an exit, displaced circumferentially from said entrance, at the opposite end of said chamber, rotary conveying means in said chamber to move pipe circumferentially from said entrance to said exit whereby the pipe can be heated as it is moving, a galvanizing tank located axially beyond the exit of said chamber, a tunnel extending between said exit and said tank below the level of zinc therein, and means to move pipe axially into said chamber and axially from said chamber through said tunnel into said tank.

2. The combination of claim 1 including means to supply a non-oxidizing atmosphere to said chamber and said tunnel.

3. Apparatus for galvanizing pipes comprising in combination a furnace having means to heat the same, a closed chamber in said furnace and heated thereby, means to move pipe axially into said chamber, means in said chamber to move pipe laterally from the position in which it enters said chamber to a second position displaced therefrom, means to move pipe in said second position axially from said chamber in the same direction as its first mentioned movement, a galvanizing tank adapted to contain molten zinc located in the path of movement of the pipe as it leaves the chamber to receive the pipe, a tunnel extending between said chamber where the pipe leaves said chamber to a point in said tank below the level of the zinc therein, and means to introduce a protective atmosphere in said chamber and tunnel to protect the pipe from the time it enters said chamber until it is beneath the zinc in said tank.

4. The combination of claim 3 in which said chamber is cylindrical in shape and in which said means in said chamber to move the pipe laterally operates to move the pipe circumferentially substantially in engagement with the inner surface of said chamber.

5. Apparatus for galvanizing pipes comprising in combination an elongated, closed chamber having an entrance in one end and an exit, displaced from said entrance, in the other end, a galvanizing tank adapted to contain molten zinc axially aligned with said exit, means forming a tunnel extending between said exit and a point below the level of the zinc in said tank, means to move pipe axially into said chamber, means to displace pipe laterally in said chamber from the entrance to the exit, means to move pipe axially from said chamber through said exit and through said tunnel into said tank, and means surrounding said chamber to heat the same.

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