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APPARATUS FOR CLEANING FURNACE CHECKERS

Filed Feb. 24, 1953

3 Sheets-Sheet 1

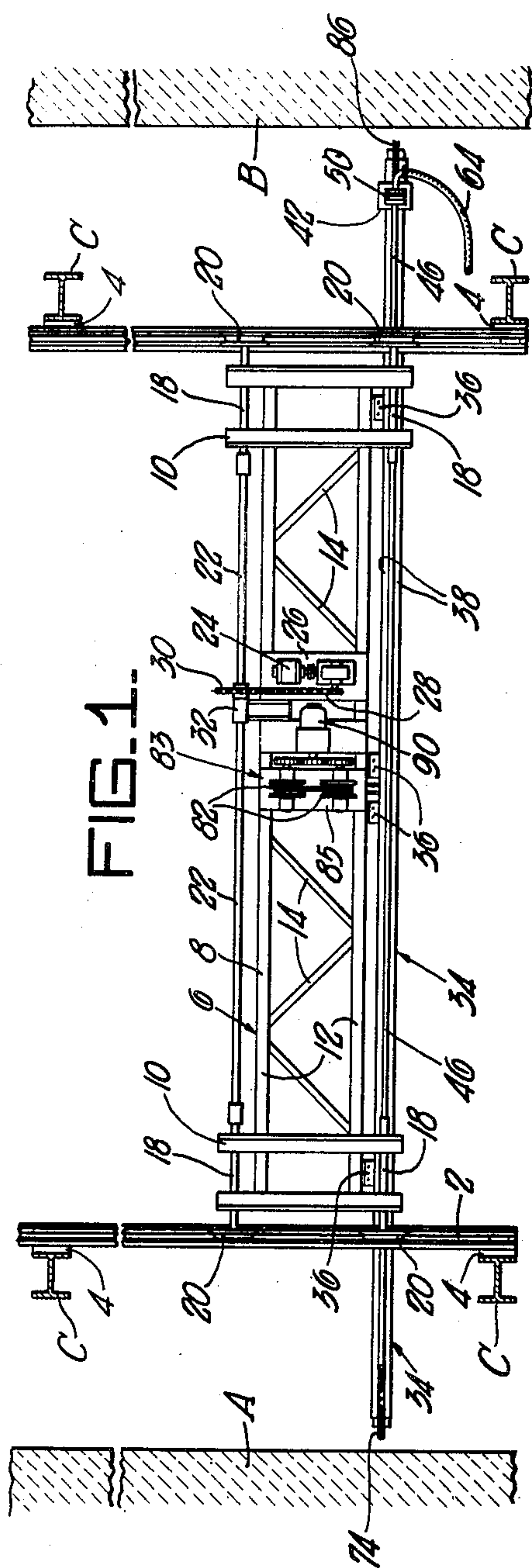


FIG. 1

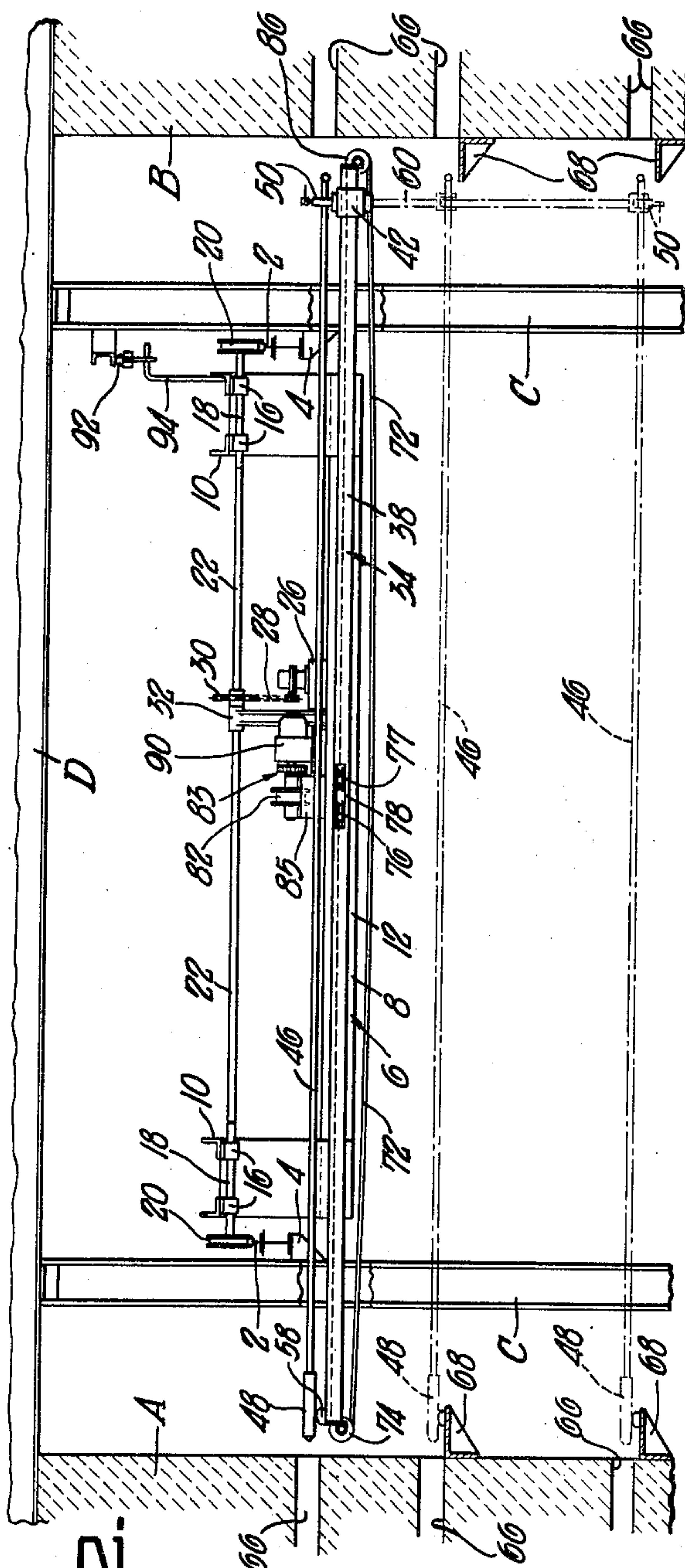


FIG. 2

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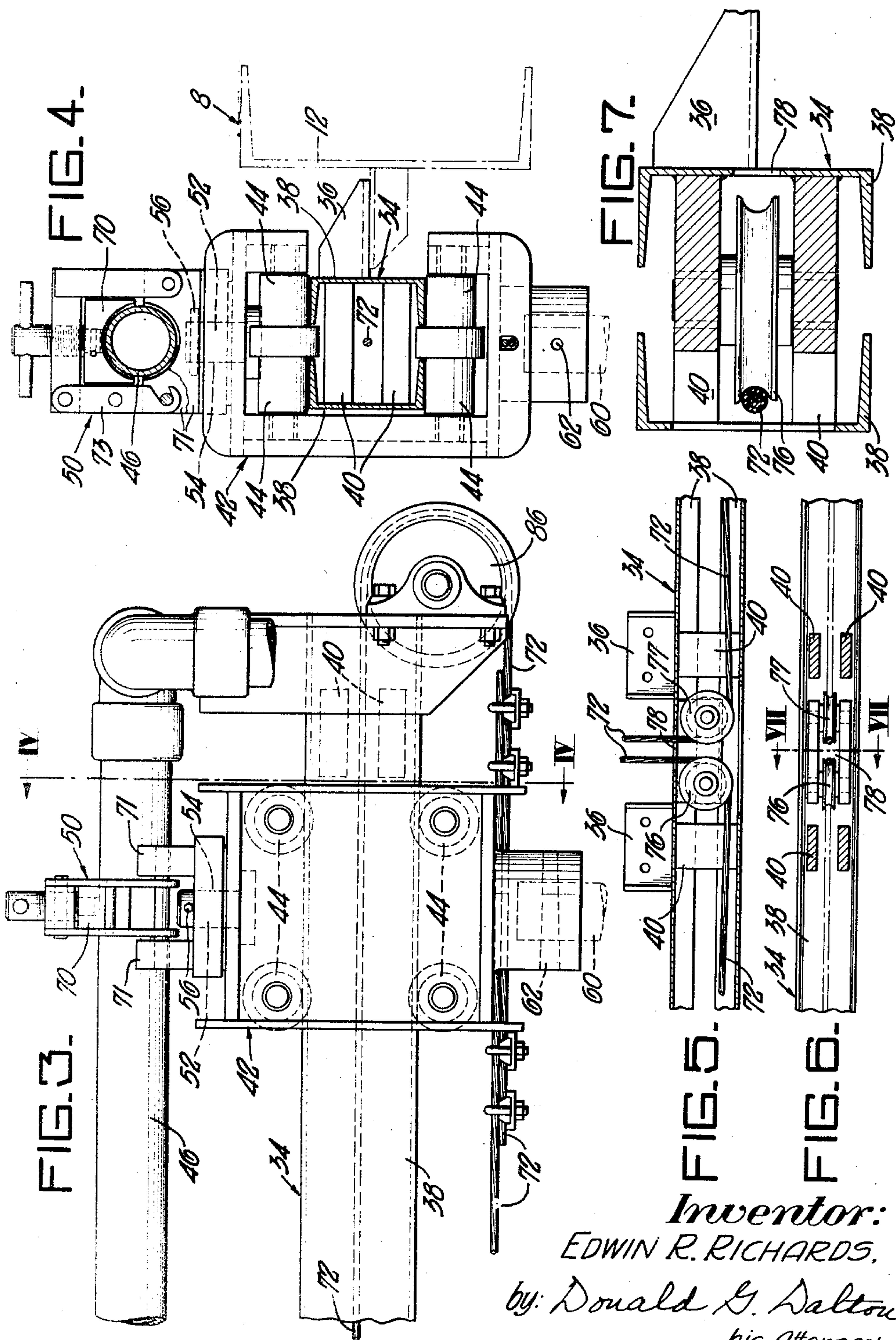
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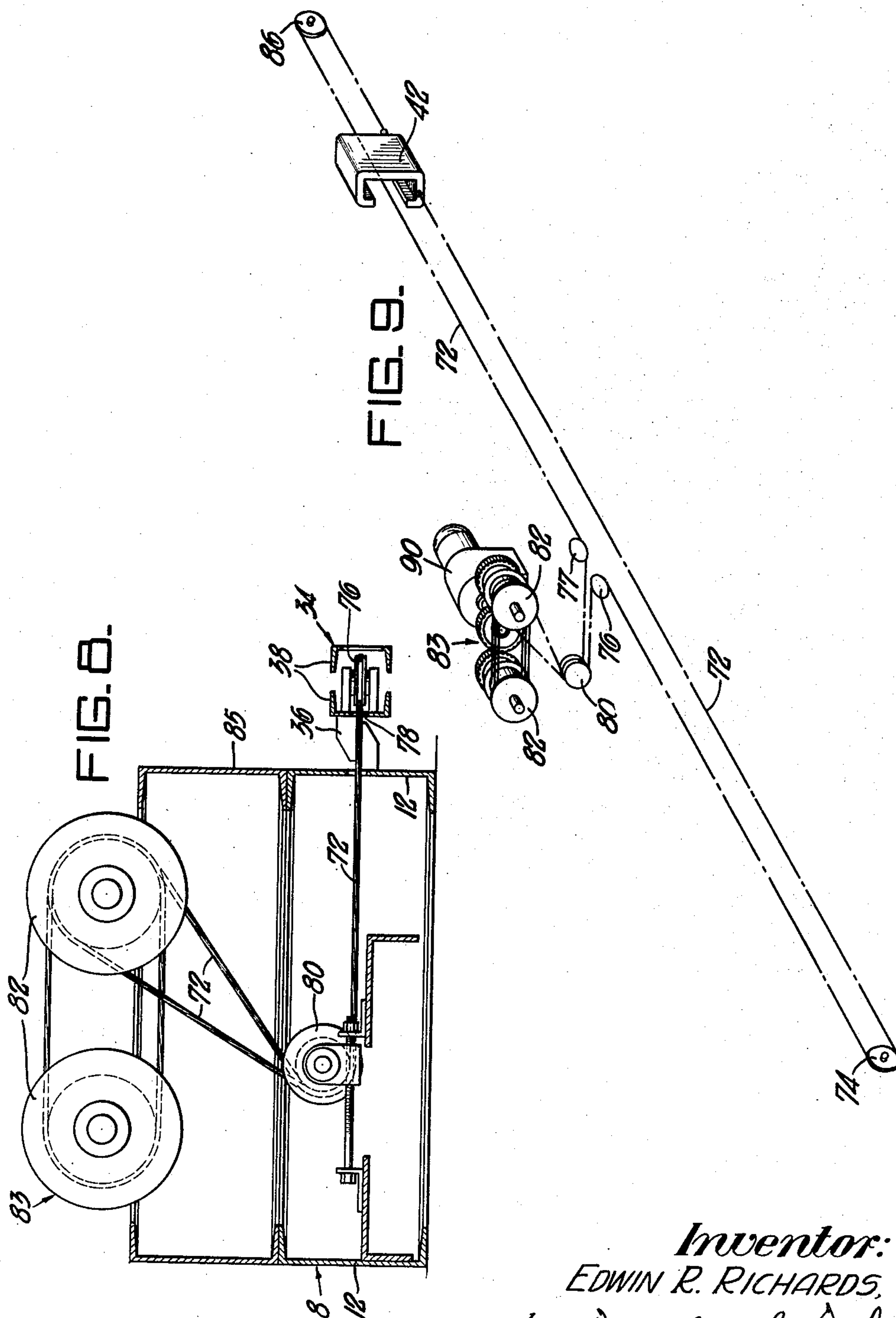
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APPARATUS FOR CLEANING FURNACE CHECKERS

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3 Sheets-Sheet 3



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APPARATUS FOR CLEANING FURNACE CHECKERS

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4 Claims. (Cl. 299—47)

The present invention relates generally to apparatus for cleaning furnace checkers and more particularly to apparatus especially suitable for cleaning the checkers of open hearth steel making furnaces.

Conventional open hearth furnaces are provided with a regenerative system for preheating the combustion air and, in some instances, the fuel gas in order to obtain sufficient flame temperature and economical fuel consumption. The ordinary open hearth regenerative system consists of a brick chamber located below the hearth level adjacent each end of the furnace. Each brick chamber is partially filled with brick in a formation commonly known as a checkerwork or checker. The bricks making up the checker are arranged so as to form a great number of passages through which the waste gases from the furnace pass on their way to the stack and, subsequently, when the flow is reversed, the air for combustion and the fuel gas pass through the passages on their way to the furnace to be heated before entering the hearth. During the operation of the furnace, debris such as flue dust, solid impurities in the combustion air or fuel gas, etc., accumulate in the checkers and tend to clog the passageways so that the efficiency of the furnace may be seriously impaired unless the accumulation of debris is removed at frequent intervals.

Various means have been devised for cleaning out furnace checkers. Almost all involved the introduction of compressed air or steam into the checker by means of a lance. Prior to my invention disclosed in Patent No. 2,604,358 issued July 22, 1952, the lance was usually manipulated manually. The apparatus of my invention provided means for mechanically manipulating the lance. The device of my hereinafter described invention is an improved mechanical apparatus for cleaning furnace checkers.

It is a primary object of my invention to provide an improved apparatus for cleaning furnace checkers which includes a lance, or similar checker cleaning instrumentality, means whereby the lance may be easily and quickly manipulated to sequentially introduce checker cleaning fluid into a plurality of checker openings along a single horizontal plane.

Another object of my invention is to provide a furnace checker cleaning apparatus of the character described in the foregoing object which may be easily and quickly adjusted to clean furnace checkers at different levels.

A further object of my invention is to provide a furnace checker cleaning apparatus of the character described in the foregoing objects which may be installed between a pair of furnace checkers and be easily operated to selectively service either of the pair of checkers.

These and other objects will become more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a plan view;

Figure 2 is an elevational view;

Figure 3 is an enlarged detail view in elevation showing the mounting of the lance on the trolley of the invention;

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Figure 4 is a sectional view taken on the line IV—IV of Figure 3;

Figure 5 is a longitudinal sectional view through the center of the trolley beam of the invention;

Figure 6 is a front elevational view of Figure 5;

Figure 7 is a cross sectional view taken on the line VII—VII of Figure 6;

Figure 8 is an end view partly in section showing the sheave and cable arrangement of the winch element of the invention; and

Figure 9 is an isometric view with parts omitted for clarity showing the cable and pulley arrangement of the invention used for moving the trolley thereof.

Referring more particularly to the drawings, reference figures A and B indicate the opposing outer walls of a pair of checker chambers of a conventional open hearth furnace. Spaced from each wall is a parallel row of vertical columns C which support the hearth D of the furnace in the conventional manner. A rail 2 is mounted by means of brackets 4 along the inside of each row of columns C for supporting a wheel mounted chassis 6 for movement in a horizontal plane parallel to the walls A and B.

Chassis 6 includes a bridge span 8 which extends transversely between the rows of columns C, and a vertical support frame 10 mounted on and projecting upwardly from each end of the span. The span 8 is preferably comprised of a pair of elongated structural members 12 held together in spaced parallel relationship by means of a plurality of welded diagonal bracing members 14.

Pairs of spaced bearings 16 are mounted on the outer side of each of the vertical frames 10 adjacent the top thereof for rotatably supporting the axles 18 of wheels 20 which carry the chassis along the rails 2. Thus, the chassis is suspended from and travels in a plane below the level of the rails.

Although the chassis may be moved along the rails manually, I have found it more suitable to provide power means for this purpose. As best shown in Figures 1 and 2, the chassis power means may include a drive shaft 22, which may be connected at its ends to the free ends of the axles 18 on one side of the chassis and reversible motor 24, which is mounted on a platform 26 carried by the span 8. The motor 24 is connected with and rotates the shaft 22 by means of a drive chain 28 and a sprocket 30 rigidly mounted on shaft 22. An upright bearing 32 may be mounted on platform 26 to provide added support for the shaft 22 intermediate its ends. Remote switches (not shown) may be utilized for operating the motor 24.

A trolley beam 34 is mounted laterally adjacent one of the elongated members of the chassis 6 in parallel spaced relation thereto by means of a plurality of welded brackets 36. The beam 34 is made up of a pair of channel members 38 held together in spaced relation with their flange edges opposing each other by means of vertically spaced longitudinal flat bars 40 which are welded to and positioned between the webs of the channels 38 as best shown in Figures 4, 5 and 6. The beam 34 is longer than the span 8, having a length slightly less than the distance between the walls A and B.

A C-shaped trolley 42 is mounted for movement along beam 34 on rollers 44, which are rotatably mounted within the body of the trolley and ride on the flanges of beams 38, an enlargement between each pair of rollers fitting in the space between the flange edges and acting as a guide.

A tubular lance 46, having a suitable type cleaning nozzle 48 affixed to its forward end, is mounted at its rearward end on the trolley 42 by means of a vise clamp 50 and supported lengthwise of beam 34. The lance may be positioned above the beam 34, as shown in

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solid lines in Figure 2, or below, as shown in broken lines in Figure 2. The vise clamp is removably mounted on the upper surface of the trolley by means of a lug 52 which is integral with and projects upwardly from the top of the trolley. The lug is shaped to fit into a hole 54 in the base of the clamp 50 and be retained therein by means of a pin 56 inserted through the lug. When the lance is mounted above the beam, its forward end may be supported on a removable guide block 58 interposed between the beam and the lance.

An extension rod 60, which depends from the bottom of the trolley, supports the vise clamp and lance when it is desired to work with the lance at a lower level. In this position the clamp is turned upside down and the rod is fitted into the hole 54 and retained therein by means of a pin 62 fitted through a suitable hole in the rod. The free end of the rod may be threaded so an additional section or sections of rod may be added when it is desired to work with the lance at lower levels.

A hose 64 is coupled to the rearward end of the lance for supplying heated compressed air, steam or other cleaning fluid thereto. The hose is preferably flexible so as to not interfere with the movement of the lance.

As shown in the drawings, the lance is positioned to clean the checkers behind wall A. When it is desired to clean the checkers in the opposite checker chamber, the lance is merely removed from the clamp vise and turned end for end so that the nozzle end thereof is positioned adjacent chamber B. When this is done, the trolley is moved to the opposite end of the beam 34 so as to support the rear end of the lance thereon, and the block 58 is moved to the opposite end of the beam.

When the lance is in suspended positions, its forward end may be supported in the cleanout openings 66 in the wall of the checker chamber, or on relatively small sills 68, made of angle plate, which may be affixed to the wall of the chamber just below the opening through which the lance is to be introduced into the chamber for supporting the nozzle end of the lance.

The vise clamp 50 is provided with a pivoted jaw 70 and a pair of fixed jaws 71 so as to facilitate the removal of the lance from the clamp when it is desired to change its position. A latch link 73 is provided for locking the jaws together to confine the lance. The jaw 70 is provided with means for adjusting the clamp to accommodate lances of various diameters.

Horizontal movement of the lance is achieved by means of a cable, pulley and winch arrangement for moving the trolley 42 along the beam 34 in either direction. A cable 72 having a first end attached to the trolley 42 extends therefrom around a vertical pulley 74 rotatably mounted on one end of the beam 34, then around a horizontally disposed pulley 76 which is rotatably mounted in a transverse opening 78 in the center portion of the beam 34. From the pulley 76, the cable travels through the opening 78 and in one of the grooves of a double groove sheave 80 and around the drums 82 of a reversible power driven winch element 83. The cable 72 is wound around the drums 82 for a suitable number of turns and then is directed around the other groove of the sheave 80 to extend around a second horizontal pulley 77 mounted in the recess 78. From the pulley 77, the cable passes through the recess 78 and around a second vertical pulley 86, rotatably disposed at the other end of the beam 34, to a point of attachment on the trolley 42.

The drums 82 and a reversible motor gear unit 90, which rotates the drums 82 simultaneously, are mounted on a platform 85 carried by the span 6. Remote switches (not shown) may be utilized for actuating the motor-gear unit 90. The motor-gear unit is reversible so that the drums 82 may be rotated in either direction to move the trolley along the beam in the desired direction to introduce the lance into or withdraw it from the checker.

Electrical current for operating the motor 24 and motor-gear unit 90 may be supplied by any suitable means,

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such as the illustrated combination of conductor bar 92 mounted above one of the rails 2 and cooperating contact arm 94 mounted on and extending upwardly from one of the vertical support frames 10.

It is usual practice, when cleaning furnace checkers, to remove bricks from the chamber wall in three horizontal rows along the bottom, center and upper portions of the chamber to make spaced openings therealong. Then the cleaning operation is carried on by introducing the lance into each of the openings along each row.

In operation, when it is desired to clean the bottom and center portions of the checker, the lance 46 is suspended from the trolley as described above and shown in broken lines in Figure 2. The lance is supported above the beam 34 for working along the upper row of openings.

While one embodiment of my invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for cleaning a furnace checker comprising a movable gantry, said gantry including a bridge span, a trolley beam laterally mounted lengthwise on said span in spaced parallel relationship therewith, a trolley mounted on said beam for movement therealong, a clamp removably mounted on said trolley, a lance supported in said clamp and extending lengthwise of said span, a nozzle affixed to one end of said lance, a flexible supply hose connected with the end of said lance opposite said nozzle, cable and pulley means mounted on said beam and connected with said trolley for moving said lance longitudinally of said span, and power means mounted on said span and connected with said cable and pulley means for actuating said cable and pulley means.

2. Apparatus for cleaning a furnace checker comprising a movable gantry, said gantry including a bridge span, a trolley beam laterally mounted lengthwise on said span in spaced parallel relationship therewith, a trolley mounted on said beam for movement therealong, an extension arm depending from said trolley, a clamp removably attached to the free end of said arm, a lance supported in said clamp and extending lengthwise of said span, a nozzle affixed to one end of said lance, a flexible supply tube connected with the end of said lance opposite said nozzle, cable and pulley means mounted on said beam and connected with said trolley for moving said lance longitudinally of said span, and power means mounted on said span and connected with said cable and pulley means for actuating said cable and pulley means.

3. Apparatus for cleaning a furnace checker comprising a movable gantry, said gantry including a bridge span, a trolley beam laterally mounted lengthwise on said span in spaced parallel relationship therewith, said beam having a transverse opening therethrough intermediate its ends, first and second intermediate pulleys rotatably mounted in said opening, first and second end pulleys rotatably mounted on the ends of said beam, a trolley mounted on said beam for movement therealong, a clamp removably mounted on said trolley, a lance supported in said clamp and extending lengthwise of said span, a nozzle affixed to one end of said lance, a flexible supply tube connected with the end of the lance opposite said nozzle, a reversible power driven winch element mounted on said span, a sheave having first and second grooves therearound rotatably mounted on said span adjacent said winch element, and a cable having first and second ends, said cable being attached to said trolley by its first end and extending therefrom around said first end pulley, back around said first intermediate pulley, then around the first of the grooves of said sheave, and next around said winch, said cable then extending from said winch to pass around the second groove of said sheave, and extending therefrom around the second intermediate pulley, then around the second end pulley to a point of attachment on said

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trolley by its second end, rotation of said winch moving said lance longitudinally of said span.

4. Apparatus for cleaning a furnace checker comprising a movable gantry, said gantry including a bridge span, a trolley beam laterally mounted lengthwise on said span in spaced parallel relationship therewith, said beam having a transverse opening therethrough intermediate its ends, first and second intermediate pulleys rotatably mounted in said opening, first and second end pulleys rotatably mounted on the ends of said beam, a trolley mounted on said beam for movement therealong, an extension arm depending from said trolley, a clamp removably attached to the free end of said arm, a lance supported in said clamp and extending lengthwise of said span, a nozzle affixed to one end of said lance, a flexible supply tube connected with the end of said lance opposite said nozzle, a reversible power driven winch element mounted on said span, a sheave having first and second grooves therearound rotatably mounted on said

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span adjacent said winch element, and a cable having first and second ends, said cable being attached to said trolley by its first end and extending therefrom around said first end pulley, back around said first intermediate pulley, then around the first of the grooves of said sheave, and next around said winch, said cable then extending from said winch to pass around the second groove of said sheave, and extending therefrom around the second intermediate pulley, then around the second end pulley to a point of attachment on said trolley by its second end, rotation of said winch moving said lance longitudinally of said span.

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