

No. 814,727.

PATENTED MAR. 13, 1906.

H. N. POTTER.  
ELECTRIC PRESSURE FURNACE.  
APPLICATION FILED JULY 23, 1903.

Fig. 1.

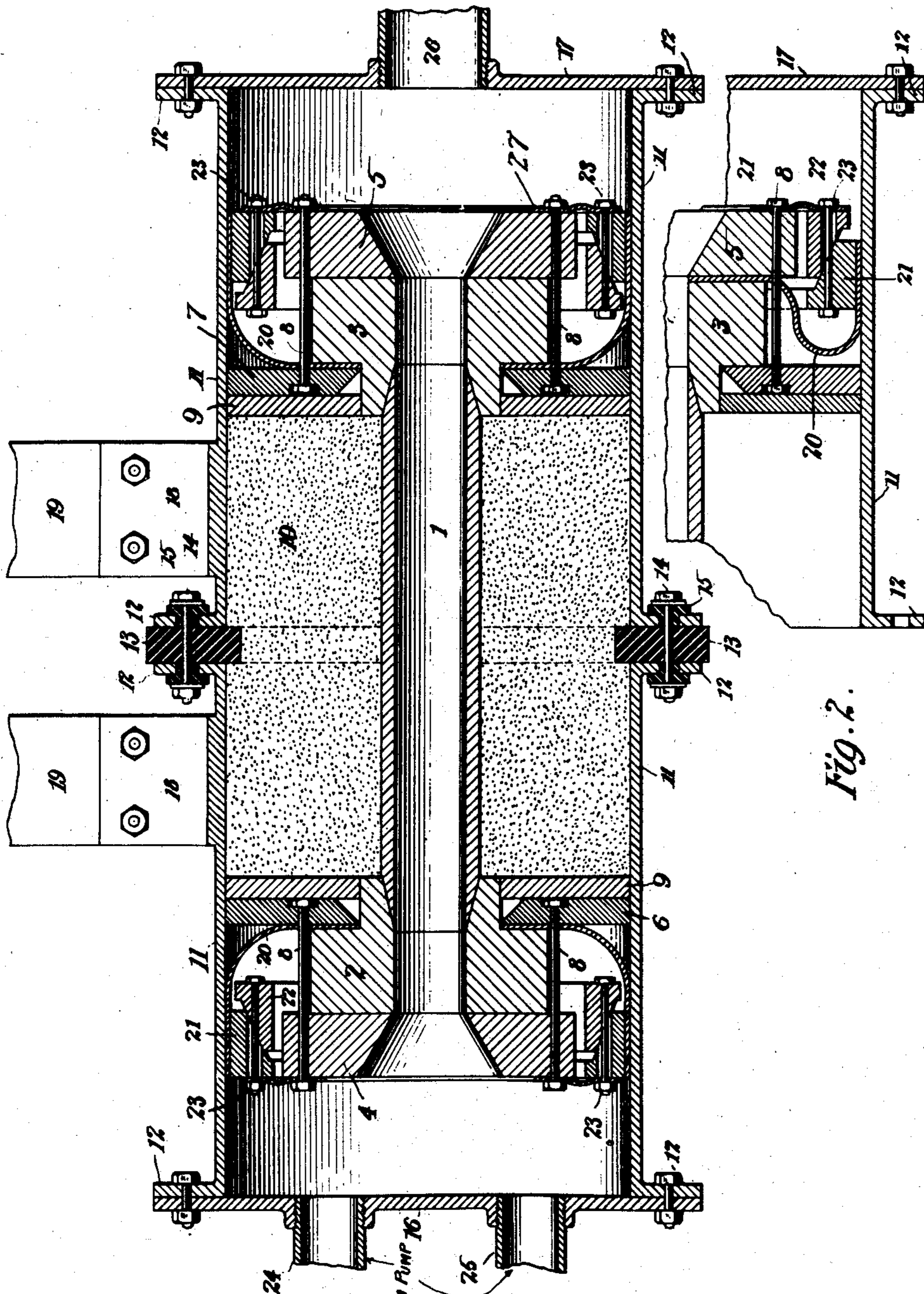


Fig. 2.

Witnesses  
Frank S. Ober  
George H. Stocker

Henry Noel Potter Inventor  
By his Attorney  
Charles A. Perry

# UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO  
GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

## ELECTRIC PRESSURE-FURNACE.

No. 814,727.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed July 23, 1903. Serial No. 166,668.

*To all whom it may concern:*

Be it known that I, HENRY NOEL POTTER, a citizen of the United States, and a resident of New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electric Pressure-Furnaces, of which the following is a specification.

My invention relates to an improved electric tube-furnace adapted to be used in carrying out processes in which gases or vapors, for example, are passed through the furnace under pressure and are subjected to intense heat during the passage.

The special features of my improved furnace are illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section through the axis of the furnace, and Fig. 2 is a detail view showing a modification of some of the clamping parts.

In the drawings, 1 is the furnace-tube, which is held between carbon terminals 2 and 3. The ends of the tube 1 are in the present instance shown as conical in form and as fitting into cone-shaped recesses in the terminals 2 and 3. This form of terminal contact for the tube has been found to be satisfactory in practice, although it is evident that any other suitable contact arrangement might be substituted therefor. The carbon terminals 2 and 3 are respectively clamped between metallic terminals 4 and 6 at one end and 5 and 7 at the other by means of a number of bolts 8 8. The plates 6 and 7 may be protected on their inner surfaces by refractory plates 9 9 of asbestos or other suitable material. The plates 9 9 are preferably of some yielding material which is adapted to relieve the tendency of the insulating material 10 to "pack" under the influence of the furnace heat. Next to these refractory plates is the packing 10 of the furnace, which packing may be in powdered form or may be pressed into shape with a binder and packed so as to facilitate its insertion into the furnace in one or more pieces.

The outside wall of the furnace is made in two tubular parts 11 11, each provided with flanges 12 12 at both ends. The two tubes are separated by an insulating-gasket 13—say of hard rubber—and are pressed firmly against this gasket by a number of bolts 14 14, with interposed insulating-bushings 15 15.

The bolts 14 14 pass through the said bushings and also through the flanges 12 12 on the inner ends of the tubes 11 11 and through the gasket 13. To the flanges at the outer ends of the tubes 11 11 are bolted end plates which close the end of the furnace and in which inlet and outlet tubes, peep-holes, and other necessary parts or appliances are appropriately inserted. One of these end plates is shown at 16 and the other at 17. Each of the tubes 11 11 is provided with one or more lugs, flanges, or equivalent devices, such as 18, to which can be bolted conducting-pieces, such as 19 19, for making connection with an electric circuit.

In order to secure contact between the carbon terminals 2 and 3 and the tubes 11 11, the inside of the tubes is finished with a smooth cylindrical surface, and a copper strap 20 bears upon the inside surface of each tube and extends to one or the other of the carbon terminals 2 and 3, against which it is firmly clamped. Take, for example, the connection between the terminal 2 and the left-hand tube 11. Here the copper strap 20 is firmly clamped by means of the bolts 8 8 throughout its central portion between the terminal 2 and the metallic plate or ring 6, while its circumferential portion is slotted and bent over so as to bear against the inner surface of the tube 11. The circumferential portion of the strap thus constitutes a practically cylindrical surface of about the same diameter as the bore of the tube 11. Its rim portion is forced outward into firm contact with the tube by the expansion of a split ring 21 through the act of forcing into it a continuous ring 22 by means of a number of bolts 23 23. A similar construction is employed at the opposite end of the furnace. By the means thus described good electrical connection is made between the furnace ends and the carbon terminals 2 and 3, which bear upon the ends 6 and 7 of the central furnace-tube 1.

The course of the current through the furnace is by way of the conductor 19, the lug or flange 18, one of the furnace-tubes 11, one of the straps 20, the carbon terminal 2, the furnace-tube 1, and out through a similar system in reverse order.

The two ends of the furnace need not be alike nor need they both be adjustable, as they are here shown, to permit a variable length of the tube 1.

The insulating-gasket 13 need not be placed midway between the ends of the furnace. It may be shifted to one side or the other, or there may be two gaskets separated by a third tube similar to the tubes 11. This latter construction is desirable when for any reason a side opening into the furnace has to be made for the insertion or withdrawal of packing or the like. It is convenient to put this side opening in the intermediate tube between the two gaskets.

It is not desirable to open the furnace repeatedly at the gasket 13 after it has been screwed up and found to be tight.

Into the end plate 16 are screwed two pipes or tubes 24 and 25, each connecting with a reservoir. A tube 26 is screwed into the end plate 17 to form an outlet-pipe at that end of the furnace. The pipe 24, for example, may be connected with the reservoir containing one gas under pressure and the pipe 25 with a reservoir containing a second gas under the same pressure. In this way a mixture of equal parts of the two gases may be formed in the furnace, and if the pipe 26 be provided with a suitable throttle before passing to the reservoir, the throttle being so arranged that gas can pass through the throttle under the imposed pressure at a proper speed, there will be a steady flow of gas from the two reservoirs into the furnace-chamber through the furnace-tube 1, where the reaction will take place, and thence out into the tube 26 and into the collecting-reservoir.

Fig. 2 shows a larger view of the clamping parts. The strap 20 is here clamped in between the contact-terminals 3 and 5. In this figure the ring 21 is a split ring, while the ring 22 is the solid ring. The ring 21 expands and presses the strap 19 firmly against the wall 11.

At 27 I show a spring-washer which is clamped under the nut on the outer ends of the rods 8 and 23. As the nut on the end of rod 23 is drawn up this spring 27 is slightly bent, bringing an axial pressure upon the terminal 5, which is thence transmitted through the terminal 3 to the contacts. This spring 27 may be made elastic enough to take care of the slight expansion of the various parts relative to one another.

Manifestly this furnace might readily be adapted to serve the purposes of a vacuum-furnace as well as those of a pressure-furnace.

I claim as my invention—

1. In an electric furnace, an inner conducting-tube, an outer conducting-tube surrounding the same, and electrical connections between the ends of the inner tube and the ends of the outer tube, the latter being insulated from each other except through the inner tube.

2. In an electric furnace, an inner conducting-tube, an outer conducting-tube sur-

rounding the same, insulating material interposed between the two tubes, the outer tube being made in two or more parts separated by insulating material, and terminal connections for an external circuit attached to the outer tube.

3. In an electric furnace, a conducting inclosing tube made in two or more parts, the successive parts being separated by one or more insulating-gaskets, in combination with terminal connections for an external circuit attached to the end sections of the tube.

4. In an electric furnace, an inner tube adapted to contain the material to be heated and an outer tube having end sections which form the terminals of the furnace.

5. In an electric furnace, an inner tube adapted to contain the material to be heated and an outer tube having end sections insulated from each other and forming the terminals of the furnace, the said end sections being electrically connected with the ends of the inner tube.

6. In an electric furnace, an inner conducting-tube adapted to contain the material to be heated and surrounded by refractory insulating material, an outer conducting-tube outside the inner tube and the insulating material, the said outer tube being made in sections, and the several sections being insulated from each other by ring-shaped gaskets.

7. In an electric furnace, an inner conducting-tube, an outer conducting-tube surrounding the same and composed of mutually insulated sections, and terminals for the inner tube, and a cup-shaped strap connecting the walls of the end sections of the outer tube with the said end terminals for the inner tube.

8. In an electric furnace, a conducting inner tube, carbon end terminals therefor, metallic terminals cooperating with the said carbon terminals, and means for compressing the respective carbon and metallic terminals at either end of the tube, all in combination with an outer conducting-tube forming part of the furnace-circuit and extending at each end beyond the limits of the terminals for the inner tube.

9. In an electric furnace, an inner conducting-tube adapted to contain the material to be heated and terminals therefor, an outer conducting-tube surrounding the same, and having a chamber at each end.

10. In an electric furnace, an inner conducting-tube, hollow terminals therefor, the openings in the said terminals registering with the openings at the ends of the inner tube, in combination with an outer tube having a chamber at each end, inlet-tubes connecting with one chamber, and an outlet-tube connecting with the other chamber, as and for the purpose set forth.

11. In an electric furnace, an inner tube, terminals therefor, in combination with an

outer tube, a cup-shaped connection between the walls of the outer tube and the said terminals, and means for securing a firm connection between the cup-shaped piece and the walls of the outer tube.

12. In an electric furnace, an inner tube adapted to contain the material to be heated, refractory insulating material surrounding the said tube, end terminals for the said tube, and an outer tube surrounding the parts named, in combination with a ring of asbestos or other yielding material separating the insulating material from the terminal connections of the inner tube, the asbestos or similar material being adapted to relieve the tendency of the insulating material to "pack" under the influence of the furnace heat.

13. An electric pressure-furnace, consisting of a conducting-tube and end terminals therefor having a continuous opening throughout, in combination with chambers communicating with the ends of the said opening, and inlet and exhaust pipes communicating with the said chambers.

14. An electric pressure-furnace open at both ends and having its open ends each communicating with a chamber, in combination with inlet and outlet pipes communicating with the respective chambers, and terminal connections for the said furnace.

15. A terminal for an electric tube-furnace, consisting of a tube-section surrounding the said furnace, an inner tube constituting the main operative portion of the furnace, and intermediate electrical connections between one end of the inner tube and the said tube-section.

16. In an electric furnace, the combination with one end of the tube constituting the main operative portion of the furnace, of a terminal consisting of an outer tube surrounding the said inner tube, a carbon terminal in contact with one end of the inner tube, metallic plates on opposite sides of the said carbon terminal, a cup-shaped strap connecting the carbon terminal and the outer tube, means for pressing the rim of the cup-shaped piece against the wall of the outer tube, and means for pressing the bottom portion of the cup-shaped piece between the carbon terminal and one or the other of the metallic plates adjacent to the said terminal.

17. An electric resistance-furnace inclosed in a gas-tight chamber, and means for modifying the pressure in the furnace.

18. An electric resistance-furnace inclosed in a gas-tight chamber, the said resistance being in the form of a tube.

19. An electric resistance-furnace inclosed in a gas-tight chamber, and surrounded by refractory heat-resisting material.

20. An electric resistance-furnace inclosed in a gas-tight chamber, one or more of the walls of the furnace constituting a furnace-terminal.

21. In an electrical furnace inclosed within a cylindrical containing-chamber, the combination with said chamber of one or more conducting furnace-terminals, adapted to slide axially within said chamber, and to be expanded into firm mechanical and electrical connection therewith.

22. In an electric furnace, a terminal connection intermediate between a cylindrical furnace-housing and a heating resistance therein, said connection being adapted to contact firmly with both resistance and housing and yet permit slight axial displacement of said resistance.

23. In an electric furnace, a housing having a cylindrical inner surface, a terminal disk adapted to slide axially within said housing and be expanded into contact therewith at any point within a range of axial movement.

24. In an electric furnace, a housing having a cylindrical form and divided transversely to the axis into two electrically-insulated portions.

25. In an electric furnace, a housing of cylindrical form and divided into two cylindrical sections, insulated electrically from each other and connected on their outer surfaces to the opposite poles of a supply-circuit, and on their inner surfaces to the opposite poles of the furnace-conductor.

26. In an electric furnace, a housing of cylindrical form, having circuit-terminals connecting to its convex surface or developments thereof, and having at its ends removable plates, which together with the housing completely inclose the furnace.

Signed at New York, in the county of New York and State of New York, this 15th day of July, A. D. 1903.

HENRY NOEL POTTER.

Witnesses:

WM. H. CAPEL,  
THOS. H. BROWN Jr