Nov. 4, 1930. J. F. GRACE 1,780,478

CONDENSER

Filed Jan. 16, 1930 2 Sheets-Sheet 1

Fig. 1.

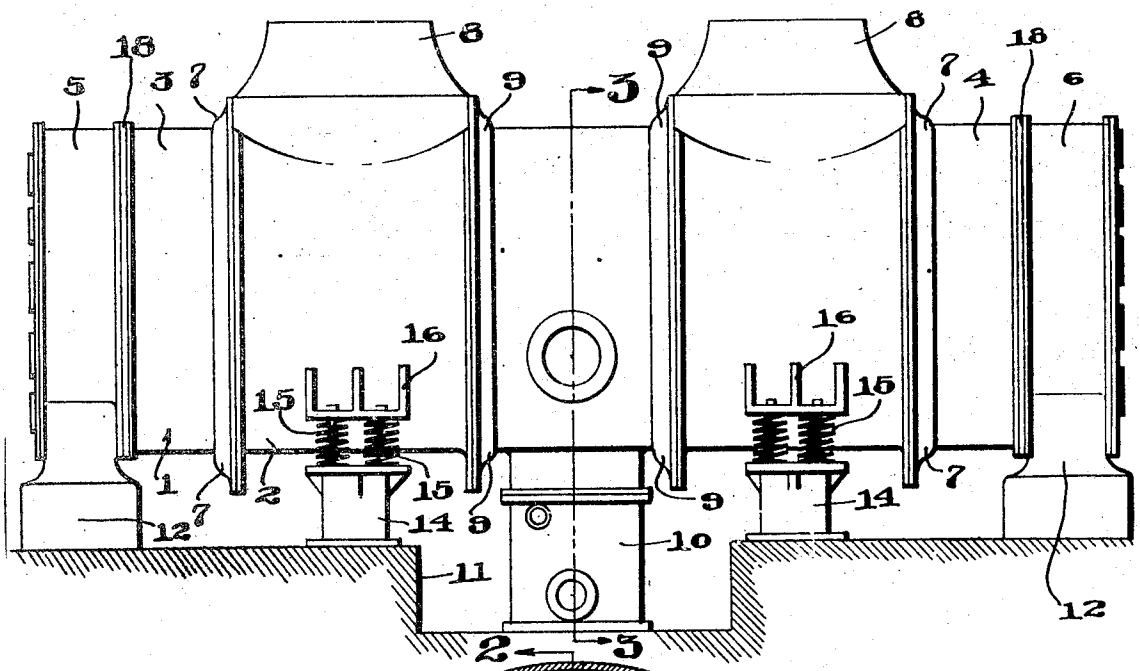
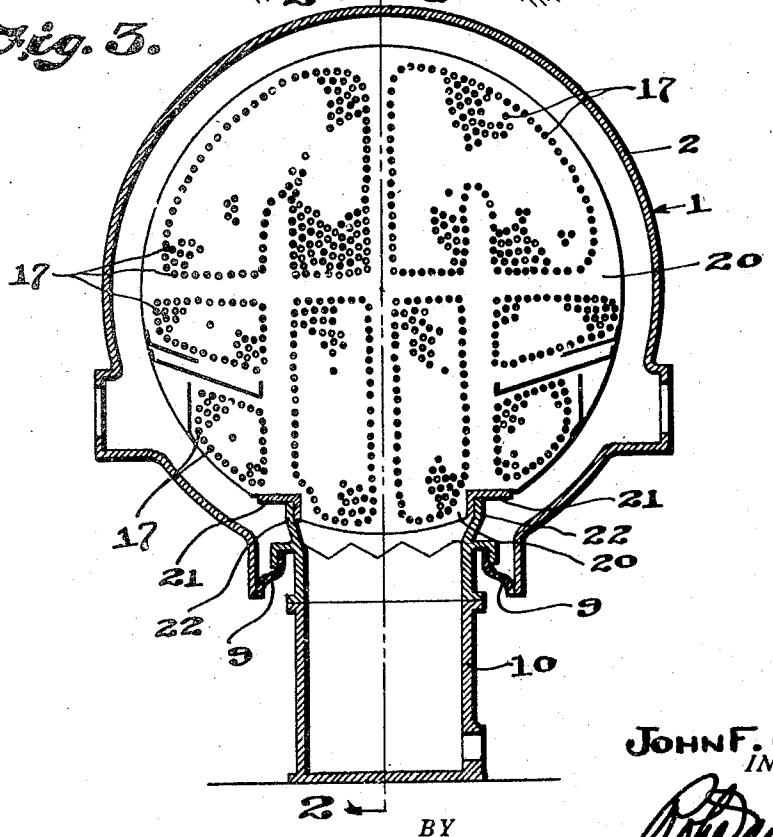


Fig. 3.



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Filed Jan. 16, 1930 2 Sheets-Sheet 2

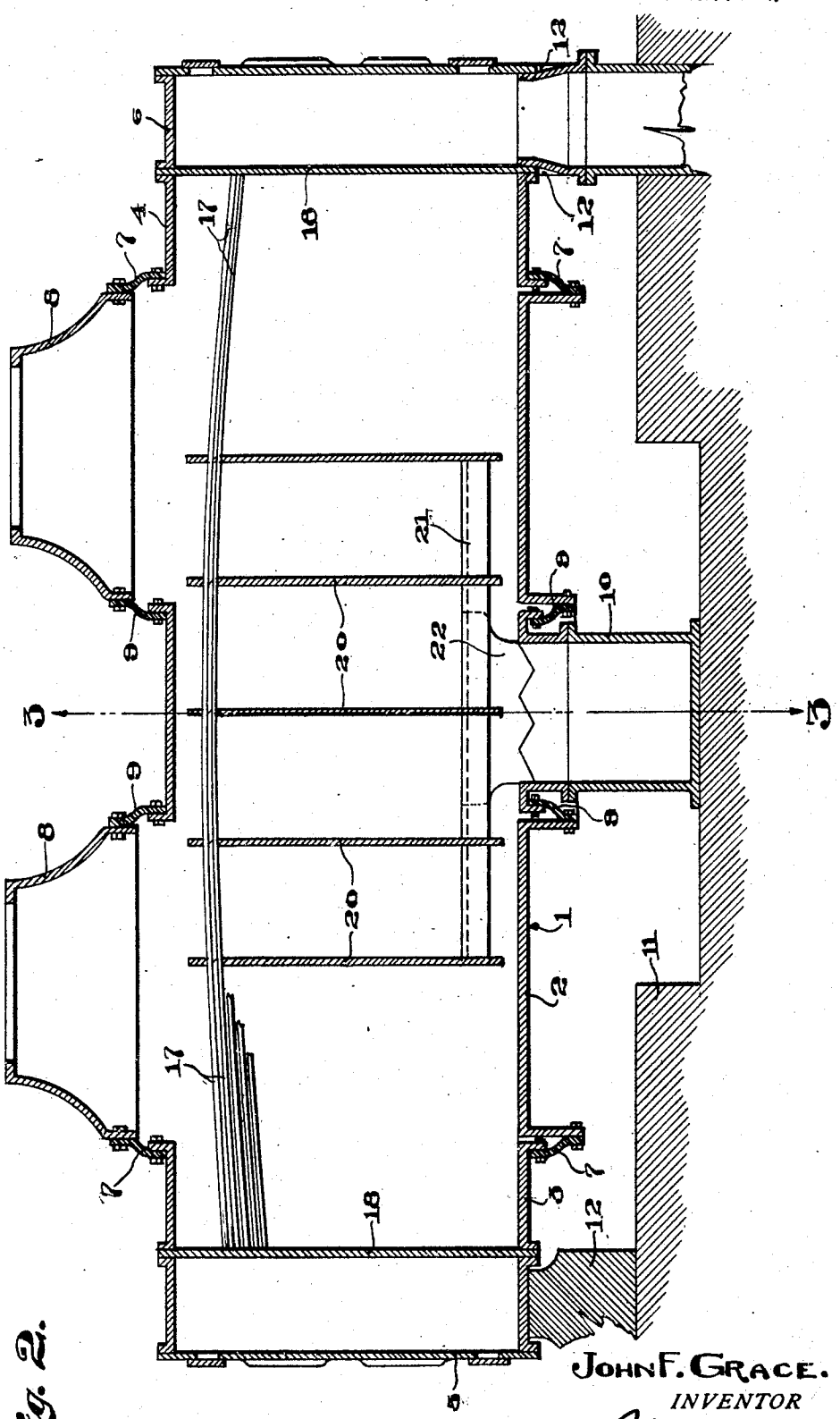


Fig. 2.

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UNITED STATES PATENT OFFICE

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CONDENSER

Application filed January 16, 1930. Serial No. 421,199.

This invention relates to steam condensers of the surface type and an object of the invention is to provide a condenser structure in which the weight of the condenser, water therein etc. is distributed in such manner as to relieve the turbine supporting structure and condenser supporting springs of a large percentage of such weight.

More specifically, the present invention comprehends a condenser structure wherein the water boxes, tube heads, hot well and support plates are supported independently of the condenser shell, being connected to the shell by expansion joints to compensate for relative movements of the parts.

With these and other objects in view as may appear from the accompanying specification, the invention consists in various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a condenser of the preferred form as embodied in the present invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings Figure 1 is a side elevation of the improved condenser.

Figure 2 is a longitudinal section through the condenser, and Figure 3 is a vertical section through the condenser taken on the line 3—3 of Figure 2.

Referring more particularly to the drawings, the improved condenser comprises a shell 1 which is composed of an intermediate section 2 and end sections 3 and 4. The water boxes 5 and 6 are rigidly connected to the end sections 3 and 4 respectively, while the end sections are connected to the intermediate section 2 by expansion joints 7. The exhaust steam inlet or inlets 8, two of which are shown in the drawings are connected to the end sections 3 and 4 of the condenser shell 1 by the expansion joints 7 and to the central or intermediate section 2 by the expansion joints 9, thus providing flexible connections between the end and intermediate sections of the condenser and between the exhaust steam inlets and the condenser shell to compensate for relative movement of these members. The hot well 10 is also connected to the intermediate section 2 by the expansion joints 9 for the same purpose. The hot well 10, end sections 3 and 4, and water boxes 5 and 6 are supported upon the foundation 11 independently of the intermediate section 2 of the condenser; that is the hot well 10 rests firmly upon and is attached, in any suitable manner, to the foundation 11 while upstanding supports 12 are formed upon the foundation 11 and engage the water boxes 5 and 6 for firmly supporting theses members and the end sections of the condenser shell from the foundation. The intermediate or central section 2 of the condenser shell is supported in the usual manner from the foundation 11 by the supports 14, support springs 15 and the supporting brackets 16 which are carried by the condenser shell.

The tubes 17 which serve to circulate the cooling water from one of the water boxes to the other, extend through the steam space of the condenser shell as is usual in condenser structures of the surface type. These tubes 17 may have their ends expanded into the tube sheets 18 or otherwise suitably connected thereto provide fluid tight joints and they are shown in Figure 2 of the drawings as being bowed upwardly or in a vertical plane to accommodate expansion and contraction of the tubes under temperature variances within the condenser. It is to be understood, of course, that condensers of this type operating upon varying loads are subject to temperature variances within a wide range which causes expansion and contraction of the tubes relative to the condenser casing etc. and accommodation for such expansion and contraction must be made to prevent rupturing of the joints between the tubes and the tube heads and the consequent leakage of the circulating cooling water into the condensing space and its mixture with the condensate.

While in Figure 2 of the drawings the tubes are illustrated as being bowed, and in a vertical plane, it is to be understood that they may be bowed in any manner found practical in the construction of the condenser, and in instances of vertical condensers, the

tubes may be bowed laterally, preferably towards the exhaust steam inlet or inlets of the condenser although they may be bowed away from the exhaust steam inlets. Also if the tubes are connected to the tube heads in approved manners which will compensate for expansion and contraction of the tubes at their connections they need not be bowed and it is also to be understood that this feature of bowing the tubes or otherwise providing, by any approved method, for accommodation of the expansion and contraction of the tubes may be resorted to without departing from the spirit of this invention.

The tubes 17 are supported intermediate their ends by a plurality of support plates 20 and since it is desired in the present invention to relieve the turbine (not shown) and its supporting structure from as much weight as possible and also to relieve the supports 14 and springs 15 of weight and provide distribution of such weight, the support plates 20 are in turn supported from the foundation 11 through the hot well 10 as clearly shown in Figures 2 and 3 of the drawings.

The various support plates 20 are carried by supporting beams 21 which are in turn attached to suitable brackets 22. The brackets 22 are attached or otherwise suitably connected rigidly to the hot well 10 thereby supporting the weight, of the support plates, and the tubes intermediate their ends, together with the water therein, from the hot well 10 and consequently from the foundation 11. This manner of support together with the supports 12 will relieve the springs 15 and supports 14 and the turbine supporting structure (not shown) of the weight of the water boxes, tubes, support plates and the water in the water boxes and tubes. The expansion joints 7 and 9 will permit relative movement of the intermediate section 2 and the end sections 3 and 4 supported directly from the foundation 11 to accommodate varying conditions in the condenser operation.

It will be understood that the invention is not to be limited to the specific construction or arrangment of parts shown but that this may be modified widely within the invention as defined by the claims.

What is claimed is:

1. In a condenser, a shell, a hot well, tubes in said shell, an expansion joint connecting said hot well and shell, and support plates for said tubes rigidly connected to and supported from said hot well.

2. In a condenser, a shell, a hot well, tubes in said shell, an expansion joint connecting said hot well and shell, and support plates for said tubes rigidly connected to and supported from said hot well, said tubes being bowed to accommodate expansion and contraction thereof.

3. In a condenser, a shell, a hot well, tubes in said shell, an expansion joint connecting said hot well and shell, and support plates for said tubes rigidly connected to and supported from said hot well, said tubes being bowed in a plane substantially parallel to the direction of inflow of steam into the condenser.

4. In a condenser, a shell, tubes therein, a hot well, an expansion joint connecting said hot well and shell, and support plates for said tubes supported from said hot well, said tubes being bowed in a plane substantially parallel to the direction of inflow of steam into the condenser.

5. In a condenser, a shell, water boxes, tube heads connected to said water boxes, expansion joints connecting said water boxes and shell, said water boxes and tube heads being supported independently of said shell, a hot well supported independently of said shell, and an expansion joint connecting said hot well and shell.

6. In a condenser, a shell, water boxes, tube heads connected to said water boxes, tubes within said shell and connected to said tube heads, expansion joints connecting said water boxes and shell, said water boxes and tube heads being supported independently of said shell, a hot well supported independently of the shell, an expansion joint connecting said hot well and shell, and support plates supported from said hot well whereby the water boxes, tube heads, tubes and water therein will be supported independently of said shell.

7. In a condenser, a shell, water boxes, tube heads connected to said water boxes, tubes within said shell and connected to said tube heads, expansion joints connecting said water boxes and shell, said water boxes and tube heads being supported independently of said shell, a hot well supported independently of the shell, an expansion joint connecting said hot well and shell, and support plates supported from said hot well whereby the water boxes, tube heads, tubes and water therein will be supported independently of said shell, said tubes being bowed to accommodate expansion and contraction thereof.

8. In a condenser, a shell, tubes therein, a hot well, said hot well being supported independently of said shell, an expansion joint connecting said hot well and casing, support plates for said tubes rigidly supported from said hot well, an exhaust steam inlet, and expansion joints between said exhaust steam inlet and shell.

9. In a condenser, a shell, tubes therein, a hot well, said hot well being supported independently of said shell, an expansion joint connecting said hot well and casing, support plates for said tubes rigidly supported from said hot well, and exhaust steam inlet, and expansion joints between said exhaust steam inlet and shell, said tubes being bowed to ac-

commodate expansion and contraction thereof.

10. In a condenser, a shell comprising an intermediate section and end sections, expansion joints connecting said shell sections water boxes connected to said end sections, tube heads carried by said water boxes, and tubes extending through said shell and having their ends connected to said tube heads, said tubes being bowed to permit expansion and contraction thereof, a hot well supported independently of said shell, and expansion joint between said hot well and shell, and support plates for said tubes supported from said hot well.

11. In a condenser, a shell comprising an intermediate section and end sections, expansion joints connecting said shell sections, water boxes connected to said end sections, tube heads carried by said water boxes, and tubes extending through said shell and having their ends connected to said tube heads, said tubes being bowed to permit expansion and contraction thereof, a hot well supported independently of said shell, an expansion joint between said hot well and shell, and support plates rigidly connected to and supported from said hot well.

12. In a condenser, a shell comprising an intermediate section and end sections, expansion joints connecting said shell sections, water boxes connected to said end sections, tube heads carried by said water boxes, and tubes extending through said shell and having their ends connected to said tube heads, said tubes being bowed to permit expansion and contraction thereof, a hot well supported independently of said shell, an expansion joint between said hot well and shell, support plates rigidly connected to and supported from said hot well, and supports for said water boxes whereby the water boxes will be supported independently of the intermediate portion of the shell.

In testimony whereof I affix my signature.

JOHN F. GRACE.