

Dec. 20, 1932.

C. A. RAINEY

1,891,607

CONDENSING APPARATUS

Filed Aug. 13, 1929

2 Sheets-Sheet 1

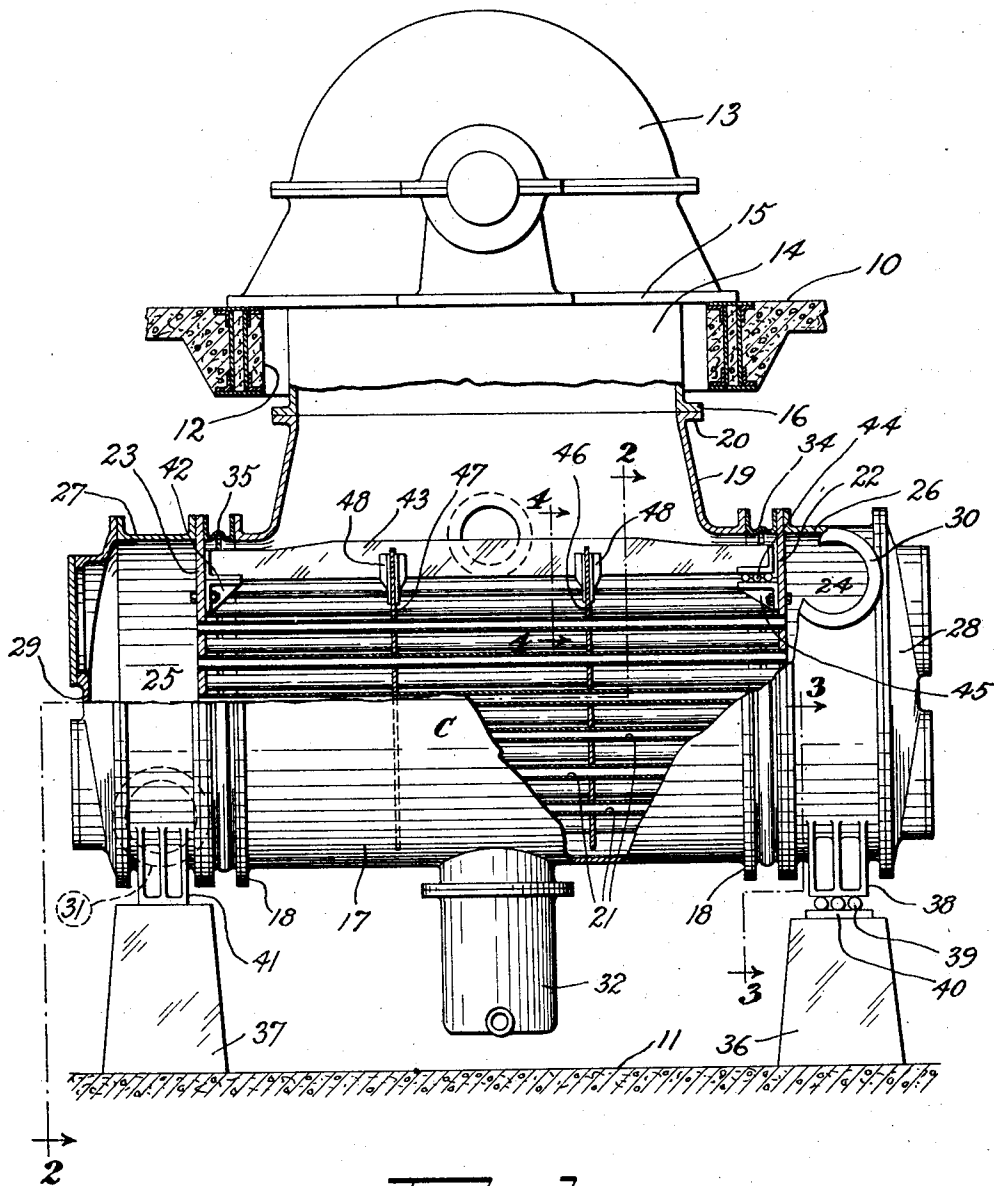


Fig. 1.

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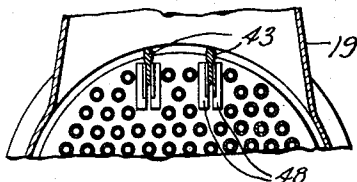


Fig. 4.

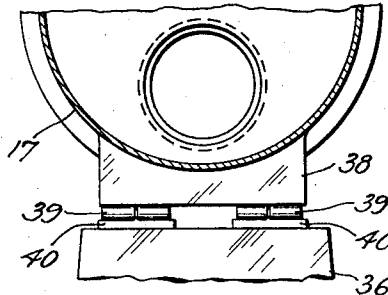


Fig. 5.

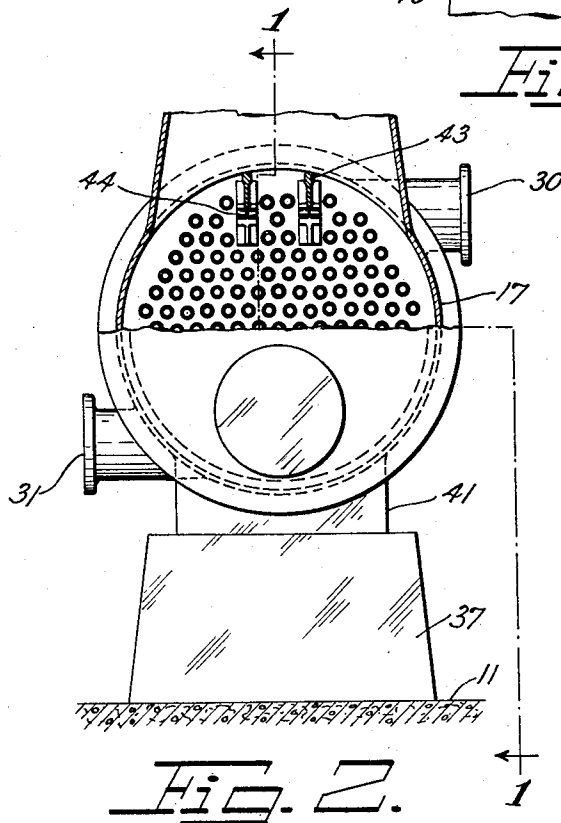


Fig. 2.

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CONDENSING APPARATUS

Application filed August 13, 1929. Serial No. 385,539.

My invention relates to condensing apparatus for steam plants and the like and particularly for power plants.

One object of my invention is to provide condensing apparatus having freedom of expansion in all ways and having no adverse effects on steam apparatus to which the condenser is connected. A further object is to so connect the condenser with steam consuming apparatus such as a turbine as to provide an equalization of pressure or thrust effect under any conditions of pressure variation within the steam consuming apparatus and the condenser while permitting proper relative movements of parts necessary or advisable on account of differences and variations in temperature. Other objects of the invention will appear as the description proceeds.

The invention consists essentially of independent supporting means for different parts of a condenser, the steam receiving part being supported by the consumer supplying the vapor or steam to be condensed and the water conveying section being independently supported, the parts being connected by flexible fluid tight joints and with tube supporting means permitting relative movement of parts.

The nature and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings showing a preferred manner of carrying out the invention, which drawings constitute a part of this specification and, of which:

Fig. 1 is a view partly in section of a power plant showing a prime mover and a condenser combined, constructed and supported in accordance with the invention;

Fig. 2 is a view, partly in section, taken on the line 2—2 of Fig. 1;

Fig. 3 is taken on the line 3—3 of Fig. 1; and

Fig. 4 is taken on the line 4—4 of Fig. 1.

In Fig. 1, reference character 10 designates a floor, deck or landing of a power plant of any type, whether stationary, marine or otherwise. Below floor 10 is another floor, deck or landing 11. Floor 10 has an opening 12. Supported on floor 10 over opening

12 is a prime mover 13, in the instant case shown as a turbine. Turbine 13 has an exhaust connection 14 extending downwardly from the base plate 15 and having a lower flange 16. While a turbine is illustrated, any type of steam consumer which exhausts steam for condensation may take the place of the turbine 13 in the matter of the present invention.

The condenser is designated generally by the letter C. The condenser comprises a shell 17. Shell 17 is in general of cylindrical form having end flanges 18. It has an upwardly extending connection 19 with a top flange 20 which is secured in fluid tight relation to and rigidly to flange 16 as by rivets, suitable gasketing being included between the flange joints if necessary or desired. It will here be noted that the turbine casing, exhaust connection 14 forming part of the turbine casing and shell 17 are rigidly connected.

Passing through shell 17 is a plurality of water conveying tubes 21 which extend between tube sheets 22 and 23. The tubes extend through the tube sheets, being expanded or otherwise fitted into the tube sheets and permit communication between chambers 24 and 25. Chambers 24 and 25 are formed by the tube sheets 22 and 23, annular flanged members 26 and 27 and covers 28 and 29. The tube sheets 22 and 23, members 26 and 27 and covers 28 and 29 make up what are known as water boxes. The water boxes have connections 30 and 31 for supplying water to and withdrawing water from the condenser. The water flows through the tubes 21 and thereby cools and condenses steam passing into shell 17. While a single-pass condenser is illustrated, the invention is not limited thereto, but partitions may be provided in the water boxes to give multiple-pass flow.

The condensate formed within shell 17 and around tubes 21 is collected in a well or pocket 32 and is drawn away by suitable pumping mechanism.

Connected between tube sheets 22 and 23 and the end flanges 18 of shell 17 are corrugated, flexible, fluid tight members 34 and 35. Members 34 and 35 may be made of lighter gauge metal to permit relative movement be-

tween shell 17 and the water boxes. They may also be made of different, relatively elastic, material.

On the floor 11 are support blocks 36 and 37. 5 A cradle 38 is formed as a part of member 26 and rests on rollers 39 which in turn rest on a steel plating 40 in turn resting upon support member 36. A cradle 41 is a part of member 27 and rests on support member 37 without 10 intermediate movable means. Rollers 39 are placed transversely of tubes 21 and permit relative movement between the tubes and the right-hand water box (as shown) and the floor. This takes care of expansion and contraction of the parts in longitudinal direction of the tubes. 15

Attached to tube sheet 23 are one or more brackets 42. Mounted on the one or more brackets 42 are one or more beams 43 of which two are shown. Beams 43 extend longitudinally above the tubes within shell 17. The other ends of beams 43 rest on rollers 44 which rest on brackets 45. Brackets 45 are secured to tube sheet 22. Suspended from 20 beams 43 are tube supporting plates 46 and 47 which are secured to the beams by means of clips 48. The plates 46 and 47 are apertured so that the tubes pass through them and so that they support the tubes. Plates 46 and 30 47 do not extend to the edge of the shell, but are sufficiently spaced therefrom to permit relative movement of the shell 17 with respect to plates 46 and 47.

It will be seen that the water conducting 35 section of the condenser and the steam receiving section of the condenser are independently supported. The steam receiving section consisting of shell 17 is supported from the turbine casing and consequently from 40 floor 10. Thus the turbine and the shell of the condenser have a common support which is entirely independent of the supporting means on the lower floor for the water boxes and the tubes. Members 34 and 35 provide 45 fluid tight flexible connections between the independently supported parts. Expansion and contraction of the tubes may take place independently of movement of shell 17 due to the roller support mounting. The roller 50 support of beams 43 permits relative movement of parts. It will be seen that all the parts have proper relative movement without constraint in any way.

The arrangement allows a constant load 55 on the turbine exhaust connection under all turbine operating loads and all vacuum conditions. It is an improvement over spring supports because, under varying vacuum conditions, the weight imposed on the turbine exhaust connection varies due to shell expansion. 60 With the expansion joint at the turbine exhaust connection, full vacuum loads are imposed on the turbine exhaust connection, which, for a 60,000 KW turbine, may 65 run up to 600,000 lbs.

The present arrangement will readily permit steel plate shell construction.

While I have described one form of the invention, it will be understood that the invention may be carried out in a number of 70 forms of apparatus and that the invention is not limited to the specific arrangement shown and described. The turbine or other steam consumer need not be above the condenser, 75 but may be on any side of the condenser. Instead of roller supports, other means may be employed which permit relative movement of the parts.

What I claim is:

1. A condenser comprising a shell, tube 80 sheets, members cooperating with said tube sheets to form water boxes, tubes inserted in said tube sheets and passing through said shell, flexible fluid tight joint members between said shell and said water boxes, means 85 for supporting the tubes intermediate the tube sheets comprising a beam, means for supporting said beam on the water boxes, means for permitting relative movement between said beam and one of said water boxes, 90 and means for supporting said water boxes independently of said shell and permitting relative movement thereof.

2. A condenser comprising a shell, tube 95 sheets, members cooperating with said tube sheets to form water boxes, tubes inserted in said tube sheets and passing through said shell, flexible fluid tight joint members between said shell and said water boxes, means 100 for supporting the tubes intermediate the tube sheets comprising a beam and a plate supported by said beam, said tubes passing through said plate, means for supporting said 105 beam on the water boxes, means for permitting relative movement between said beam and one of said water boxes, and means for supporting said water boxes independently of said shell and permitting relative movement thereof.

3. A condenser comprising a shell, tube 110 sheets, members cooperating with said tube sheets to form water boxes, tubes inserted in said tube sheets and passing through said shell, flexible fluid tight joint members between said shell and said water boxes, means 115 for supporting the tubes intermediate the tube sheets comprising a beam and a plate carried by said beam through which the tubes pass, means for securing said beam to one of said tube sheets, a roller support for supporting 120 said beam on another of said tube sheets and permitting relative movement between the beam and the last mentioned tube sheet, and means independent of said shell and comprising rollers for supporting said water 125 boxes and permitting relative movement therebetween.

4. A condenser comprising a shell, tube sheets, members cooperating with said tube sheets to form water boxes, tubes inserted in 130

said tube sheets and passing through said shell, flexible fluid tight joint members between said shell and said water boxes, means for supporting the tubes intermediate the
5 tube sheets comprising a plurality of beams and a plurality of plates carried by said beams through which said plates pass, means for securing said beams to one of said tube sheets, roller supporting means for support-
10 ing said beams on another of said tube sheets and permitting relative movement between the beams and the last mentioned tube sheet, and supporting means for said water boxes independent of said shell and permitting
15 relative movement therebetween.

In testimony whereof I have hereunto af-
fixed my signature.

CLEMENT A. RAINEY.

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