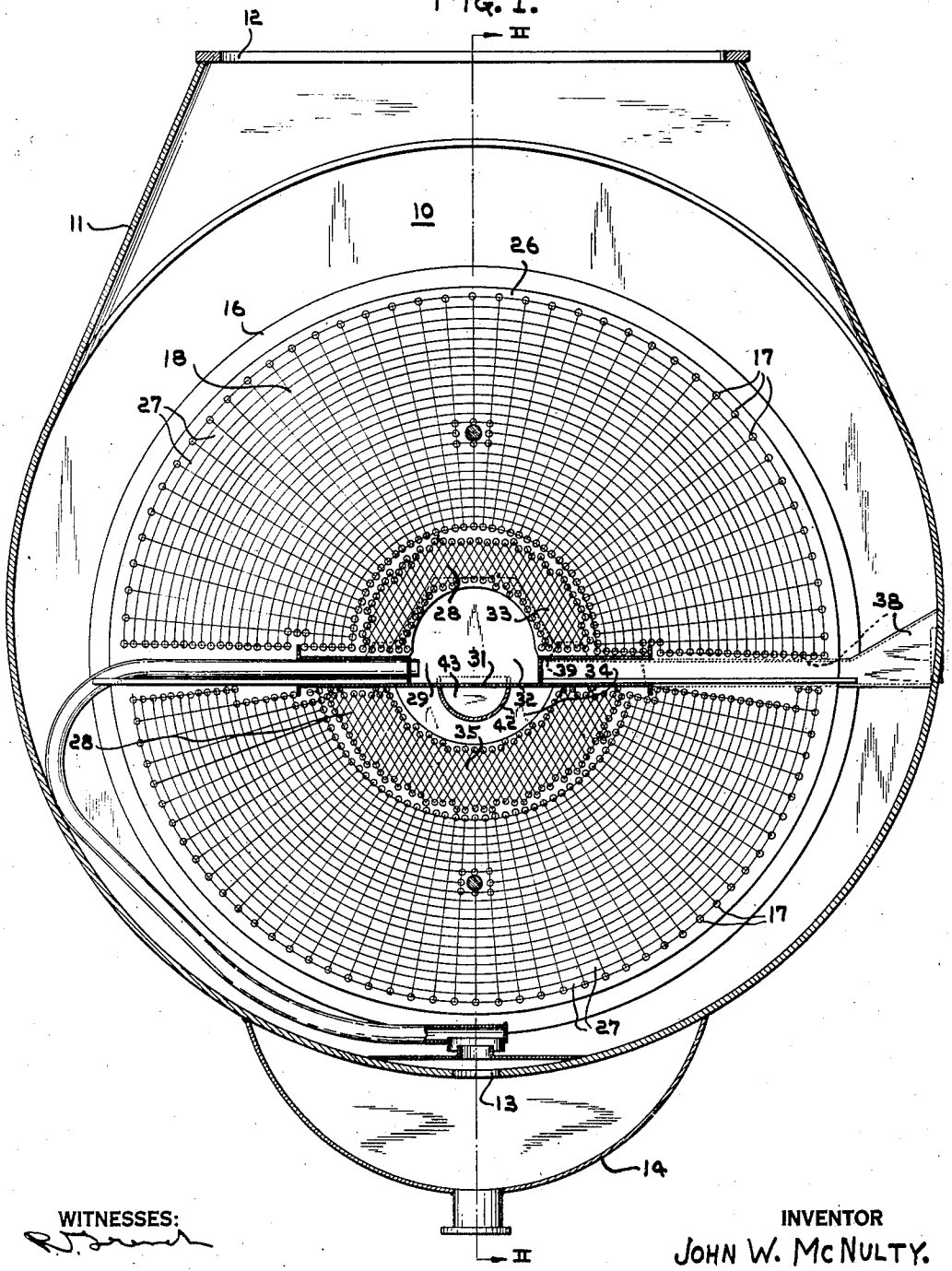
Feb. 23, 1943. J. W. McNULTY 2,312,113

CONDENSER APPARATUS

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Fig. 1.



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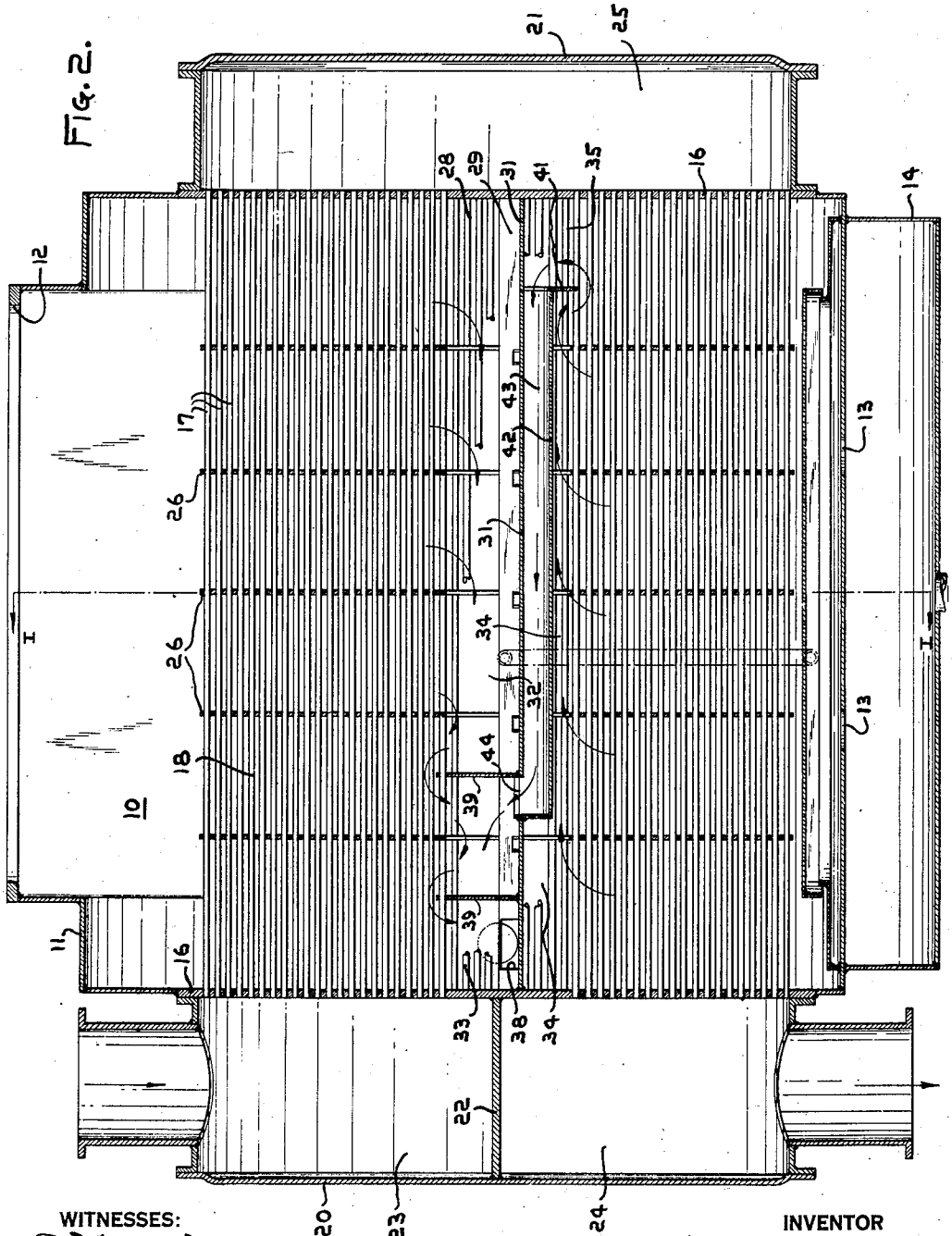
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FIG. 2.



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2,312,113

CONDENSER APPARATUS

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Application February 21, 1942, Serial No. 431,789

7 Claims. (Cl. 257—43)

This invention relates to surface condensers, more particularly to those of the two-pass type, and has for an object the provision of improved apparatus of this character.

A further object of the invention is the provision, in the two-pass surface condenser, of means for obtaining the advantages of single-pass operation as regards air removal.

Yet another object of the invention is to provide, in a two-pass radial-flow type condenser, means for removing air from the cooler end of the second pass, together with means for conveying such air in parallel-flow relation to the air being removed from the first pass.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawings forming a part of this application in which:

Fig. 1 is a transverse sectional view taken along the line I—I of Fig. 2, looking in the direction of the arrows; and,

Fig. 2 is a longitudinal sectional view taken along the line II—II of Fig. 1, looking in the direction of the arrows.

Referring now to the drawings more in detail, there is shown, at 10, a surface condenser of the radial-flow type comprising a shell 11 having an exhaust steam inlet 12 at the top and a condensate outlet 13 at the bottom through which condensate may pass to the hot well structure 14 therebelow. The ends of the shell are closed by a pair of tube plates 16 which serve as supports for the terminal portions of a plurality of tubes 17 defining a tube nest 18 extending longitudinally of the shell.

Water box structures 20 and 21 cooperate with the tube plates 16, the water box 20 having a horizontally-disposed partition 22 therein serving to divide the water box into an inlet chamber 23 and an outlet chamber 24. The water box structure 21 provides a reversing chamber 25, the two water boxes serving to direct cooling water through the tubes in two passes, a plurality of intermediate tube supporting plates 26 serving to support and space the tubes at points intermediate their terminal portions.

In the apparatus illustrated in the drawings, the first pass is shown in the upper half of the tube nest and the second pass in the lower half, although it will be apparent that this arrangement is for the purpose of illustration only and that the relative positions of the two passes may be reversed without affecting the invention.

Preferably, the spacing of the tubes 17 in the nest 18 is such that there are provided for the entering steam radial-flow paths 27 converging inwardly toward the center of the tube nest. Also, the innermost tubes are arranged in closely-spaced relationship to provide an air cooling section 28 surrounding an open core 29 extending from end to end of the tube nest.

Both the air cooling section 28 and the core 29 are separated by a horizontally-disposed baffle 31 to provide a first-pass core or air passage 32 and a first-pass air cooling section 33, and a second-pass core or air passage 34 and second-pass air cooler 35.

Air and noncondensable gases accumulating at the radial center of the first pass flow along the core 32 thereof toward the cold end of the pass where they leave the condenser through an air offtake 38. One or more transverse baffles 39 are provided near the cold or offtake end of the core 32, whereby the air and noncondensable gases are forced radially outward among the tubes of the air cooler 33 for final cooling before they enter the air offtake 38 to leave the condenser.

In the second pass air and noncondensable gases flow from the warm end toward the cool end of the pass along the core 34, a baffle 41 provided near the cold end of the core, forcing the air and gases radially outward into the air cooler 35 for contact with the tubes at the cooler end of the latter. A member 42, cooperating with the horizontal baffle 31, serves to define a passage 43 extending longitudinally of the second-pass core 34 and having an inlet opening at the cooler end of the second pass adjacent the baffle 41, so that air and noncondensable gases finding their way to that point may pass through the passage 43 to a point near the cold end of the first pass. At this point, the passage 43 has a discharge opening 44 for flow of air and noncondensable gases from the second pass into the core 32 of the first pass. Thus, it will be apparent that the air and noncondensable gases from the second pass are forced to mingle with those of the first pass and, because of one or more of the baffles 39 interposed between the opening 44 and the conduit 43, are directed outwardly among the coldest tubes of the first-pass air cooler 33 for final cooling before exhausting through the air offtake 38.

It will be seen that, by the novel apparatus herein disclosed, there is provided, in a two-pass radial-flow type condenser, means for obtaining the advantages of single-pass operation in so far as flow of air and non-condensable gases is concerned.

While the invention has been shown in but one form, it will be obvious to those skilled in the

art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed is:

1. A condenser comprising a shell having an exhaust steam inlet at the top and a condensate outlet at the bottom; tube plates closing the ends of the shell; a nest of tubes extending from end to end of the shell with their terminal portions supported by the tube plates, said tubes being arranged to provide an open core at the center of the nest with the tubes adjacent said core constituting an air cooler section; water box structure associated with the tube plates and adapted to direct cooling water through the tubes; a baffle in one of the water boxes dividing the space therein into an inlet chamber and an outlet chamber and serving to divide the tube nest into first and second passes; a baffle extending longitudinally of the tube nest and separating the core and air cooler section into a first-pass core and air cooler section and a second-pass core and air cooler section; an air offtake at the cold end of the first-pass core; and a conduit for conducting air from the cold end of the second-pass core to the cold end of the first-pass core.

2. Structure as specified in claim 1, including a baffle disposed transversely of the first-pass core between the air offtake and the discharge end of the conduit, whereby air and noncondensable gases from both passes are forced out among the tubes of the first-pass air cooler section at the cold end thereof prior to withdrawal from the condenser.

3. Structure as specified in claim 1, wherein the conduit for conducting air from the cold end of the second-pass core to the cold end of the first-pass core extends longitudinally of the second-pass core.

4. Structure as specified in claim 1, including a pair of spaced baffles disposed transversely of the first-pass core adjacent the air offtake, and wherein the conduit for conducting air from the cold end of the second-pass core to the cold end of the first-pass core communicates with said first-pass core intermediate said pair of spaced baffles.

5. In a surface condenser, a nest of tubes, means providing for flow of water through the tubes in first and second passes, means providing for each pass a passage for air and noncondensable gases, said last-named means including some of said tubes which are closely spaced, air offtakes communicating with the passage near to the cold ends of their passes, and a conduit connecting the offtake of the second pass to the passage of the first pass near the offtake of the latter.

6. Structure as specified in claim 5, including a baffle disposed transversely of the first pass air passage between the air offtake of said passage and the intersection of the connecting conduit with said passage.

7. In a surface condenser, a nest of tubes, means providing for flow of water through the tubes in a plurality of passes, means providing for each pass a passage for air and noncondensable gasses, each passage being in communication with the tube space of its pass from end to end of the condenser, and means providing for flow of air and noncondensable gases along each passage in a direction counter to the direction of flow of water in the tubes of its pass and including air offtakes at the cold ends of the passes and a conduit for conducting air and noncondensable gases from the offtake of each pass wherein the direction of flow of water in the tubes is opposite to that in the initial pass to the passage of the latter at a point near to the offtake thereof.

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