March 29, 1932. J. P. LIDIAK 1,851,050

CONDENSING SYSTEM

Filed Dec. 9, 1929

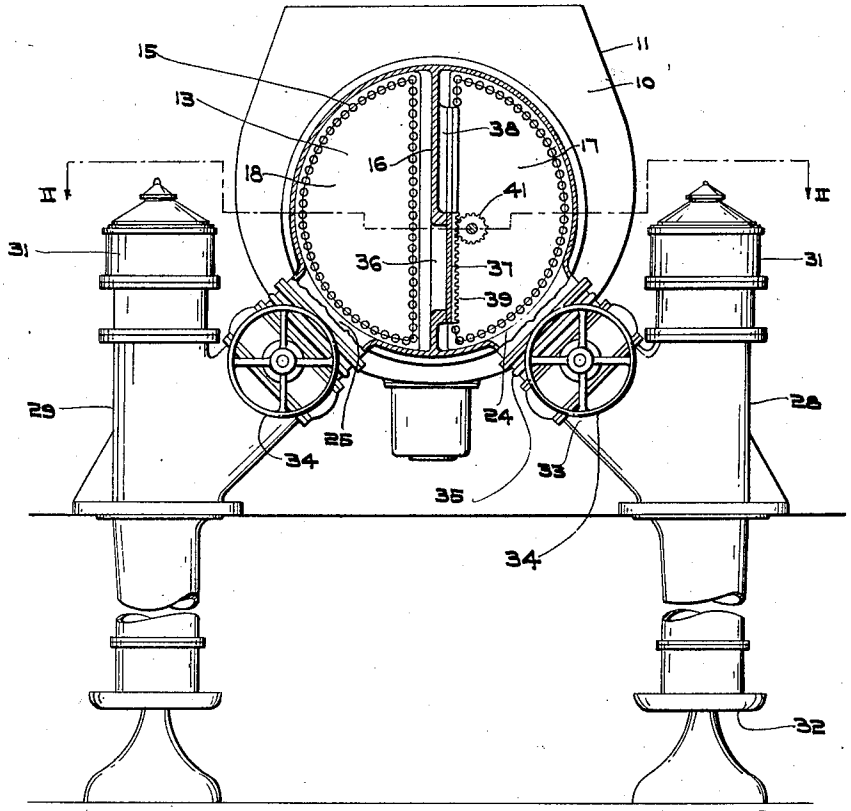

Fig. 1.

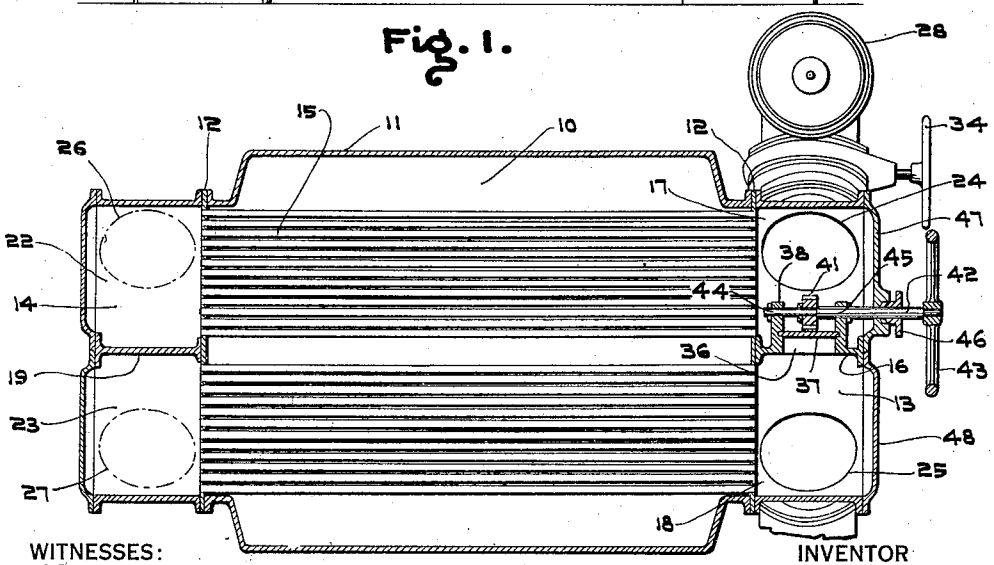

Fig. 2.

WITNESSES:
E. Lutz.

INVENTOR
J. P. Lidiak.
BY
A. B. Rivers
ATTORNEY

Patented Mar. 29, 1932 1,851,050

UNITED STATES PATENT OFFICE

JOSEPH P. LIDIAK, OF LANSDOWNE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

CONDENSING SYSTEM

Application filed December 9, 1929. Serial No. 412,762.

My invention relates to condensing systems and particularly to water circulating systems for condensers of the surface type and still more particularly, condensers of the surface type provided with divided water boxes, that is, condensers wherein the water boxes are divided into two or more compartments separated by vertically-extending partition walls and wherein separate pumping apparatus is provided for the respective compartments, whereby water may be circulated through one portion of the tube nest of the condenser while another portion is being cleaned.

It has for an object to provide a system of the foregoing character which shall be arranged so as to provide for circulating cooling water from a single pumping system to a plurality of compartments of the water box and their corresponding tube nest portions in order that all, or nearly all, of the tube surface of the condenser may be made available at such times as one of the pumping systems may be rendered temporarily inactive.

It has for a further object to provide a system of the foregoing character wherein the partition or partitions within the water box are provided with opening or openings arranged to be covered and uncovered by a valve or valves operated from outside of the condenser in order that the compartments of the water box may be placed in communication with each other so that two or more compartments may, at times, be supplied with water from a single pumping system.

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

Fig. 1 is a view, partly in section and partly in elevation, of one form of condensing system arranged in accordance with my invention; and

Fig. 2 is a plan view, in section, of the same condensing system taken on the line II—II of Fig. 1.

It is the general practice to provide condensers of the larger capacities with water boxes which are divided into two or more separate compartments, each compartment having a separate water circulating system or pump associated therewith. By means of such an arrangement, the tube nest of the condenser may be cleaned without interrupting the working of the condenser. This is readily effected by shutting down one of the circulating pumps, opening up its connecting water box compartment and cleaning the tubes of the nest associated with the opened water box compartment. During the cleaning process, the other pump or pumps continue to operate and circulate water through the remainder of the tube nest, that is, the tubes which are not being cleaned.

When the cleaning of the first group has been completed, the water is again circulated therethrough and the circulation of water through another group is interrupted. By working upon the respective groups of tubes in such sequence, the entire tube nest may be cleaned without any interruption in the operation of the condenser. Of course, during the time when such cleaning process is taking place, the vacuum produced by the condenser may be somewhat impaired owing to the heat transfer inactivity of a portion of the tube nest.

It sometimes happens that one of the circulating pumps may require overhauling and, as a consequence, the portion of the tube nest associated therewith receives no circulating water while the pump is being worked upon. At such times, the condenser may be operated by circulating water through the remainder of the tube nest, in the same manner as when the tube cleaning process is under way. However, here again, the vacuum is affected somewhat detrimentally and it has therefore been proposed to interconnect the pumps so that,

in times of emergency, or, with water at low temperature, one pump may supply circulating water not only to its own associated group of tubes, but also to the tubes ordinarily associated with the inactive pump. In this way, a single pump may be utilized to circulate water through the entire tube nest and, the vacuum obtained, which possibly may not be as good as when both pumps are employed, is better than if the single active pump supplied water to only a portion of the tube nest.

The provision of suitable valves and piping for interconnecting the circulating pumps is not always desirable because of the cost thereof, the space occupied, the weight to be supported and the fact that the use of the interconnection is only periodic and temporary. This can be better appreciated when it is taken into consideration that cross-connecting pipes and valves of this character may be of the order of 60″ in diameter.

I have therefore conceived the idea of providing an opening or openings in the partition which separates the inlet water box into separate compartments and of embodying, in the water box, a valve structure arranged to control the flow of water through the opening or openings and between the compartments. In this way, only a single valve of simple structure is required, which valve is located inside of the water box and out of the way, and the requirement for considerable piping, valves, T-fittings, elbows, etc., is entirely dispensed with.

Referring now to the drawings, I show a condenser 10 embodying a shell structure 11, tube sheets 12, an inlet water box 13 and a discharge water box 14. Extending between the tube sheets 12 is a nest of cooling tubes 15 through which the cooling water passes in a single longitudinal direction from the inlet water box 13 to the outlet water box 14. In the present embodiment, I have shown a condenser of the single-pass type, but it is to be understood, as will be apparent from the following description, that my invention is equally applicable to condensers of the multipass type.

Embodied in the inlet water box 13 is a vertically-extending partition 16 which divides the water box into two separate compartments 17 and 18. Likewise, the discharge water box 14 is provided with a partition 19 which divides the outlet water box into compartments 22 and 23. Included in the compartments 17 and 18 of the inlet water box are respective inlets 24 and 25 while the compartments 22 and 23 of the outlet water box have separate outlets 26 and 27.

Cooling water is supplied to the condenser by means of suitable pumps 28 and 29 driven by suitable motors 31. The pumps illustrated are of the propeller type and each is provided with an inlet connection 32 for removing water from an intake tunnel of the power plant (not shown) and for discharging the same through an outlet 33. The outlets 33 connect, respectively, by means of suitable stop valves 34 and expansion joints 35, with the inlets 24 and 25 of the inlet water box 13. At this time it is noted that while, in the present embodiment, I show pumps of the propeller type, it will be apparent that my invention applies equally to condensing systems wherein pumps of other types are employed.

The pump 28 is therefore arranged to supply water to the compartment 17 of the inlet water box and the group of tubes associated therewith, while the pump 29 supplies water to the compartment 18 and its associated tubes. In order that either pump may supply water to the entire tube nest, I provide, in the partition 16, an opening 36 arranged to be covered and uncovered by some means such as, for example, a slide valve 37 movable in a suitable guideway 38 disposed within the water box and carried by the partition wall 16. The slide valve 37 may be moved to cover and uncover the opening 36 by means of various types of operating gears. In the present embodiment, a rack 39 is provided, which rack meshes with a pinion 41. The latter, in turn, is connected to an operating shaft 42 which projects outside of the water box and to which an operating hand wheel 43 may be attached. The shaft 42 is preferably supported in bearings 44 and 45 forming a part of the guideway structure of the valve and, in order that a fluid-tight joint may be maintained where the operating shaft passes through the wall of the water box, a suitable stuffing box 46 is provided. In order to permit access to the interior of either compartments of the inlet water box 13, the latter is provided with separate, independently removable covers 47 and 48.

From the foregoing description, the operation of my improved condensing system will be apparent. Assuming that the system is operating under normal conditions, the pump 28 supplies cooling water to the inlet 24 and the pump 29 supplies cooling water to the inlet 25. At such times, it does not matter whether the valve 37 covers or uncovers the opening 36. The water flows through the nest of tubes and enters the compartments 22 and 23 of the outlet water box from which it is discharged through the outlets 26 and 27.

Assuming that it is desired to clean the condenser tubes, the valve 37 is closed, the pump 29 is stopped, and the cover 48 is removed. At such times, the pump 28 continues to circulate water between the compartments 17 and 22 of the inlet and outlet water boxes. As the valve 37 is in a closed position, the water circulates substantially through one-half of the tube nest, the condenser be-

ing continued in operation without any interruptions whatsoever.

After the tubes associated with the compartments 18 and 23 have been cleaned, water is again circulated through these tubes by the pump 29 while the pump 28 is stopped and cleaning of the tubes associated with the compartments 17 and 22 is proceeded with. In this way, the entire tube nest of the condenser may be cleaned without interrupting its operation.

Assuming that it is desired to overhaul one of the pumps, for example, the pump 29, this may be readily effected by shutting its associated valve 34, thus isolating the pump from the condenser. At such times, the hand wheel 43 is actuated to move the valve 37 to uncover the opening 36 so that the circulating pump 28 is capable of supplying the water to both compartments 17 and 18 of the inlet water box. As a result, the pump 28 supplies cooling water to the entire tube nest of the condenser, thus rendering the latter highly effective even though one of its circulating pumps is temporarily disabled. It will be apparent that, should it be necessary at any time to overhaul the pump 28 rather than the pump 29, the arrangement is such that the pump 29 may supply cooling water to the entire tube nest.

From the foregoing, it will be apparent that I have evolved a form of condensing system which is especially adapted for condensers of the larger capacities and which provides for a highly flexible method of operation in that not only may the tubes of the condenser be cleaned while the condenser is in operation, but the entire tube surface of the condenser may be rendered available during such times as one of the circulating pumps is inactive. My arrangement has the further advantage that, during periods of light loads, either one of the pumps may supply the required cooling water to the entire condenser tube nest merely by opening the valve 37. It will be obvious that all of this is accomplished at very little expense merely by providing a single valve of simple structure in the inlet water box.

While I have shown my invention 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 imposed by the prior art or as are specifically set forth in the appended claim.

What I claim is:—

In a condensing system, the combination of a surface condenser having a steam inlet and an inlet water box divided by a partition into a pair of compartments, the partition extending in the general direction of the plane of the condenser and steam inlet axes, two separate and independent pumps for supplying cooling water independently to the respective compartments, means for isolating each pump from its compartment, and means for supplying water from one pump to both compartments when the other pump is isolated from its compartment including valve means affording communication between the compartments and means extending exteriorly of the condenser for operating the valve means.

In testimony whereof, I have hereunto subscribed my name this 29th day of Nov., 1929.

JOSEPH P. LIDIAK.