Aug. 3, 1937. J. H. SENGSTAKEN 2,088,931

SUPPORTING MEANS FOR ECONOMIZERS

Filed June 17, 1936 2 Sheets-Sheet 1

Fig. 1

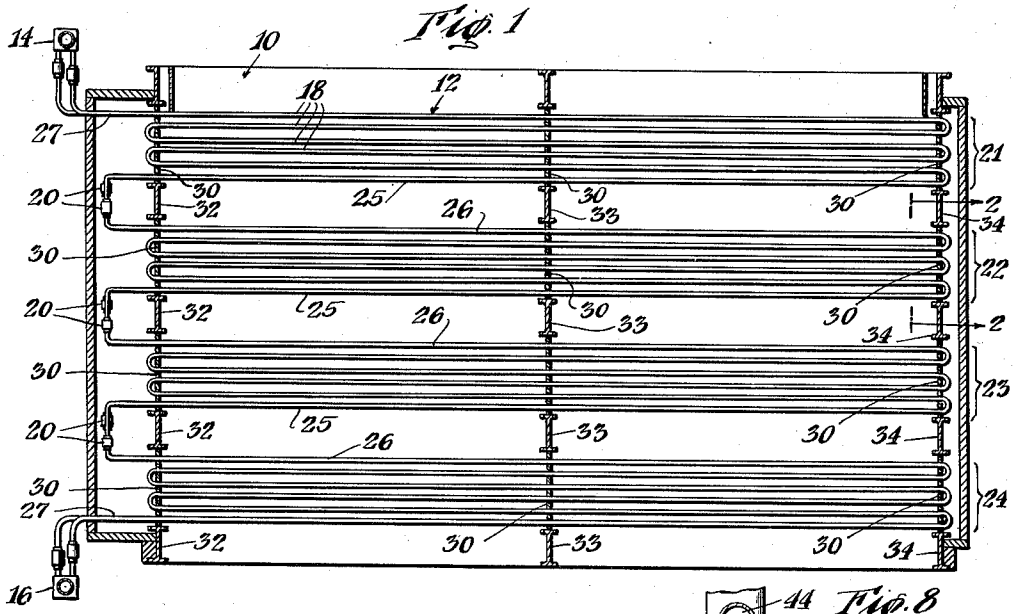


Fig. 4

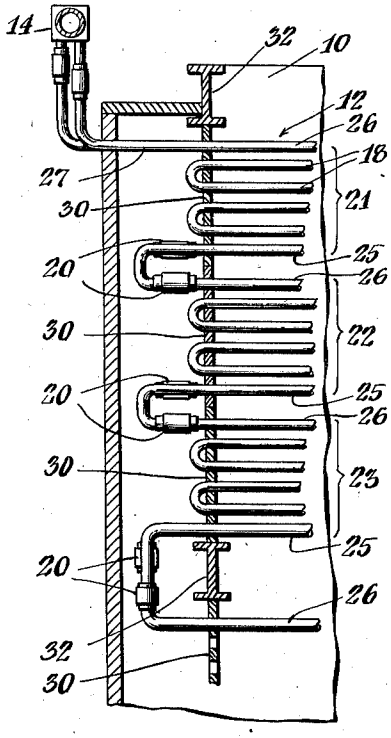


Fig. 5

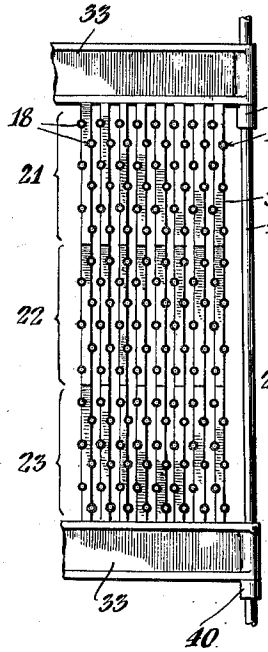


Fig. 8

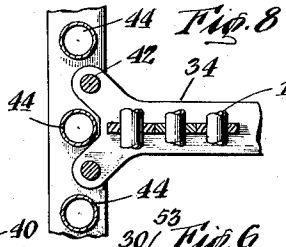


Fig. 6

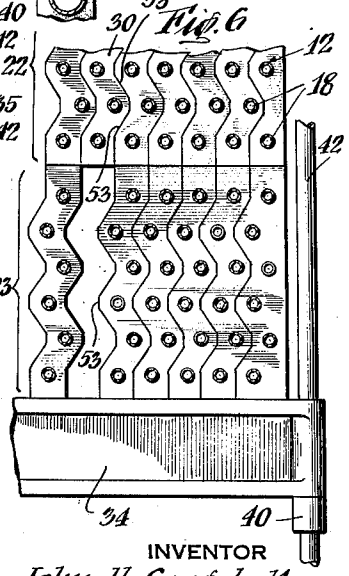


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Fig. 3

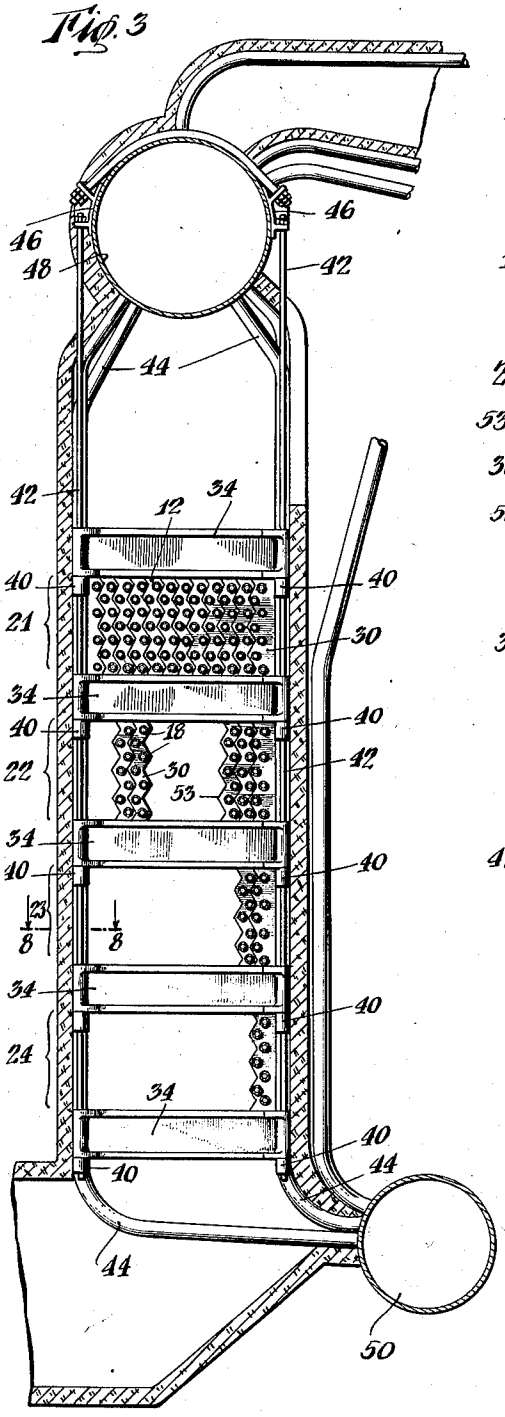



Fig. 2

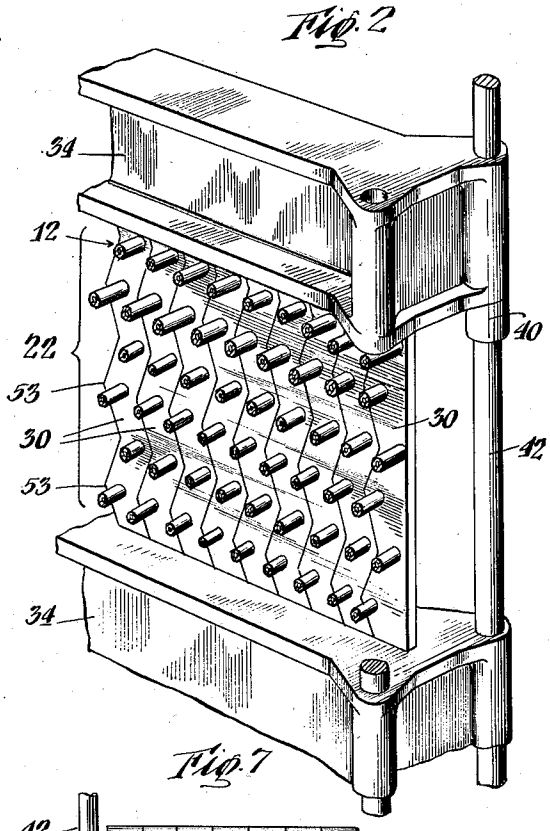
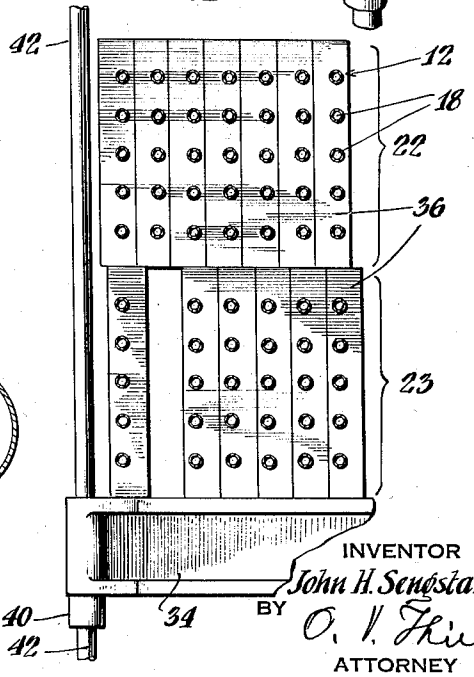



Fig. 7

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Patented Aug. 3, 1937

2,088,931

# UNITED STATES PATENT OFFICE

2,088,931

## SUPPORTING MEANS FOR ECONOMIZERS

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Application June 17, 1936, Serial No. 85,670

11 Claims. (Cl. 257—230)

This invention relates to heat transfer apparatus and particularly to means for supporting the tubular heat absorbing elements thereof. The invention will be described by way of illustration as embodied in an "economizer" having tubes through which boiler feed water is circulated to absorb heat from the boiler gases.

A feature of the invention resides in relieving the headers for the tubes of substantially all the strain usually imposed thereon by the weight of the tubes.

A second feature resides in providing for easy removal of some of the tubes for replacement or repairs without disturbing the supporting means for other tubes.

Other features and advantages of the invention will become apparent upon consideration of the following detailed description and the appended claims when read in conjunction with the accompanying drawings in which:

Figure 1 is a vertical sectional view of an economizer embodying the present invention;

Figure 2 is a fragmentary perspective view of a portion of the economizer as indicated on the line 2—2 in Figure 1;

Figure 3 is a diagrammatic view illustrating the mounting of the economizer in a boiler, parts being omitted for simplicity of illustration;

Figure 4 is an enlarged fragmentary sectional elevation illustrating a modified arrangement embodying the invention;

Figure 5 is a fragmentary transverse sectional view through the economizer showing means for spacing and supporting the center portions of the economizer tubes;

Figure 6 is a fragmentary elevational view showing supporting means for the end portions of the economizer tubes;

Figure 7 is a view similar to Fig. 6 showing a modified arrangement; and

Figure 8 is a sectional view on line 8—8 in Fig. 3.

Referring to the drawings, the economizer comprises an open-ended casing 10 which contains a plurality of sinuous tubular heat absorbing elements 12, one of which appears in side elevation in Fig. 1. The elements 12 are disposed in side by side relation (Fig. 3), and exposed to boiler gases that flow through the casing for heating feed water or other fluid circulated through the elements between the inlet and outlet headers 14 and 16 respectively. Each element comprises a number of superposed tubes 18 interconnected by return bends to form a continuous and sinuous tubular element and, as illustrated in the drawings, consists of several sections 21, 22, 23, 24 and the return bends or couplings 20, connecting the lower tube 25 of one section to the upper tube 26 of the adjacent section, are disconnectable from these tubes. Likewise the end tubes 27 of each element are disconnectable from the headers 14, 16.

Plates 30, individual to each section of each element are secured near the ends of the component tubes of each section in any convenient manner, and near their mid-points also if desired. Several series of beams 32, 33, 34 that extend transversely of the economizer between the sections of the elements 12 are aligned with and supportingly engaged by the plates 30, associated with corresponding sections of all the elements. The plates 30 associated with the component tubes of the lowest sections 24 in all the elements rest upon a similar series of beams extending beneath the lowermost sections. Correspondingly positioned beams, near the ends and mid-points of the tubes, are in vertical alignment and rest upon collars or nuts 40 on rods 42 extending through the beams and suspended from saddle members 46 mounted on the steam and water drum 48 of the boiler. Thus, the economizer is suspended from the steam drum of the boiler and located in a gas passage communicating with the off-take thereof. The supporting rods 42 which interconnect the several series of beams 32, 33, 34 are located between downcomer tubes 44 connecting the steam drum with the water drum 50 and lining the walls of the off-take (Fig. 8) so that the suspension rods are protected against high temperature conditions in the gas passage.

The plates 30 which interconnect the component tubes of each section of an element 12 near the ends are in abutment at their side edges and being located between the beams 34 complement the latter to form end walls for the gas path through the economizer. The plates 30 connected to the mid-points of the tubes may likewise be arranged to form a baffle dividing the gas passage. Plates 30 preferably have their side edges formed with a sinuous contour so that the plates may be nested in such manner that they interlock and afford mutual support to each other. The interlocking of the sides of plates 30 is of particular advantage when, as illustrated in Figs. 4 to 7, several sections 21, 22, 23 of each element are supported upon a single series of beams 32, 33, 34 instead of there being a series of beams between the sections 21 and 22 and between sections 22 and 23 as in Fig. 1. With

this interlocking arrangement, the plates **30** associated with the component tubes of a section, such as **22**, of any element **12** rest in part upon the plate for the next lower section **23** of the same element and in part upon the plate for the corresponding section **22** adjacent thereto. Thus, if a section **23** of an element is removed, as illustrated in Fig. 6, the section **22** thereabove of the same element remains supported due to the supporting engagement of the edge portions **53** of the plates **30**.

In Fig. 7 the plates **36** connected to the component tubes of the sections **22** and **23** are illustrated as having straight rather than sinuous edges and the plates for contiguous (vertical) sections of an element are offset with respect to each other so that the plate for an upper section, as **22**, rests in part upon the plate for the next lower section **23** of the same element and in part upon the plate for the section **23** of an adjacent element **12**. Thus, as illustrated for the second element **12** from the left of Fig. 7, a section, such as **23**, may be disconnected and removed while the upper sections **22** and **21** of the same element remain fully supported.

If desired, the component tubes of the elements may be maintained in spaced relation at their mid-points in any suitable manner instead of by means of plates **30**. One such arrangement is illustrated in Fig. 5 wherein the component staggered tubes of each of the respective sections fit into notches in the side edges of plates **35** and are connected to the latter as by welding.

It will be seen that since the component tubes of each corresponding section of each element are connected to plates **30** and the plates for corresponding sections of all the elements are supported upon a common series of beams extending transversely therebeneath, any section of any element may readily be removed from the economizer for repair or replacement by disconnecting the end tubes of a particular section from the related couplings or return bends and, in the case of the upper and lower sections, from the headers **14**, **16**. The headers **14**, **16** are relieved of the weights of the tubes and the entire economizer may readily be suspended from the boiler drum **50** or a convenient portion of the boiler frame since the several sets of vertically aligned beams **34** are interconnected and supported by the rods **42**.

Although illustrative embodiments of the invention have been shown in the drawings and described in detail herein, it is understood that there are many changes and variations that may be made without departing from the invention and it is therefore intended to include all such changes and variations within the scope of the appended claims.

What I claim is:

1. In an economizer or the like having a plurality of fluid circulating elements disposed in side by side relation and each divided into a number of superimposed sections which comprise sinuously connected parallel tubes, and detachable couplings interconnecting the component sections of the respective elements; a plurality of supporting members extending transversely of said elements between the sections thereof and below the lowermost sections thereof and supporting corresponding sections of all said elements so that upon disconnection of any section of any element from the related coupling said section may be removed from the economizer while the other sections of the same element remain supported by the transverse members associated therewith; and means supporting said members.

2. In an economizer or the like having a plurality of sinuous fluid circulating elements disposed in side by side relation and each divided into a number of superimposed sections which comprise interconnected parallel tubes, and detachable couplings interconnecting the several sections of the respective elements; members extending transversely of said elements between the sections thereof and below the lowermost sections thereof in vertically spaced and aligned relation near each end of the lowermost tube of each section; individual means attached to the lowermost tube, at least, of each section of each element at locations corresponding to the positions of said transverse members, said means for any section resting on the transverse member immediately therebelow so that upon disconnection of any section of an element from the related coupling said section may be removed from the economizer while any other section of the same element remains fully supported by the respective transverse member therebelow; and means interconnecting vertically aligned transverse members for suspending the economizer from a fixed support thereabove.

3. In an economizer or the like having at least one fluid circulating element that is divided into a number of superimposed sections which comprise sinuously connected parallel tubes with detachable couplings interconnecting the several sections of said element; a plurality of series of beams extending transversely of the economizer, certain series extending between the sections of said element and another series extending beneath the lowermost section thereof, said beams being positioned below and adjacent the ends of the lowermost tubes of each section of said element and correspondingly positioned beams being in vertical alignment; a plurality of series of plates connected with the component tubes of each section of said element and aligned with said beams, the plates for each section of said element being individual thereto and removably supported on the transverse beams beneath the lowermost tube thereof so that upon disconnection of any section from the related coupling the said section may be removed from the economizer while the other sections of said element remain supported on the transverse beams beneath said sections; and means interconnecting vertically aligned beams for supporting the economizer.

4. In an economizer or the like having a plurality of sinuous fluid circulating elements disposed in side by side relation and each divided into a number of superimposed sections which comprise interconnected superposed tubes, and detachable couplings interconnecting the several sections of the respective elements; a plurality of plates attached to the tubes of each section at intervals along said tubes; a plurality of series of similarly spaced beams extending between the sections thereof and beneath the lowermost sections thereof and each engaged by a series of said plates associated with each element for supporting corresponding sections of said elements; and means interconnecting correspondingly positioned beams for supporting the economizer.

5. In an economizer or the like having a plurality of sinuous fluid circulating elements each divided into a number of superimposed sections comprising parallelly arranged interconnected tubes with detachable couplings connecting the

component sections of each element; a plate disposed in each section adjacent each end of the component tubes thereof and interconnecting said tubes; and correspondingly positioned series of vertically spaced beams extending transversely of the elements between the sections of said elements and beneath the lowermost sections of the latter upon which said plates for corresponding sections of said elements are supported so that upon disconnection of the coupling or couplings associated with any section of any element said section may be withdrawn from the economizer together with the plates for the tubes thereof while the remaining sections of said element remain supported upon the transverse beams associated therewith.

6. In an economizer or the like having a plurality of fluid circulating elements disposed in side by side relation and each divided into a number of superimposed sections which comprise interconnected parallelly arranged tubes, and detachable couplings connecting the sections of the respective elements; a plurality of vertically spaced series of beams extending transversely of the economizer elements between sections of the latter and below the lowermost sections thereof, the beams of each series being disposed adjacent each end and near the midpoints of the lowest tubes in the respective sections of said elements; a plurality of correspondingly located plates individual to each section of each element spacing the tubes of each section and removably supported on said beams, the plates for corresponding sections of adjacent elements being in abutment at their sides and together with said beams upon which they rest forming walls defining gas passages through the economizer; and means interconnecting the vertically aligned beams for supporting the economizer.

7. In an economizer or the like having a plurality of fluid circulating elements disposed in side by side relation and each comprising a plurality of superposed tubes sinuously connected by fixed return bends to form tube groups removable as units from each element, and detachable couplings interconnecting each tube group above the lowermost one in the respective elements to the group below; one or more plates individual to each tube group and interconnecting the component tubes thereof, the plates for the groups above the lowermost one in each element resting at least in part upon the plates for the next lower group of the same element; one or more beams extending transversely of said elements and supportingly engaging the plates for the lowest tube groups of the respective elements, the plates for the several superposed groups of the respective elements interlocking with the plates for adjacent elements so that upon removal of a group of tubes from a particular element, any other groups of tubes of said element above the position of the group removed therefrom are supported on said beam or beams through the intermediary of plates associated with the elements adjacent said particular element; and means for supporting said beams.

8. In an economizer or the like having a plurality of fluid circulating elements disposed in side by side relation and each comprising a plurality of superposed tubes sinuously connected by fixed return bends to form tube groups removable as units from each element, and detachable couplings interconnecting each tube group above the lowermost one in the respective elements to the group below; one or more plates individual to each tube group and interconnecting the component tubes thereof, the plates for the groups above the lowermost one in each element resting at least in part upon the plates for the next lower group of the same element; one or more beams extending transversely of said elements and supportingly engaging the plates for the lowest tube groups of the respective elements, the plates for the several superposed groups of the respective elements being positioned to interlock with the plates for adjacent elements so that upon removal of a group of tubes from a particular element, any other groups of tubes of said element above the position of the group removed therefrom are supported on said beam or beams through the intermediary of plates associated with the elements adjacent said particular element; and means for supporting said beams.

9. In an economizer or the like having a plurality of fluid circulating elements disposed in side by side relation and each comprising a plurality of superposed tubes sinuously connected by fixed return bends to form tube groups removable as units from each element, and detachable couplings interconnecting each tube group above the lowermost one in the respective elements to the group below; one or more plates individual to each tube group and interconnecting the component tubes thereof, the lower edges of the plates for the groups above the lowermost one in each element resting at least in part upon the upper edges of the plates for the next lower group of the same element; one or more beams extending transversely of said elements and supportingly engaging the plates for the lowest tube groups of the respective elements, the plates for the several superposed groups of the respective elements being formed at their side edges to interlock with the plates for adjacent elements so that upon removal of a group of tubes from a particular element, any other groups of tubes of said element above the position of the group removed therefrom are supported on said beam or beams through the intermediary of plates associated with the elements adjacent said particular element; and means for supporting said beams.

10. In an economizer or the like having a plurality of fluid circulating elements disposed in side-by-side relation and each comprising a plurality of superposed tubes sinuously connected by fixed return bends to form tube groups removable as units from each element, and detachable couplings interconnecting each tube group above the lowermost one in the respective elements to the group below; one or more plates individual to each tube group interconnecting the component tubes thereof; one or more beams extending transversely of said elements for supporting the plates of the lowermost groups of tubes in the respective elements, the plates for any group above the lowermost one in the respective elements resting in part upon the plates for the groups therebelow of the same unit and in part upon the plates for groups of tubes of other elements adjacent thereto so that upon removal of a group of tubes from a particular element any other groups of tubes of said element above the position of the group removed therefrom are supported on said beam or beams through the intermediary of plates associated with the elements adjacent to said particular element; and means for supporting said beams.

11. In an economizer or the like having a plu-

rality of fluid circulating elements disposed in side-by-side relation and each comprising a plurality of superposed tubes sinuously connected by fixed return bends to form tube groups removable as units from each element, and detachable couplings interconnecting each tube group above the lowermost one in the respective elements to the group below; one or more plates individual to each tube group interconnecting the component tubes thereof; one or more beams extending transversely of said elements for supporting the plates of the lowermost groups of tubes in the respective elements, the plates for any group above the lowermost one in the respective elements resting in part upon the plates for the groups therebelow of the same unit and in part upon the plates of corresponding lower tube groups of another element adjacent thereto so that upon removal of a group of tubes from a particular element any other tube groups of said element above the position of the group removed therefrom are supported on said beam or beams through the intermediary of plates associated with elements adjacent to said particular element; and means for supporting said beams.

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