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F. BLOSSOM & J. D. E. DUNCAN.  
ECONOMIZER SYSTEM.

(Application filed Jan. 13, 1902.)

(No Model.)

Fig. 2

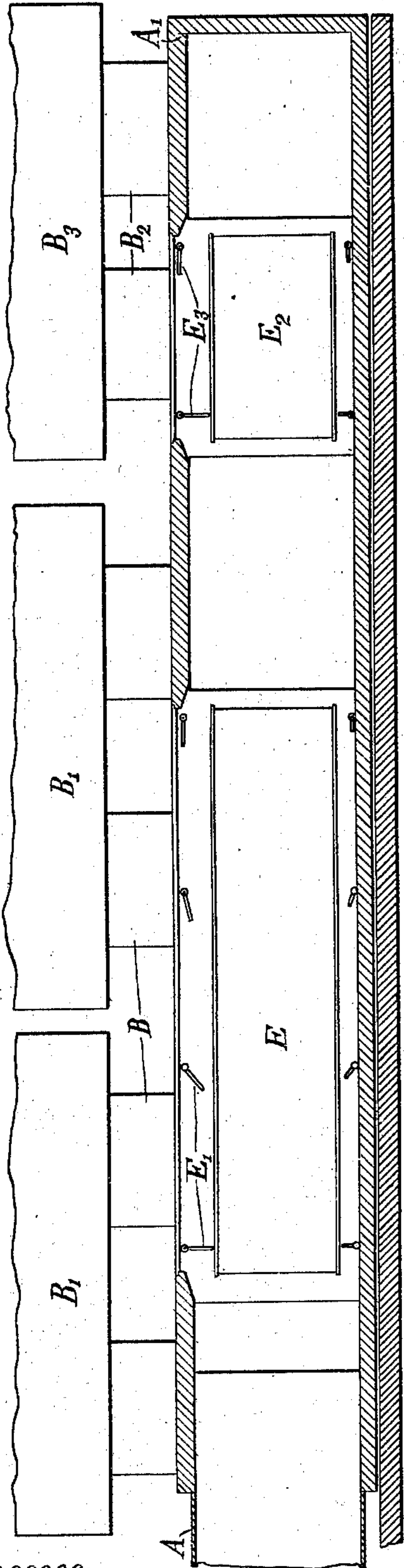
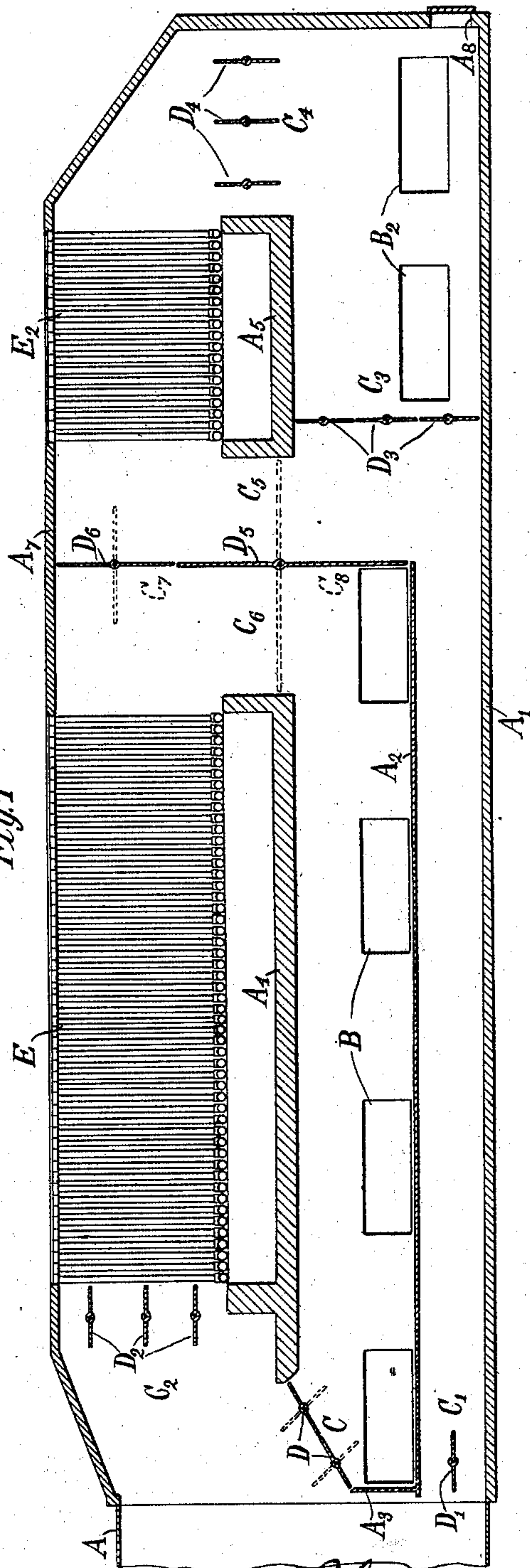


Fig. 1



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# UNITED STATES PATENT OFFICE.

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## ECONOMIZER SYSTEM.

SPECIFICATION forming part of Letters Patent No. 712,490, dated November 4, 1902.

Application filed January 13, 1902. Serial No. 89,471. (No model.)

*To all whom it may concern:*

Be it known that we, FRANCIS BLOSSOM and JOHN D. E. DUNCAN, citizens of the United States, and residents of New York city, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Economizer Systems, of which the following is a specification, taken in connection with the accompanying drawings.

This invention relates to a system of connecting-economizers such as are used for heating the feed-water of boilers or for heating water for other uses by means of the flue-gases from such boilers, and embodies a system by which maximum efficiency is secured under varying conditions of load on the boilers. Under light and normal loads all the hot gases from the boiler-furnaces may pass successively through all the economizers, while under heavy or overload conditions the gases from one set of boiler-furnaces may pass through part of the economizers and then directly into the stack, while the gases from other boiler-furnaces pass through another part of the economizers and then into the stack. In this way it will be seen that under light loads all the furnace-gases pass through all the economizers in series, while under extreme or overload conditions the furnace-gases are only conducted through part of the economizer before reaching the stack, the several parts of the economizer in this way being connected so as to form parallel passages for the furnace-gases.

In the accompanying drawings, in which the same reference character represents similar parts in the several figures, Figure 1 shows the economizer system in vertical section. Fig. 2 shows a partial horizontal section of the same.

In the particular embodiment of this invention which is indicated in the drawings, A' represents the economizer-housing, formed of any suitable material and communicating with the stack connection A, by which the furnace-gases are led to the stack. The division-plate A<sup>2</sup> is arranged parallel to the bottom of the housing, so as to form a parallel flue C', extending throughout part of the length of the housing at the bottom of the same. The economizers,

of which two groups or sections are shown, although it is understood that any number of sections may be employed and that these sections may be of the same or different capacity, as desired, are mounted in the usual way, the economizer E being provided with a soot-chamber A<sup>4</sup> of the usual construction. The economizer-section E<sup>2</sup> is provided with a similar soot-chamber A<sup>5</sup>. These economizer-sections are constructed in the usual manner well known in this art, and therefore not described in detail. It will be noted by reference to Fig. 2 that the economizer E may be provided with suitable hinged baffle-plates E', which serve to direct the hot gases through different parts of the economizer in the manner desired. The economizer-section E<sup>2</sup> is provided with similar baffle-plates E<sup>3</sup>. In the drawings the housing is shown connected with a number of boilers, the set of boilers B' being connected by boiler-flues B with the housing, the boiler-flues entering the housing directly above the division-plate A<sup>2</sup>, as indicated. The boiler-flues B<sup>2</sup>, which conduct the hot gases from the boilers B<sup>3</sup> to the housing, open into the same near the right of Fig. 1 and substantially below the economizer-section E<sup>2</sup>, with which they cooperate. The cleaning-door A<sup>8</sup> is provided in this end of the housing, and other cleaning-apertures may be constructed as desired to allow the various parts of the apparatus to be cleaned as necessary. The vertical plate A<sup>3</sup> is arranged at the end of the division-plate A<sup>2</sup> to form in connection with the adjacent portion of the wall of the soot-chamber A<sup>4</sup> a by-pass C. This by-pass is controlled by by-pass damper D, (shown as a multiple or shutter damper,) although it is understood that any other form of damper to properly control this passage may be employed. The parallel flue C' is controlled by the parallel flue-damper D' at the end of the same near the stack connection. This damper is shown of the ordinary hinged construction. The escape-passage C<sup>2</sup>, by which gases pass from the economizer-section E into the stack connection, is controlled by the escape-damper D<sup>2</sup>. The cut-off damper D<sup>3</sup> serves to control the passage C<sup>3</sup> as desired. The throat-damper D<sup>4</sup> is located adjacent the economizer-section E<sup>2</sup> in the throat C<sup>4</sup> and serves to control the pas-



sage of gases through this part of the apparatus. As indicated in Fig. 1, the chamber or passage between the two soot-chambers and economizer-sections is divided (as indicated in that figure) into two passages  $C^5$  and  $C^6$  by the partition-damper  $D^5$  and the chamber-damper  $D^6$ , which together make a central partition from the end of the division-plate to the upper wall  $A^7$  of the housing.

It is of course understood that instead of the particular construction of dampers indicated in the drawings any other desired form may be employed to properly control the passages indicated. Furthermore, the exact construction of these passages and partitions may be varied to a considerable extent, and any desired number of sections of an economizer may be combined in a single housing and provided with suitable connections and dampers to operate on the same principle as the form of this invention indicated in the drawings.

The operation of this apparatus in the position in which it is indicated in Fig. 1 is as follows: The dampers are arranged so that the gases circulate through the several economizer-sections in the proper manner for overload operation of the boilers, under which conditions the boilers are producing an excessive quantity of steam, and the amount of hot gases issuing from the boilers through the boiler-flues  $B$  and  $B^2$  is considerably more than the amount for average or normal load. The economizer-sections are connected under these conditions so as to afford parallel passages for the furnace-gases from the boiler-flues to the stack connection, so that the gases pass through the several groups or sections of the economizer in parallel. The gases entering the housing through the boiler-flues  $B^2$  pass up through the throat  $C^4$ , through the economizer-section  $E^2$ , where they give up a large part of their heat to the water within the economizer. Then they pass down through the passage  $C^5$  on the right of the partition-damper  $D^5$  and through  $C'$  to the stack. The furnace-gases which issue from the other set of boilers through the boiler-flues  $B$  take a different course, passing through the passage  $C^6$ , then through the economizer-section  $E$ , where they have a large portion of their heat utilized, and thence through the escape-passage  $C^2$  to the stack. It will be seen that by this means the furnace-gases are not obliged to pass in series through all the sections of the economizer, so that the great volume of furnace-gases which are produced under overload conditions have a much freer passage through the economizer-housing to the stack than would be the case if all the gases were passed successively through all the sections of the economizer. It will be noted, furthermore, that under this condition of operation the by-pass damper  $D$  may be so set as to allow any desired portion of the furnace-gases issuing from the boiler-flues  $B$  to escape di-

rectly into the stack without passing through the economizer-section  $E$ . In a similar way also the cut-off damper  $D^3$  may be operated to allow any desired portion of the gases from the boiler-flues  $B^2$  to pass directly into the flue  $C'$  without passing through the economizer-section  $E^2$ . The passage  $C^3$  in this manner would act as a by-pass. Where, however, the boilers are run under light or normal load it is desirable that all the furnace-gases shall pass through all the sections of the economizer, so as to utilize in this way a greater proportion of the heat in these gases. The amount of the gases under such conditions is not sufficient so that their passage through the economizer is unduly impeded. In order to accomplish this, the partition-damper  $D^5$  is swung into the position indicated in dotted lines in Fig. 1, so as to close the vertical passages  $C^5$  and  $C^6$  through the chamber. The chamber-damper  $D^6$  is also moved into horizontal position, so as to provide the passage  $C^7$  between the sections of the economizer  $E$  and  $E^2$ . The parallel-flue damper  $D'$  is closed and the cut-off damper  $D^3$  is opened to give an open passage for the gases from the furnace-flues  $B$  under the soot-chambers, and after mingling with the gases from the boiler-flues  $B^2$  all the gases pass together through the throat and through the several sections of the economizer in series to the stack. Under these conditions of operation the by-pass damper  $D$  may be operated to allow a by-pass of the gases to any desired extent through the by-pass  $C$ . The parallel-flue damper  $D'$  may also be operated to allow the parallel flue  $C'$  to act as a by-pass. Numerous other connections may be made by operating the various dampers in different ways.

It will be apparent of course that either section of the economizer may be operated to utilize the heat in the gases issuing from the corresponding set of boiler-flues, as the apparatus is indicated in Fig. 1, while the other section of economizer is not used at all, so that either section of the economizer may be repaired. It is furthermore possible to pass the gases from all the boiler-flues through a single section of the economizer. This may be done by closing the damper  $D^4$  and opening the dampers  $D^3$  and  $D^6$ , while at the same time the flue-damper  $D'$  is closed. In this way the gases from the boiler-flues  $B^2$  pass through the passages  $C^3$   $C^5$  and then mingling with the gases from the other boiler-flues pass through the economizer  $E$  to the stack. If desired for purposes of repair, both economizer-sections may be cut out by closing the throat-damper  $D^4$  and by moving the partition-damper into horizontal position. Then by opening the by-pass damper  $D$  and the cut-off damper  $D^3$  the furnace-gases pass directly into the stack. The flue  $C'$  may or may not be used under these conditions of operation.

Many variations may be made from the



form of apparatus which is indicated in the drawings. If desired, the sections of the economizer may all be made of the same size, and the number of boiler-flues cooperating with each section of the economizer may likewise be made equal in all cases, if desired. It is also apparent to those skilled in the art that any desired number of economizer-sections may be connected in this manner, so that the gases pass through all the economizer-sections in series under light or average conditions, while under full-load or overload conditions parallel passages are provided by which the several parts of the furnace-gases pass through only a single section of the economizer before reaching the stack. Numerous other changes may be made in the apparatus indicated in the drawings without departing from the spirit of this invention, and, furthermore, parts of this apparatus may be employed without using the whole of the same. We do not, therefore, wish to be limited by the disclosure which we have made in this case; but what we claim as new, and what we wish to secure by Letters Patent, is set forth in the appended claims.

What is claimed as new is—

1. In an economizer system, a housing, two economizer-sections mounted in the upper portion of said housing, there being a chamber between said sections, boiler-flues communicating with said housing arranged in sets below said economizer-sections, each of said sets cooperating with the adjacent economizer-section, a parallel flue at the lower portion of said housing having a division-plate above said flue, a stack connection at one end of said housing to put said stack in communication with said chamber, through said parallel flue, soot-chambers below said economizer-sections, a by-pass damper controlling the by-pass between said division-plate and the adjacent soot-chamber to allow gases to pass into the stack, a parallel-flue damper in said parallel flue adjacent the stack, an escape-damper controlling the passage from the economizer-section adjacent the stack, a chamber-damper and a partition-damper in said chamber controlling the passage from said division-plate to the upper wall of said chamber, a throat-damper controlling the admission of gases to the section of economizer removed from said stack, and a cut-off damper, said chamber and said partition-damper being arranged to form parallel passages through said chamber, said passages communicating with the economizer-sections respectively and also to form a single passage through said chamber between said economizer-sections.

2. In an economizer system, a housing connected with the stack, economizer-sections mounted within said housing, boiler-flues communicating with said housing and arranged in sets to communicate with the ad-

jacent economizer-sections and connections and dampers therefor to connect each set of boiler-flues with the stack through the adjacent section of economizer or to connect all of said boiler-flues with the stack through all of the sections of the economizer.

3. In an economizer system, a housing connected with the stack, economizer-sections mounted in said housing, boiler-flues communicating with said housing to cooperate with the adjacent economizer-sections, passages and dampers therefor, to provide parallel passages from each set of boiler-flues through the corresponding sections of economizer to the stack and to allow any desired portion of the gases from any of said boiler-flues to simultaneously pass directly into the stack; or to provide connection between all of said boiler-flues and the stack through all of the sections of economizer in series and simultaneously to provide by-passes for any desired portion of the gases from said boiler-flues to the stack.

4. In an economizer system, economizer-sections, boiler-flues to cooperate with said sections and connections therefor to pass the gases from said boiler-flues in parallel through the cooperating economizer-sections or to pass said gases in series through all of said economizer-sections.

5. In an economizer system, economizer-sections, boiler-flues cooperating therewith and connections to provide parallel passages for the gases issuing from said boiler-flues through the several economizer-sections and simultaneously to provide by-passes around said economizer-sections or to provide passages for said gases through all of said economizer-sections and to provide simultaneous by-passes around said economizer-sections.

6. In an economizer system, a housing, economizer-sections mounted in said housing, there being a chamber between adjacent economizer-sections, and dampers in said chamber between said economizer-sections to provide parallel passages communicating with the adjacent sections respectively and when moved into another position to close said parallel passages and to connect the adjacent economizer-sections.

7. In an economizer system, a housing, economizer-sections mounted in said housing, boiler-flues connected with said housing to cooperate with said economizer-sections, said housing being connected with a stack, connections and dampers therefor to provide parallel passages from said boiler-flues through several economizer-sections to said stack or to provide a single passage through said economizer-sections in series to said stack, said connections and dampers comprising a chamber between adjacent economizer-sections and dampers therein to form parallel passages communicating with the adjacent ends of said economizer-sections re-



spectively and also to close said parallel passages and simultaneously to connect said adjacent ends of said economizer-sections.

8. In an economizer system, a plurality of  
5 economizer-sections, boiler-flues to cooperate with said sections, passages and dampers therefor to provide parallel passages for the gases from said boiler-flues through each of

said economizer-sections or to provide passages for said gases through more than one of said economizer-sections in series.

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