June 17, 1930. W. F. KEENAN, JR 1,764,172

LOCOMOTIVE BOILER

Filed April 16, 1925

Fig. 1.

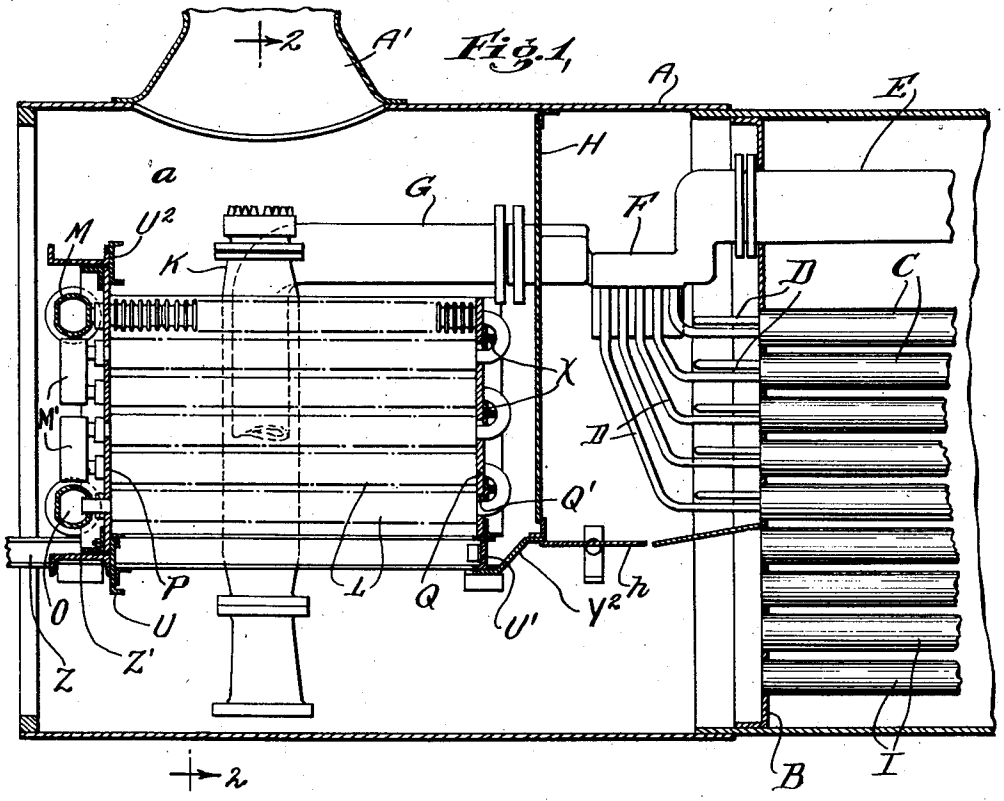
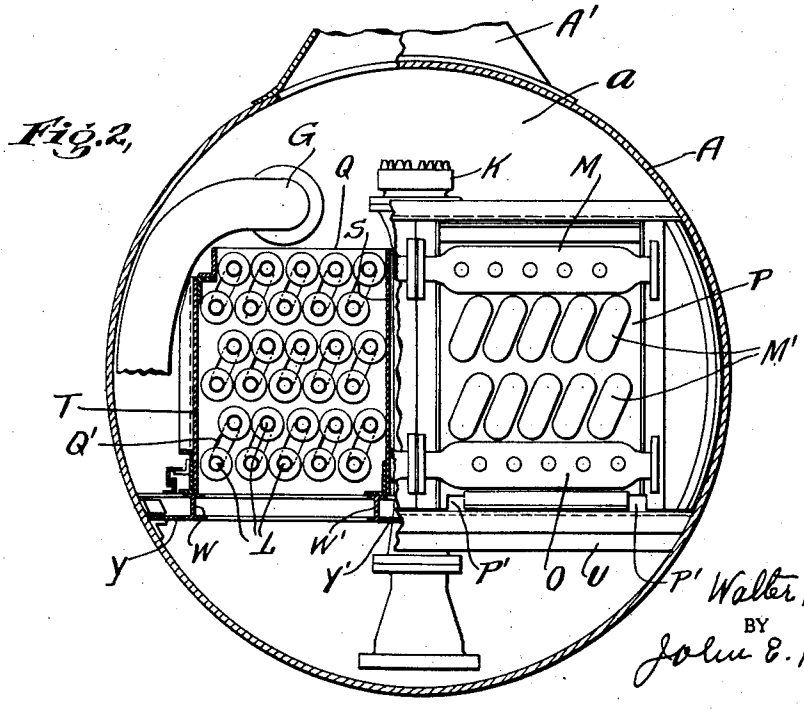


Fig. 2.



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LOCOMOTIVE BOILER

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The general object of the present invention is to provide a locomotive boiler with improved means for utilizing the heating gases escaping from the boiler proper in pre-heating the boiler feed water. More specifically, the object of the invention is to provide a locomotive boiler of usual construction with a feed water heater or economizer located in the smoke box of the locomotive and so disposed as to effectively utilize the available heat in the escaping gases without requiring any substantial change in the locomotive construction, or interference with the general operation of the locomotive.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification: but for a better understanding of the invention, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of my invention.

Of the drawings:

Fig. 1 is a longitudinal section of a front end portion of a locomotive; and

Fig. 2 is an end elevation of the structure shown in Fig. 1, with the left hand portion in section on the line 2—2 of Fig. 1.

In the drawings, A represents the shell of a locomotive boiler of known type, and B the tube sheet at the front end of the boiler. As shown, the upper boiler fire tubes C contain superheater elements D receiving steam from the locomotive steam pipe E through the superheater header structure F which may be of standard structure and comprises the usual outlet openings through which the superheated steam from the elements D passes into the curved distributing pipes G running to the locomotive steam chests, (not shown). In front of the tube sheet B is a baffle H which in conjunction with a damper h forms a means for regulating the distribution of the heating gases among the superheater containg fire tubes C and the lower fire tubes I. The damper h may be connected to the throttle in a known manner so as to be closed and stop practically all flow of heating gases through the tubes C when no steam is being withdrawn from the locomotive boiler. In so far as above described, the locomotive shown is of standard construction.

In accordance with the present invention, an economizer or boiler feed water heater is located in the locomotive smoke box a, in front of the baffle H. In the preferred consstruction shown, the economizer is formed of two similar sections, one at each side of the vertical exhaust nozzle pipe K which, for the purposes of the present invention, advantageously extends to a higher level in in smoke box than is usual. Each section of the economizer comprises a bank of tubular elements L advantageously, and as shown, in the form of U-tubes, the legs of which are surrounded by externally corrugated cast iron casing sections to increase the heat absorbing surface area of the element, which in this respect, is similar to the tubular elements of ordinary Foster superheaters. The legs of the elements L are parallel to the fire tubes, and are arranged in closely spaced horizontal rows, the legs in adjacent rows being staggered. At the front end of the boiler the upper legs of the top row elements of each economizer section are connected to a corresponding inlet header M, and the lower legs of the elements in the bottom row of each economizer section are connected to a corresponding outlet header O. The lower leg of each of the elements L, except those in the bottom row, is connected at the front of the locomotive to a corresponding upper leg of the elements L in the row below by a corresponding return header M'. The adjacent ends of the headers O for the two economizer sections are advantageously formed with flanges and are detachably connected together so that in operation they form in effect a single header, while the two headers may be disconnected to permit either economizer section to be bodily removed from the locomotive through the front end of the smoke box without disturbing the other

section when this is necessary or desirable to permit cleaning, inspection, or repairs, and to make the superheater and front tube sheet B accessible. The inlet headers of the two sections are constructed and detachably connected as are the headers O.

Each economizer section comprises a box-like casing open at top and bottom and formed of front and rear plates P and Q, and inner and outer side wall plates S and T, these plates being secured together and provided with suitable stiffening flanges. The economizer sections rest on a frame work shown as comprising transverse beams U and U', and longitudinal beams W and W'. The front plate P is bolted at the top to a transverse beam member U^2 and at the bottom to the beam U. The front ends of the bare tube portions of the economizer elements L project through the front plate P, and at the rear end of each economizer section the bent portions of the bare tubes project through inclined slots Q' in the plate Q. The elements L are anchored in the wall Q by locking bars shown as angle bars X which may or may not normally be bolted or otherwise detachably secured at their ends to the locomotive structure. Horizontal plates Y between the outer sides of each economizer section and the adjacent side wall of the smoke box, and a plate Y' between the economizer sections, and an inclined plate Y^2 between the beam U' and the baffle H compel the heating gases issuing from the fire tubes C and I to enter the economizer casings at their lower ends in their passage upward to the smoke stack A'. The direction of flow of the heating gases through the economizer is the same whether the damper *h* is closed or opened. The plates Y and Y' are apertured for the passage of the steam pipes G and the exhaust nozzle pipe K.

To facilitate the bodily removal of either economizer section through the front end of the locomotive shell when necessary or desirable, the lower ends of the front casing plates P are notched as indicated at P' to clear skids or beams Z then extended for the purpose into the front end of the smoke box with their inserted ends resting on a transverse beam Z' incorporated in the locomotive structure. With the beams or skids Z in place, the economizer section to be removed may be slid out of the front end of the smoke box on the skids.

The described economizer construction is obviously simple, reliable, and effective, and so constructed, proportioned and arranged as to permit the economizer to be readily incorporated in a locomotive of standard construction notwithstanding the restricted space conditions and with but slight structural changes in the locomotive, and without interference with the normal operation of the locomotive.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a locomotive comprising fire tubes and a front tube sheet into which the front ends of the fire tubes are connected, and a smoke box in front of said tube sheet, the improvement which consists in a structural frame work extending across the lower portion of the smoke box, an economizer comprising a box-like casing open at top and bottom removably supported on said frame work, tubular elements located in said casing, and baffle provisions arranged to confine the flow of the heating gases issuing from the fire tubes through said casing.

2. In a locomotive comprising fire tubes and a front tube sheet into which the front ends of the fire tubes are connected, and a smoke box in front of said tube sheet, the improvement which consists in a structural frame work extending across the lower portion of the smoke box, an economizer comprising a box-like casing open at top and bottom removably supported on said frame work, tubular elements located in said casing, and baffle provisions arranged for closing all communication from the fire tubes through said smoke box except through the lower end of said casing.

3. In a locomotive comprising a smoke box at its front end, a smoke stack, fire tubes, and a vertical exhaust pipe centrally disposed in said smoke box, the improvement which consists in two economizer sections located in the smoke box one at each side of said pipe and each economizer section including horizontal tubular elements and a casing enclosing said elements and open at top and bottom, and baffles arranged to close all communication from the fire tubes to said stack except through said casings.

4. In a locomotive comprising a smoke box at its front end, a smoke stack, fire tubes, and a vertical exhaust pipe centrally disposed in said smoke box, the improvement which consists in two economizer sections located in the smoke box one at each side of said pipe and each economizer section including horizontal tubular elements and a casing enclosing said elements and open at

top and bottom, and baffles arranged to close all communication from the fire tubes to said stack except through said casings, said exhaust pipe extending above the upper ends of the economizer sections and carrying an exhaust nozzle at its upper end.

5. In a locomotive comprising a smoke box at its front end, a smoke stack, fire tubes, and a transverse baffle in front of the fire tubes for diverting the gases issuing from the fire tubes to the bottom of the smoke box, the improvement which consists in an economizer located in the smoke box and including U-tube elements the legs of which are parallel to the fire tubes and the yokes of which are at the rear of the economizer, an economizer casing open at top and bottom and comprising a rear wall apertured to receive said yoke portions and locking bars at the rear of said wall extending between the legs of the U-tubes.

6. In a locomotive comprising fire tubes and a front tube sheet into which the front ends of the fire tubes are connected, and a smoke box in front of said tube sheet, the improvement which consists in a structural frame work extending across the lower portion of the smoke box, an economizer comprising a box-like casing open at top and bottom removably supported on said frame work, U-tube elements having their legs parallel to the fire tubes and their yokes anchored in the rear wall of the casing, and their ends projecting through the front wall of the casing whereby the tube ends are accessible from the front of the locomotive.

7. In a locomotive comprising fire tubes and a front tube sheet into which the front ends of the fire tubes are connected, and a smoke box in front of said tube sheet, of a structural frame work extending across the lower portion of the smoke box, an economizer comprising a box-like casing open at top and bottom removably supported on said frame work, tubular elements located in said casing, and baffle provisions for causing the heating gases issuing from the fire tubes to pass into the lower end of said casing, said frame work comprising a portion adapted to support removable skids over which the economizer may be inserted in or removed from the locomotive through the front end of the latter, and the front wall of said casing being notched to clear said skids.

8. In a locomotive comprising fire tubes and a front tube sheet into which the front ends of the fire tubes are connected and a smoke box in front of said tube sheet containing a vertical exhaust pipe, the improvement which consists in a pair of economizer sections one at each side of said pipe and each economizer section comprising a longitudinal bank of tubular elements and a casing for said elements, inlet and outlet headers connected to said elements, each of said headers being detachably connected to the corresponding header of said other section, and baffle provisions connected to the lower part of said casings and arranged to close all communication from said fire tubes through said smoke box except through said casings.

9. In a locomotive smoke box, an economizer comprising a box-like casing, a plurality of tubular elements positioned in said casing, and baffles connected to said casing and arranged to prevent heating gases exiting from the smoke box except through said casing.

Signed at New York city, in the county of New York, and State of New York, this 13th day of March, A. D. 1925.

WALTER FRANCIS KEENAN, JR.