(No Model.)

W. CRAIG.

MEANS FOR PRODUCING CIRCULATION IN STEAM BOILERS.

No. 294,118. Patented Feb. 26, 1884.

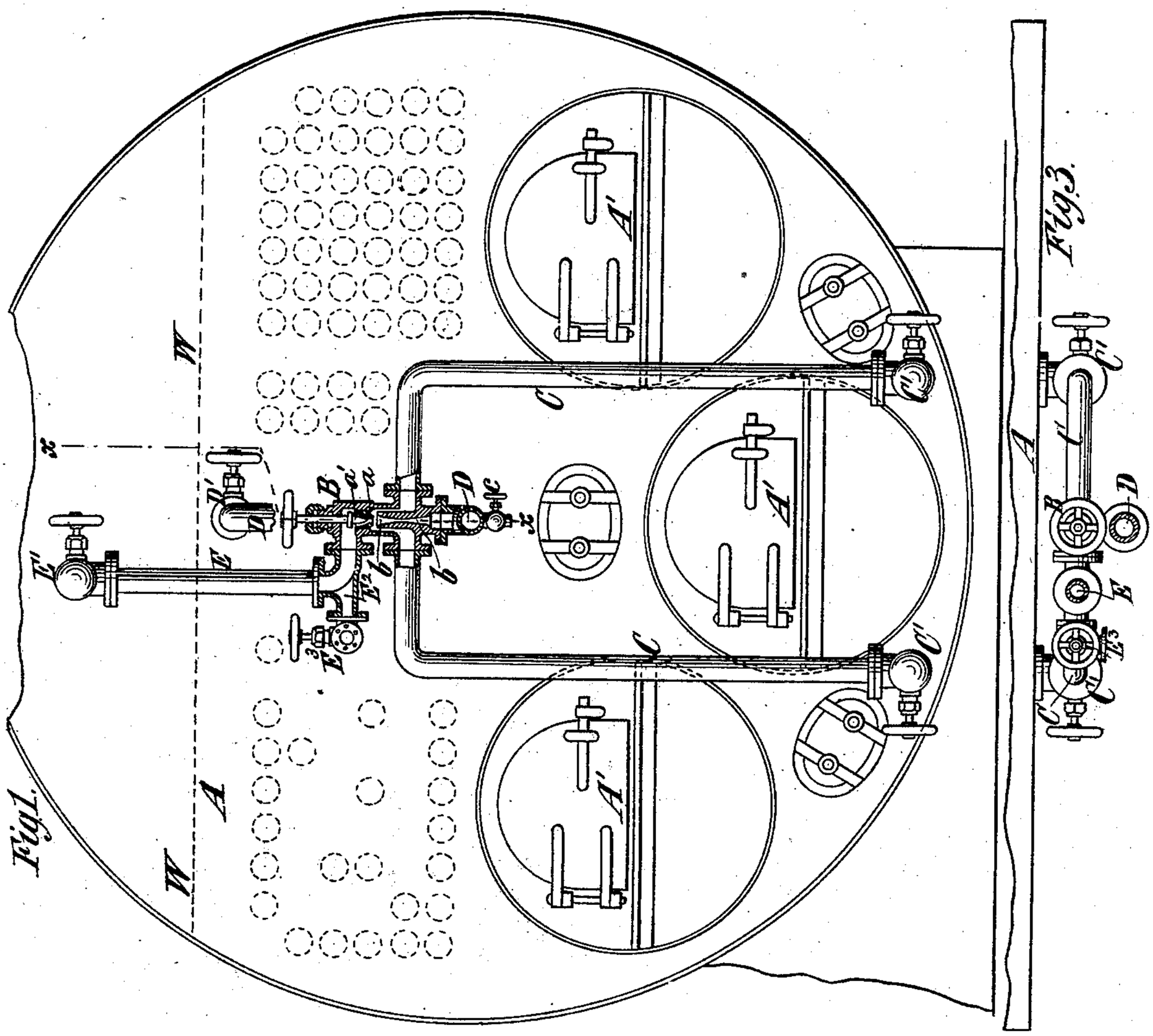

Fig. 1.

Fig. 3.

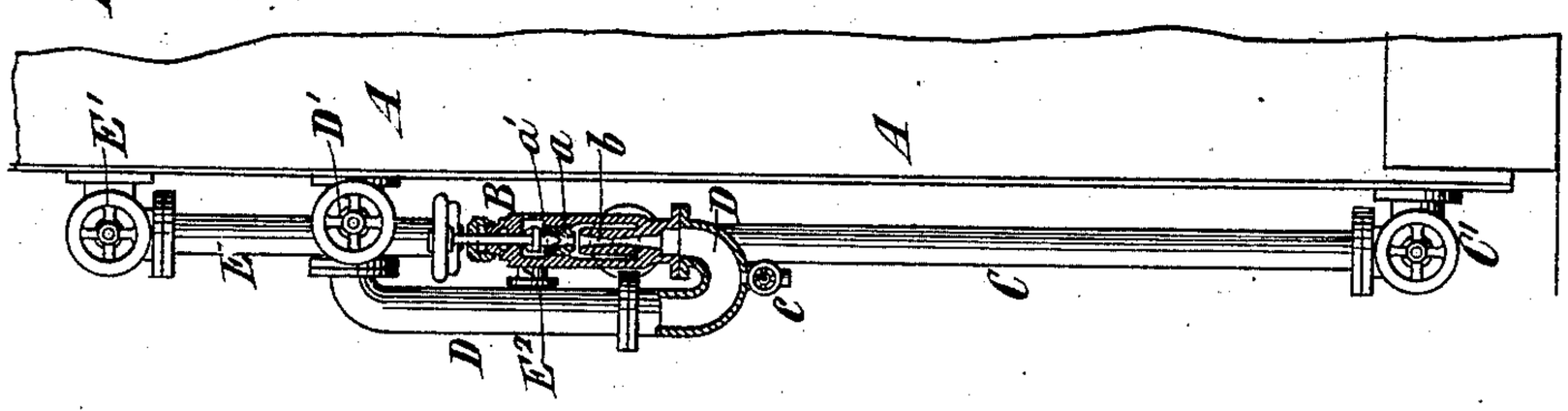

Fig. 2.

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WILLIAM CRAIG, OF BROOKLYN, NEW YORK.

MEANS FOR PRODUCING CIRCULATION IN STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 294,118, dated February 26, 1884.

Application filed December 14, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM CRAIG, of the city of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Means for Producing Circulation in Steam-Boilers, of which the following is a specification.

My invention is more particularly intended for marine boilers of large size, although it may be employed in connection with other boilers.

It is well known by marine engineers that in getting up steam in modern marine boilers of large size the water which is in the upper part of the boiler, and which is in contact with or above the upper parts of the furnaces and the tubes, becomes heated much more quickly than the water in the lower parts of the boiler. In some boilers if steam is got up quickly it will be found that the temperature in the upper part of the boiler will be even as high as 300° Fahrenheit, while at the bottom of the boiler it may be below fifty degrees. In fact, in most modern marine boilers the water will be comparatively cold at the bottom of the boiler for several hours after steam is got up and the engines are running. When such differences in temperature exist in the boiler, it is evident that the parts which are affected by the differences must be subjected to enormous strain and greatly weakened by reason of unequal expansion, and especially is this true of such parts as are most exposed to the heat of the fire—such as the furnaces, back connections, tubes, and tube-sheets. At any time but very little steam is generated below the grate-bars of the modern marine boiler, and the consequence is a very slow circulation and comparatively low temperature in the lower part of the boiler, and a rapid circulation and high temperature in the upper parts of the boiler; and it is undoubtedly a fact that boilers are greatly weakened and their life shortened by such constant and considerable differences of temperature. Large steamships have a number of large boilers—sometimes ten or more—and it is obvious that the quantity of water to be moved to produce an effective circulation in them all, especially in getting up steam, is very great, while at the same time the room available for means to produce an outside circulation from the lower to the upper parts of the boiler is limited.

The object of my invention is to provide a means which shall be more effective than any heretofore used in producing the necessary circulation, which shall occupy but little room, and which may be applied to boilers at a comparatively small cost.

To this end my invention consists, essentially, in the combination, with a steam-boiler, of an injector, a suction or supply pipe leading from the lower portion of the boiler to the water-inlet of the injector, and a discharge-pipe leading from the injector to the upper portion of the boiler, whereby the injector will serve to circulate the water from the lower part to the upper part of the boiler, and will be made to work under almost an equilibrium of pressure—that is to say, the pressure on the suction or supply pipe will be nearly as great as the pressure against which the water is to be forced by the injector. The injector may have only a single suction or supply pipe; but I prefer to provide two or more suction or supply pipes leading from the lower portion of the boiler at different parts thereof to the water-inlet of the injector, and each provided with a valve, whereby the passage through it may be controlled, thus providing for increasing or diminishing the quantity of water taken through either suction or supply pipe, as the temperature of water on one side or the other of the boiler may be greater or less.

In the accompanying drawings, Figure 1 is a front elevation of a boiler having my invention applied to it, the discharge-pipe of the injector being broken away or removed to expose the injector behind it, and the injector being in section. Fig. 2 is a vertical section on the line *x x*, Fig. 1, showing the front end portion of the boiler; and Fig. 3 is a plan of the parts embodying my invention and a portion of the extreme front of the boiler.

Similar letters of reference designate corresponding parts in all the figures.

A designates the boiler, which is shown as having three furnaces, A′, and at the front of which the injector B is placed. The injector and its connections may be placed in any other position; but when at the front of the

boiler it is within reach of the fireman or engineer, and is therefore more convenient of access. The injector may be of any well-known type. As here shown, the injector B is connected by two pipes, C C, with the lower part of the boiler at opposite sides of and below the lowermost furnace, A′, and in these pipes are valves C′, whereby the passage of water from the lower part of the boiler upward to the injector can be controlled.

D designates the discharge-pipe, which, as here shown, extends from the lower end of the injector and then upward, as shown in Fig. 2, in front of the injector and into the boiler. This discharge-pipe enters the boiler a short distance below the water-line, which is represented by the dotted line W, and is broken away or partly removed in Fig. 1 in order to show the injector, which is behind it. The pipe D is provided with a valve, D′, whereby the entrance of water into the upper part of the boiler may be controlled. The pipe D might enter the boiler above the water-line, if desired.

E designates a steam-pipe leading from the main steam-space of the boiler, and provided with a stop-valve, E′; and E^2 designates a branch steam-inlet, which is provided with a valve, E^3, and with which is to be connected a pipe extending from the donkey-boiler usually used on steam-ships, and which is not here shown. The steam enters the injector through the nozzle or orifice *a*, under control of the usual valve, *a′;* and *b* designates the passage through which the steam and the current of water induced thereby pass downward to the discharge D and thence into the boiler. At the bottom of the bend in the discharge-pipe D is the usual overflow or try-cock, *c*. When the fires are first lighted in the boiler, and before steam is generated, the steam for operating the injector is taken from the donkey-boiler through the branch steam-inlet E^2. The donkey-boiler, as commonly used, is employed for supplying steam to hoisting-engines; but by the time the fires are started in the main boilers the hoisting of cargo is generally about completed, and consequently the donkey-boiler will furnish an ample supply of steam for the injectors on the several boilers, at least one being applied to each boiler. The valve E^3 being opened and the valve *a′* properly adjusted, the steam issues from the orifice *a* into the passage *b*, and induces a current through the suction-pipes C and through the discharge-pipe into the upper part of the boiler. This circulation is continued until steam of sufficient pressure to work the injector is generated in the main boiler, whereupon the valve E^3 is closed and the valve E′ opened, and thereafter the steam for operating the injector is taken from the main boiler. By the operation of the injector a rapid circulation is kept up, and any considerable differences in temperature in different parts of the boiler are prevented. The injector may be kept in operation as long as desired, and the fireman or engineer, by adjusting valves C′, can increase or diminish the quantity of water taken from either side of the boiler, as may be necessary to preserve a temperature as nearly uniform as possible. But a single pipe, C, may be used to connect the lower part of the injector with the boiler.

It will be observed that no matter how great the pressure in the boiler, the injector is operated nearly in equilibrium, and hence but a comparatively small quantity of steam will be used; and even this steam, or the heat given off by its condensation, all enters the boiler through the pipe D.

From the above description it will be seen that I provide a means which will be effective in circulating the water in the largest boiler, which may be applied at comparatively a small cost, and which will occupy little space.

The apparatus is preferably entirely supported from the boiler, and from Figs. 2 and 3 it will be seen how slightly it projects beyond the front of the boiler when it is arranged in that position.

In a steamship I intend to provide each of the main boilers with an injector, combined with the boiler as herein described, and when the fires are started the injectors will all be supplied with steam from the donkey-boiler.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with a steam-boiler, of an injector, a suction or supply pipe leading from the lower part of the boiler to the water-inlet of the injector, and a discharge-pipe leading from the injector to the upper part of the boiler, whereby water taken by the injector from the lower part of the boiler will be delivered into the upper part thereof, and an outside circulation of the water in the boiler will be produced, substantially as described, and for the purpose set forth.

2. The combination, with a steam-boiler, of an injector, two suction or supply pipes provided with valves and leading from the lower part of the boiler at opposite sides thereof to the water-inlet of the injector, and a discharge-pipe leading from the injector to the upper part of the boiler, whereby provision is afforded for circulating the water in the boiler and for varying the quantity of water supplied to the injector from different parts of the boiler, substantially as herein described.

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Witnesses:
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