No. 690,426. Patented Jan. 7, 1902.

G. E. HESSE.

BOILER FOR ENGINES.

(Application filed Nov. 28, 1900. Renewed July 10, 1901.)

(No Model.) 2 Sheets—Sheet 1.

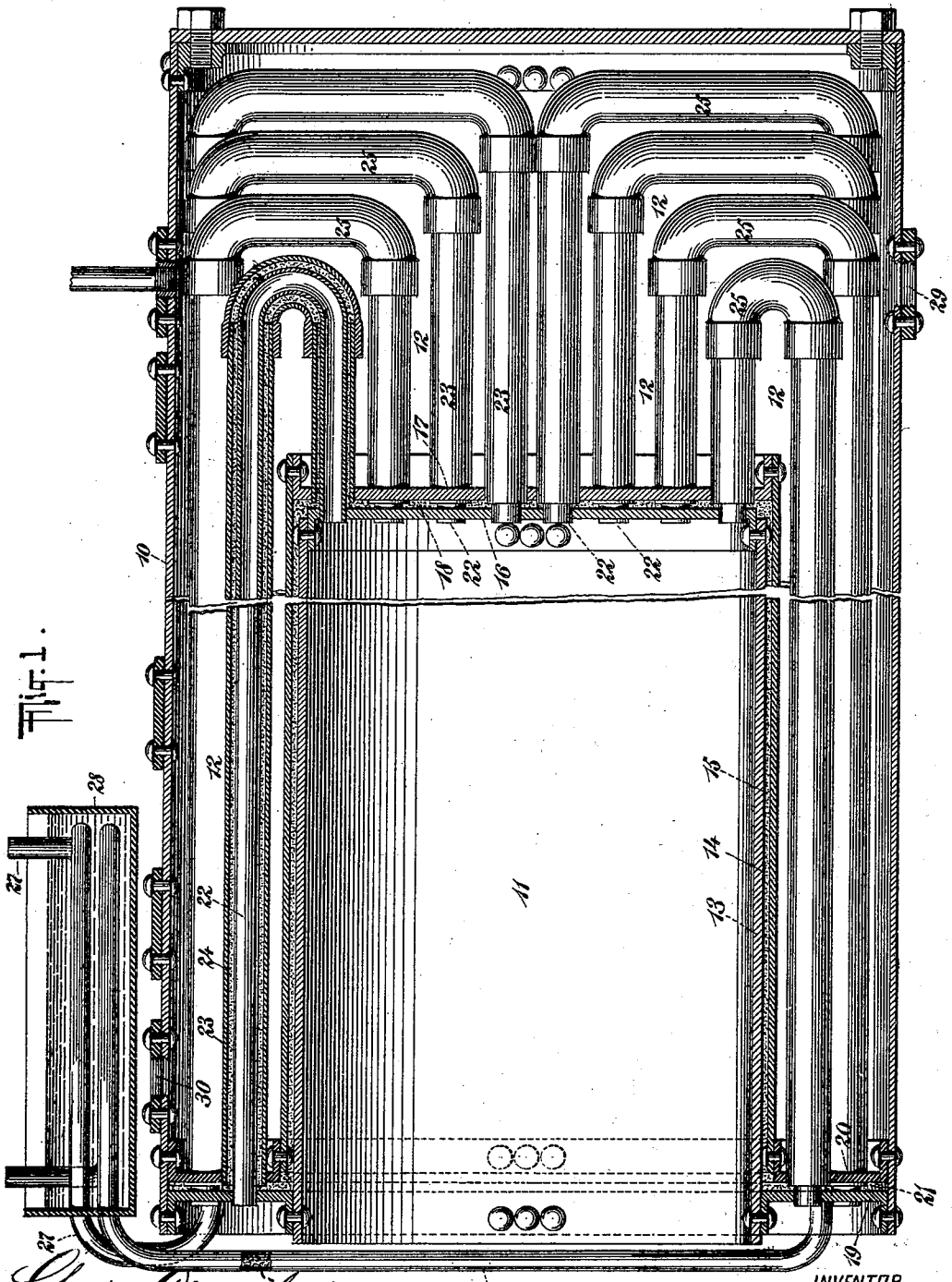

Fig. 1.

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Fig. 2.

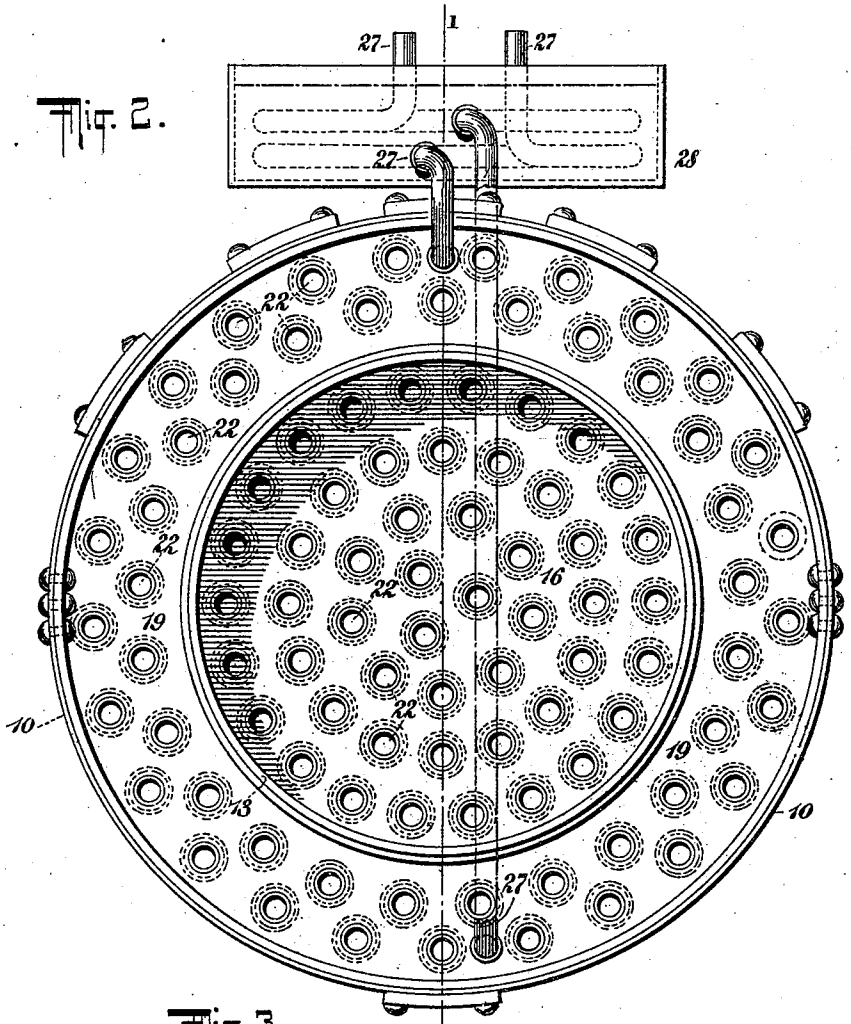
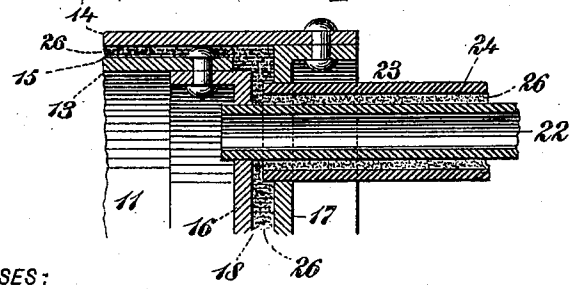


Fig. 3.



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UNITED STATES PATENT OFFICE.

GUSTAF EMIL HESSE, OF BROOKLYN, NEW YORK, ASSIGNOR OF TWO-THIRDS TO ANSEL L. WASHBURNE, OF NEW YORK, N. Y.

BOILER FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 690,426, dated January 7, 1902.

Application filed November 28, 1900. Renewed July 10, 1901. Serial No. 67,810. (No model.)

To all whom it may concern:

Be it known that I, GUSTAF EMIL HESSE, a subject of the King of Sweden and Norway, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Boilers for Engines, of which the following is a specification.

The invention relates to improvements in boilers for engines; and it consists in the novel features, structure, and combinations hereinafter described, and particularly pointed out in the claims.

One of the main objects of my invention is to provide a boiler (for air or steam) which may be given the proper temperature for heating the air or creating the steam and in which the proper temperature cannot be exceeded, and to this end I produce a boiler in which the tubes and the plates about the fire-box are covered at their outer surfaces with a metal or other suitable substance capable of melting at a low degree of heat—such, for instance, as zinc, which melts at 360° centigrade or, if a higher degree is desired, antimony, which melts at 432° centigrade, this latter degree being considered a safe limit, since red heat corresponds with about 525° centigrade. The said surrounding or covering metal is confined by making said tubes and said plates double or each of two separated layers or thicknesses, between which the said metal will be introduced, and the spaces containing said metal will be communicating, so that said metal will be, in effect, a continuous body, which exterior to the boiler will be extended through a pipe or otherwise to a cooling-tank or other cooling medium, whereby a part of said body of metal will under all circumstances be kept in a solid state, this condition being important, since so long as a part of said body of metal is kept cool or in an unmelted state that portion of the metal covering the tubes and plates will not reach a higher temperature than the one at which it melts. Thus in the employment of my invention the proper temperature in the boiler may be attained but not exceeded, the excess of high temperature being prevented by the melting of the covering metal and this metal being prevented from acquiring a temperature above the one at which it melts.

My invention and satisfactory means for carrying the same into effect are described in detail hereinafter and are illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical longitudinal section of a boiler constructed in accordance with and embodying my invention, the section being on the dotted line 1 1 of Fig. 2. Fig. 2 is an end view of same looking into the fire-box; and Fig. 3 is a central longitudinal section, on an enlarged scale, through a portion of the boiler, this figure being presented to more clearly disclose the protecting metal confined between the double tubes and plates, said section being on the same dotted line as that on which the section of Fig. 1 is taken.

In the drawings, 10 designates the exterior shell or casing of the boiler, 11 the fire box or chamber, and 12 the series of boiler-tubes.

The fire-box 11 is formed of the inner and outer shells 13 and 14, between which is formed the space 15, and at its inner end the said fire box or chamber 11 has formed between the inner and outer heads 16 17 the space 18, which, as shown in Fig. 1, communicates entirely around the shell 13 with the space 15, encompassing the same. The outer head 17 is riveted to the outer shell or plate 14, while the inner head 16 is riveted to the inner shell or plate 13. At its left-hand end the shell or plate 13 is secured to the ring 19, and at its left-hand end the outer shell or plate 14 is secured to the ring 20, these rings substantially corresponding with one another and extending around the left-hand end of the fire box or chamber 11 and being at their outer edges riveted to the outer or main shell 10. The rings 19 and 20 are separated from one another, so as to form a space 21 between them, this space extending entirely around the left-hand end of the fire box or chamber and being in direct communication with the space 15, intermediate the inner and outer shells 13 14. Thus in respect of the fire box or chamber 11 it will be seen that the inner shell 13, outlining said fire box or chamber, is surrounded by a chamber. (Represented by the spaces 15, 18, and 21.)

The boiler-tubes 12 are each formed of the inner tube 22 and the outer tube 23, the tube 22 being within the tube 23 and a space 24 being formed between said tubes. The tubes 12 substantially correspond with one another except in the matter of their length, and said tubes extend from the left-hand end of the boiler to a position adjacent to the right-hand end of the same and thence extend toward the left-hand end of the boiler and engage the plates at the right-hand end of the fire box or chamber 11. The inner tubes 22 are the tubes through which the products of combustion will pass, and these tubes 22 are at the left-hand end secured in the apertures formed in the ring 19 according to well-known methods, as shown in Fig. 1, while at their other end said tubes 22 are secured within apertures in the end plate or head 16 at the right-hand of the fire box or chamber 11, as shown in Fig. 1. The tubes 23, which inclose the tubes 22, are secured at their left-hand end in apertures formed in the ring 20, while at their other end they are secured in apertures formed in the outer head or plate 17 at the right-hand end of the fire box or chamber 11, and in view of this construction the spaces 24 intermediate the tubes 22 and 23 open at their left-hand end into the space 21 between the rings 19 and 20, while at the right-hand end of said tubes the spaces 24 open into the space 18 intermediate the heads 16 and 17 at the right-hand end of the fire-box. It will thus be seen that the spaces 24 intermediate the tubes 22 and 23 are in direct communication with the space or chamber which surrounds the shell 13, forming or outlining the fire box or chamber. The tubes 12 at their right-hand portions have the bends, (numbered 25,) which vary in length in accordance with the distance the right-hand portions of the tubes are compelled to extend in order to properly reach the right-hand end of the fire box or chamber 11, and the bending of the tube in the manner indicated in Fig. 1 affords extra heating-surface and also provides a means whereby expansion and contraction may take place in the tubes without affecting the joints formed at the ends thereof with the heads 16 and 17 and ring-plates 19 and 20.

The chamber formed by the spaces 15, 18, 21, and 24 intermediate the boiler plates and tubes is filled with a metal such as zinc or antimony or other suitable substance capable of melting at a low degree of heat, said substance being designated by the numeral 26, and the said chamber containing a metal or other suitable substance 26 is at the ring-plate 19 in communication with pipes 27, which are also filled with the said metal or substance 26 and at their ends are within a tank 28 of water or other cooling medium. The metal or substance 26 thus entirely fills the chamber formed by the spaces 15, 18, 21, and 24 and extends through the pipes 27, filling the latter, so that the metal in said pipes 27 and in said chamber formed by the said spaces 15, 18, 21, and 24 may be in one continuous body. The object of the tank 28 containing the cooling medium is to at all times keep in an unmelted state that portion of the body of the metal 26 which may be within the pipes 27 or that portion thereof subject to the influence of the cooling medium in said tank 28, it being the purpose of my invention that a part of the said body of metal 26 shall at all times be kept cooled and in an unmelted state.

The boiler shown in the drawings is intended mainly for receiving cold air and heating the same preparatory to the passage of the heated air into the cylinder of the engine (not shown) for driving the latter in accordance with well-known principles. Every stroke of the power-piston of the engine will cause a supply of cool air to enter the boiler through the aperture 29, Fig. 1, and this air will become properly heated by its circulation over the exterior walls of the tubes 12 and plates surrounding the fire box or chamber 11, and the heated air will then pass out through any suitable connection from the boiler through the aperture 30, which is specially provided to receive the usual connection leading from the boiler to the engine. When steam is to be the motive power, a small pump will be used, according to well-known principles, to pump in the exact amount of water to the boiler, this water being converted into steam by its contact with the exterior walls of the tubes 12 and plates or shells surrounding the fire box or chamber 11. The present application is not limited to any special construction of engine or appliance for handling either the air, water, steam, or gas, nor is the present invention limited to any special construction of boiler, various forms and constructions of which may be made to embody the present invention, which consists more especially in the employment between the double walls of the boiler plates and tubes of the metal 26, capable of melting at a suitably low degree of heat and connected with a body of like metal exterior to the fire-box in an unmelted state, so that while the proper temperature in the boiler may be attained said temperature cannot be exceeded, owing to the melting of that portion of the metal 26 surrounding the heated plates and tubes, and the prevention of said metal at said points reaching a higher degree than that at which it melts, owing to its connection with a body of like material kept in a cool or unmelted state.

The boiler shown in the drawings while, therefore, of a desirable and highly efficient construction for carrying the present invention into effect is not the only embodiment of my invention to be produced. The operation of the boiler shown in the accompanying drawings will be understood from the foregoing description, since the treatment of the

air or steam with the use of the said boiler involves known principles applicable to engines.

When the chamber formed by the spaces 15, 18, 21, and 24 is filled with the metal 26, one part of which is kept in an unmelted state, the proper degree of heat in the boiler may be secured; but any excessive heat will result in the melting of said metal 26 around the fire box or chamber 11 and tubes 22, and this then melted metal 26 will be prevented from exceeding the degree at which the melting took place by its direct union with a solid part of the metal within the pipes 27, and hence since the melted metal surrounding the fire box or chamber 11 and tubes 22 is prevented from reaching an unsafe degree of heat it will be evident that the temperature of the boiler must necessarily be preserved from exceeding a safe limit or degree of heat, the presence of the metal being a constant and automatic safeguard against any excessive heat in the boiler without preventing the boiler from attaining the proper degree of heat for the operation of the engine. In the drawings I illustrate two of the pipes 27, leading to the cooling-tank 28, because of the extended area of the chamber formed by the spaces 15, 18, 21, and 24; but in instances where the chamber containing the metal 26 is of smaller area one pipe 27, leading to a cooling-tank, will be sufficient for the purposes of my invention.

It will be seen that the invention does not consist in having the metal capable of melting at a low degree of heat surrounding the tubes or plates of a boiler, but in not only thus providing such metal, but having the same in communication with a body of metal kept in a solid state, so as to prevent the protecting metal from attaining a higher degree of heat than that at which it melts. The invention is not confined to the protecting of any special part or parts of the boiler or tubes, but is broad and generic and is intended to be claimed herein as applied to the protection of any part of the boiler or tubes or other plates or devices requiring its employment.

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

1. A boiler having surfaces exposed to the action of the heat, and a metal or suitable substance capable of melting at a comparatively low temperature confined against the same for controlling the temperature said surfaces may attain, a portion of said metal or substance being extended beyond said heating-surfaces, combined with means for keeping a part of said metal or substance extended beyond said heating-surfaces in a solid state; substantially as set forth.

2. A boiler having heating-surfaces, and a metal or suitable substance capable of melting at a comparatively low temperature confined against the same for controlling the temperature said surfaces may attain, combined with means for preventing said metal or substance from reaching a temperature materially greater than that at which it melts; substantially as set forth.

3. A boiler having the double tubes, one tube being within but separated by a space from the outer tube, and a metal or suitable substance capable of melting at a comparatively low temperature confined within said space between the inner and outer tubes, a portion of said metal or substance being extended beyond said space, combined with means for keeping a part of said metal or substance thus extended beyond said space in a solid state; substantially as set forth.

4. A boiler having the double tubes, one tube being within but separated by a space from the outer tube, and a metal or suitable substance capable of melting at a comparatively low temperature confined within said space between the inner and outer tubes, combined with means for preventing said metal or substance from reaching a temperature materially greater than that at which it melts; substantially as set forth.

5. A boiler having tubes and a fire box or chamber, the walls of said fire box or chamber being double or of two thicknesses separated by a surrounding space, and a metal or suitable substance capable of melting at a comparatively low temperature confined within said space, a connecting portion of said metal or substance being extended beyond said space, combined with means for keeping a part of said metal or substance thus extended beyond said heating-surfaces in a solid state; substantially as set forth.

6. A boiler having surfaces exposed to the action of the heat, and a metal or suitable substance capable of melting at a comparatively low temperature confined against the same for controlling the temperature said surfaces may attain, combined with a cooling-tank, and a pipe containing a body of said metal or substance and extending from said cooling-tank to the said confined portion of said metal or substance protecting said surfaces; substantially as set forth.

7. A metal plate, and means for applying heat to the same, combined with a body of metal capable of melting at a comparatively low degree of heat confined against said plate and extended outward therefrom, and a cooling medium to act on said extended part of said body of metal so as to keep said part solid and thereby control the temperature of the remaining part of said body and of said plate; substantially as set forth.

8. The boiler having the fire-chamber 11, the exterior shell 10, the series of tubes 12 encircling said chamber 11 and having the bends 25, and the rings 19 and 20, intermediate the shell of said chamber and said shell 10, said tubes 12 being formed of the inner and outer tubes 22, 23 separated by the space 24, the latter opening into the space between said rings 19 and 20, combined with a metal capable of melting at a comparatively low

degree of heat confined within the space between said tubes 22 and 23 and communicating with the space between said rings 19 and 20, a pipe leading from said space between said rings 19 and 20 and containing a part of the body of said metal which surrounds the inner tube 22, and means for keeping said metal in said pipe in a solid state; substantially as set forth.

9. A boiler, comprising the exterior shell 10, the fire box or chamber 11, the separated plates or shells 13 and 14 surrounding said fire box or chamber, the heads 16 and 17 at the end of said fire box or chamber and separated by a space, the rings 19 and 20 separated by space and connecting the end of the shell 10 with the end of the shells 13 and 14, and the double tubes 22, 23 separated by space, the tubes 22 extending through the ring 19 and head 16 and the tubes 23 extending through the ring 20 and head 17 so that said space between said tubes may communicate with the space between the rings 19, 20, and the space between the heads 16, 17, combined with a metal capable of melting at a comparatively low degree of heat filling the space between the shells 13, 14, heads 16, 17, rings 19, 20, and tubes 22, 23, the cooling-tank, and a pipe leading from the confined body of said metal to said cooling-tank and being itself filled with said metal, so that a portion of said metal may be maintained in a solid state; substantially as set forth.

10. A boiler, comprising the exterior shell, the fire box or chamber 11 and the series of double tubes 12, each of said double tubes being composed of the inner tube 22 and the outer tube 23 separated by a space 24, and said tubes having the bends 25 so as to allow for expansion and contraction, combined with a metal capable of melting at a comparatively low degree of heat intermediate said tubes 22, 23, and a portion of the body of which is extended beyond said tubes, and a cooling medium for maintaining in a solid state a part of the said body of metal thus extended beyond said tubes; substantially as set forth.

11. A boiler comprising the shell, fire-box and double tubes, one tube 22 being within the outer tube 23 and separated therefrom to form a space surrounding the inner tube, and said boiler at its ends having confined spaces in communication with the spaces surrounding said inner tubes, combined with a metal capable of melting at a comparatively low temperature filling said spaces, and means for preventing said metal from reaching a temperature substantially greater than that at which it melts; substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

GUSTAF EMIL HESSE.

Witnesses:

CHAS. C. GILL,

GUNDER GUNDERSON.