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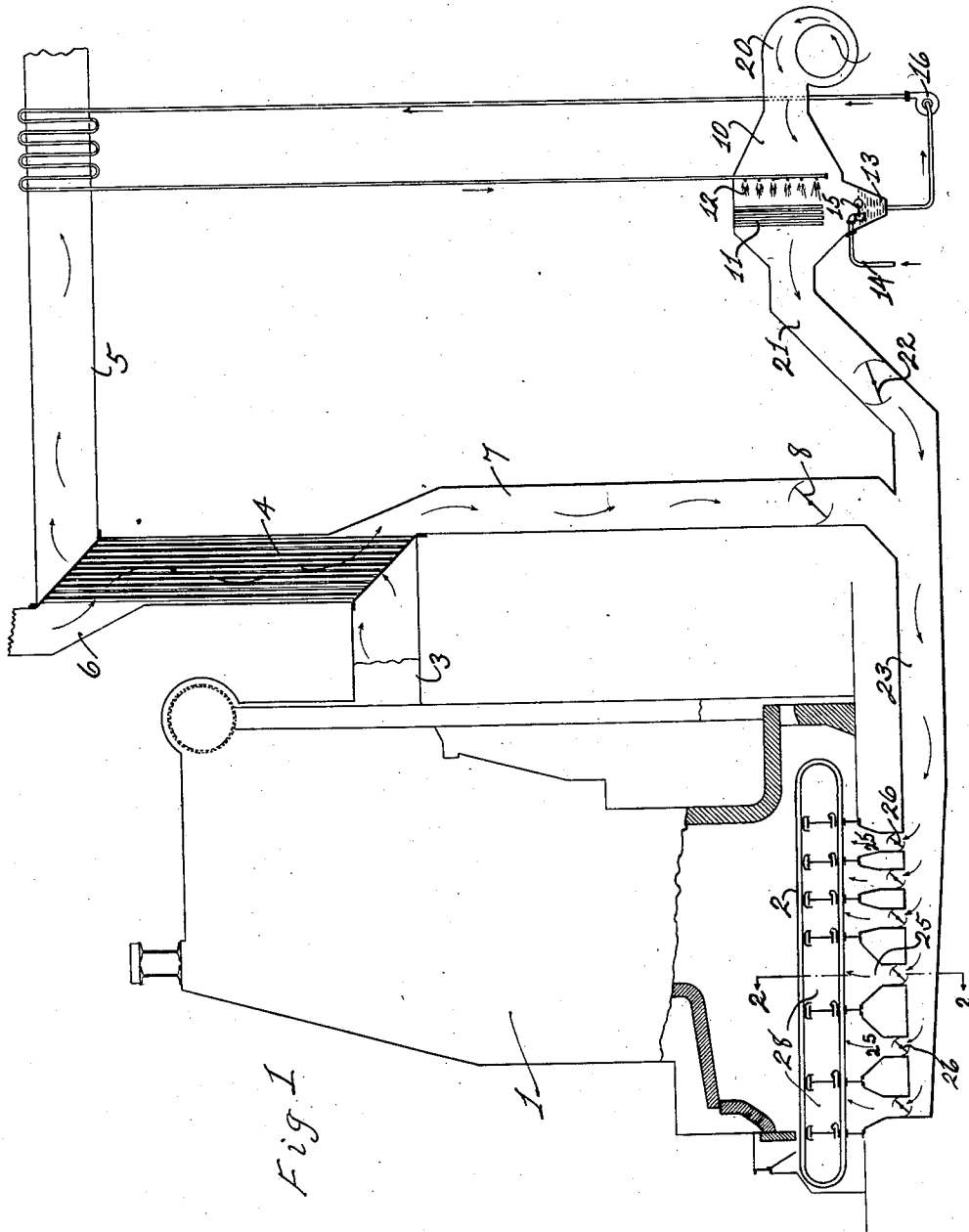
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STEAM BOILER AND PROCESS OF FIRING IT

Filed Dec. 10, 1927

2 Sheets-Sheet 1



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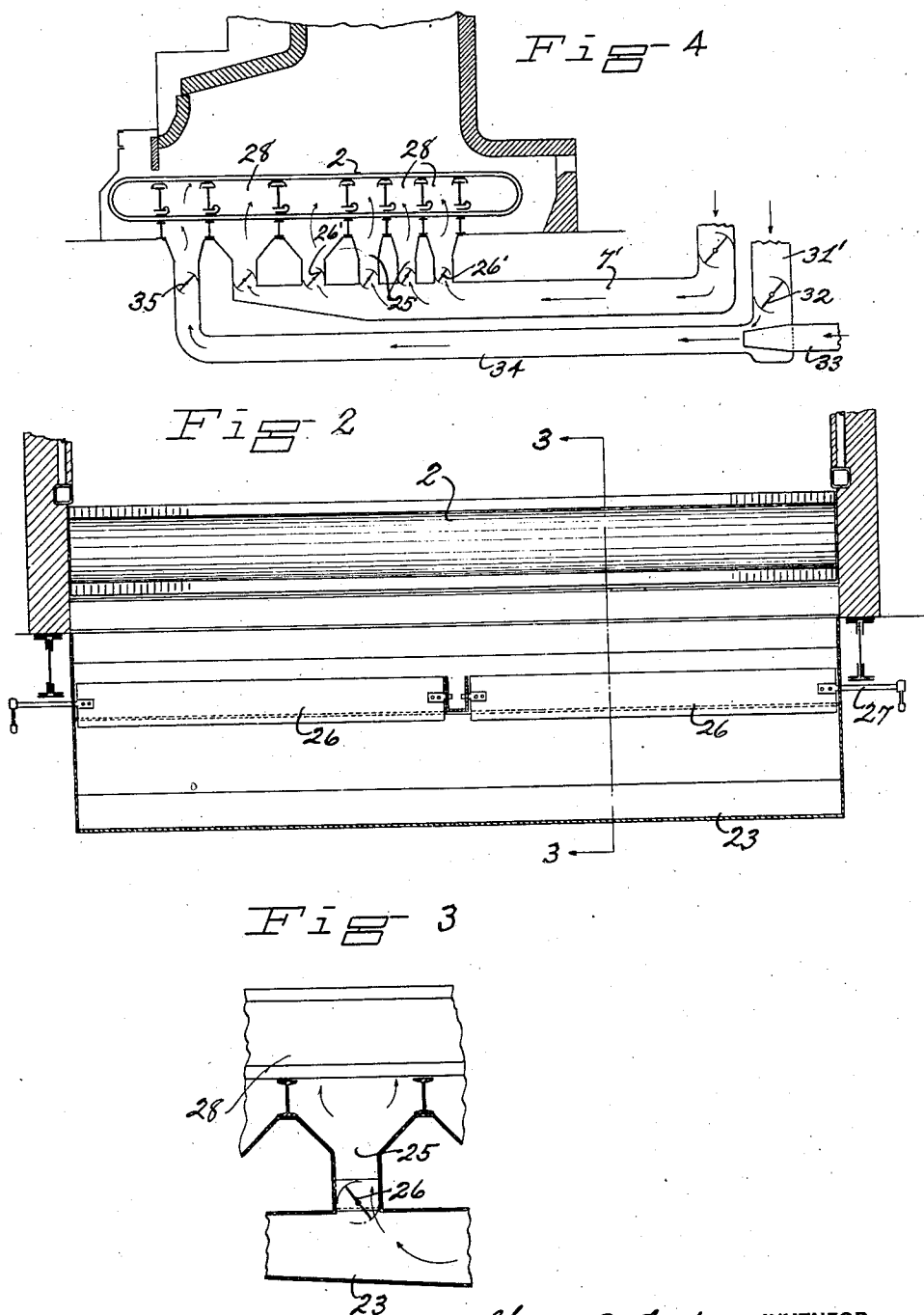
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UNITED STATES PATENT OFFICE

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STEAM BOILER AND PROCESS OF FIRING IT

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This invention relates to a steam boiler that is provided with a mechanical stoker and to the process of firing the boiler so that it can be operated at high ratings without overheating the stoker and especially with heated air. The invention will be understood from the description in connection with the accompanying drawings, in which Fig. 1 is a vertical section showing somewhat diagrammatically an illustrative embodiment of the invention; Fig. 2 is a section on an enlarged scale along the line 2—2 of Fig. 1; Fig. 3 is a section along the line 3—3 of Fig. 2 and Fig. 4 is a vertical section, partly broken away, illustrating a modification.

In the drawings, reference character 1 indicates the furnace of a boiler that is provided with a chain grate stoker 2. The exit for waste gases is shown at 3 and leads to an air heater 4 from which a conduit 5 leads to the stack. The cold air enters the air heater 4 at 6, and heated air passes out through a conduit 7 that is provided with a damper 8. A humidifier 10 for air is provided, and heat in the waste products of combustion leaving the air heater 4 is utilized for heating water to humidify the air in the humidifier. The humidifier is provided with a separator 11 to remove unvaporized drops of water from the sprays 12. The heat for vaporization is derived from flue gases, and in the form shown these gases heat the water to be sprayed into the air. A sump 13 is provided in the lower portion of the humidifier, and water is fed to the sump 13 through the pipe 14 with a float valve 15 for keeping the proper water level therein and to replace the evaporated water. A pump 16 forces water from the sump 13 through the heating coil 17 located in the waste gas conduit 5.

A fan or blower 20 forces air into the humidifier where it becomes saturated with moisture at an elevated temperature and this fixes the weight of water vapor carried. The heated saturated air passes through the outlet 21 that is provided with a damper 22 and joins the hot air from the outlet 7, and the mixture passes through the conduit 23 into the spaces below the stoker 2. Adjust-

ment of relative position of dampers 8 and 22 determines the temperature of the air delivered to the stoker and also the amount of water vapor carried by that air. This adjustment also determines what part of the boiler waste heat is utilized for raising the temperature of the air and what part for vaporizing water. A plurality of branches 25, each provided with a valve 26, leads from the conduit 23 to the compartments 28 of the chain grate stoker. The compartments 28 are provided in a well known manner to divide the space under the chain grate stoker into sections, and the amount of air admitted to each section can be regulated by means of the dampers 26.

In the modification shown in Fig. 4, air of one condition as to humidity and temperature is admitted through the conduit 7' and passes through branches 25' that are provided with dampers 26', into some of the compartments 28 of the chain grate stoker. Air that contains more moisture obtained from a humidifier is delivered through the injector nozzle 33 and draws in air of less humidity from conduit 31' producing a mixture in conduit 34 of higher humidity for one of the stoker compartments than is supplied through conduit 7' to the others. The air supplied to 7' and 33 may be the same as, for example, that from the air heater, or it may be different as to temperature and moisture. It may be supplied from another humidifier.

In the modification shown in Fig. 4, the humidified air is indicated as being led to the first compartment of the series of compartments 28, but the conduits and dampers may be arranged to give a different distribution.

The operation is as follows: The dampers 8 and 22 are regulated, so that air with the desired amount of moisture and temperature therein is admitted to all the compartments 28, or, in the modification shown in Fig. 4, a division may be made so that air with more moisture may be admitted to one or more of the compartments. The invention is especially useful for controlling the temperature of the structure of chain grate stokers under

very hot furnaces and especially when using preheated air. The presence of the moisture in the air causes the formation of water gas when this moisture strikes the lower layers of highly heated coal bed nearest to the metal parts, and the endothermic reaction with the coke that results absorbs heat and lowers the temperature of this zone and the metal parts beneath it. The water gas thus produced undergoes combustion within the furnace so that the heat is not lost. Without this temperature control of the metal parts of the stoker the allowable air temperature cannot be high enough to give the best possible efficiency to the boiler unit by return of its waste heat, and with my invention it is possible to use hotter air than would otherwise be safe and thereby get higher boiler plant efficiencies.

I claim:

1. The hereindescribed method of operating a stoker fire furnace, which includes the steps of introducing through the stoker, and distributing throughout the area of incandescence adjacent the stoker, an air mixture humidified only to the required degree for producing an endothermic reaction forming water gas and cooling the hotter portion of the stoker area, and consuming the water gas.
2. The hereindescribed method of operating a stoker fired furnace which includes the steps of introducing through the stoker and distributing throughout the area of incandescence adjacent the stoker a mixture of heated, and relatively unheated humidified air combined in proportions to preserve only the requisite degree of humidification for producing an endothermic reaction forming water gas and cooling the hotter portion of the stoker area, and consuming the water gas.
3. In combination with a furnace and stoker, an air heater supplying some air to the incandescent area adjacent the stoker, a humidifying air supply means also supplying air to the aforesaid area, and means regulating the air supplies to retain only the requisite humidity to produce an endothermic reaction producing water gas at the aforesaid incandescent area to cool the hotter portion of the stoker.
4. The hereindescribed method of operating an endless chain grate stoker fired furnace with high temperatures therein, which includes the steps of introducing through the stoker, and distributing throughout the area of incandescence of the fuel bed adjacent the feed end of the stoker, a preheated air mixture humidified to the degree required for producing an endothermic reaction forming water gas and thereby limiting the temperature of the adjacent portion of the fuel bed and cooling the adjacent portion of the stoker, and consuming the water gas so formed in the furnace.

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