

E. H. FOSTER.
SUPERHEATER.
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1,357,493.

Patented Nov. 2, 1920.

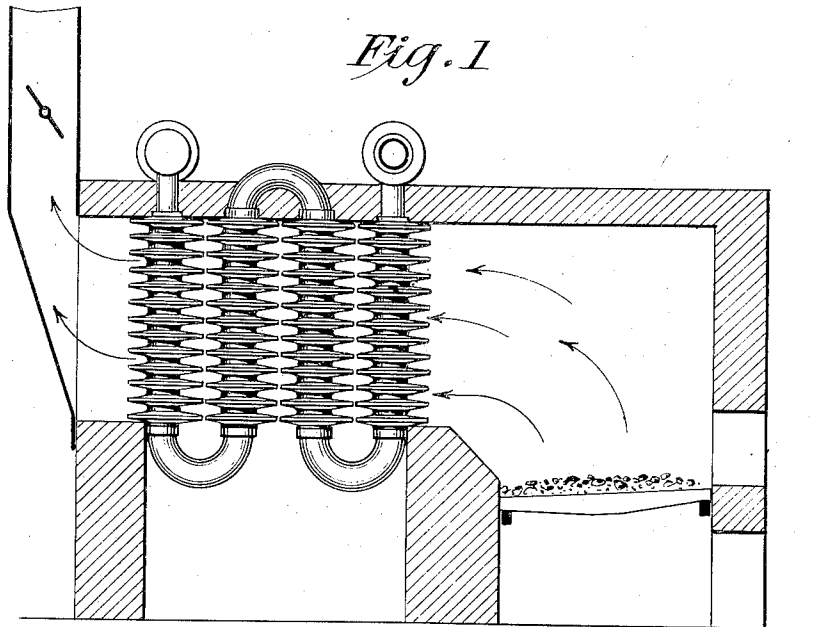


Fig. 2

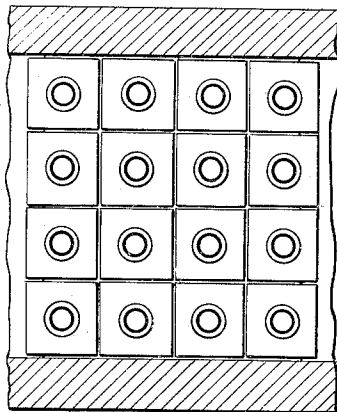


Fig. 3

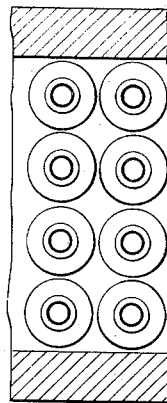
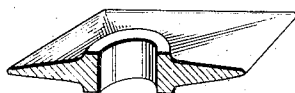


Fig. 4



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UNITED STATES PATENT OFFICE.

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SUPERHEATER.

1,357,493.

Specification of Letters Patent.

Patented Nov. 2, 1920.

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To all whom it may concern:

Be it known that I, ERNEST H. FOSTER, a citizen of the United States, residing at Dongan Hills, Richmond, county and State of New York, have invented certain new and useful Improvements in Superheaters, of which the following is a full, clear, and exact description.

What is now commonly known in the trade as the Foster superheater is distinguished by wrought steel tubes or elements, the parallel portions of which are surrounded by envelops of cast iron rings which form a corrugated heating surface. It has been found that the life of the superheater is thus very greatly prolonged, as the cast iron envelop is much better adapted to resist the destructive effects of the hot gases passing over the device than the steel tubes, while the metallic heating surface is greatly enlarged in a superheater of given size, and the transfer of heat to the steam thus largely increased.

One outstanding condition peculiar to steam superheaters is best appreciated when considering that, by means of a superheater, heat from furnace gases is transferred to steam, the transfer taking place through the wall of a metal tube, while the rate of flow of heat from metal to steam is much greater than from furnace gases to metal, based upon an equality of surface exposed to the steam and to the furnace gases. It, therefore, becomes the object of the superheater designer to increase the surface exposed to the furnace gases over that exposed to the steam. This has led to increasing the diameter of the cast iron rings or circular gills which surround the inner tubes. But this plan while affording an increased heating surface per lineal foot of element presents, at least, two somewhat serious objections,—the increased cost of making such castings in the foundry, and the greater space required for such a construction, due to the greater center to center distance required between the superheater elements.

After laborious and extended efforts to overcome these objections and to increase the efficiency of the superheaters. I have devised a superheater which is very greatly superior on the score of practicability and efficiency to any that have heretofore been proposed. The change in construction from existing forms is exceedingly simple, but the

results of the change are attended by a most surprising increase in its efficiency, and this change consists in making the circular rings or gills, heretofore used, rectangular. In the detailed description of the improvement which follows, I shall point out the manner in which I utilize this discovery, and the nature of the new relations which are obtained by its use and of the results which are secured thereby.

In the accompanying drawings.

Figure 1 is a view in elevation of a typical form of superheater, the setting for same being in section.

Fig. 2 is a longitudinal cross-section of superheater, looking either up or down.

Fig. 3 is a similar view of the ordinary superheater with circular gills; and

Fig. 4 is a view partly in perspective and partly in section of one of the improved rectangular gills.

In Fig. 1, as above stated, is shown a typical, separately fired superheater, with parallel steel tube elements A, connected in series and incased in envelops of cast iron gills B. These gills instead of being circular, as in Fig. 3, are rectangular as shown in Figs. 2 and 4, and they are so formed as to have hubs or central portions C of greater thickness than the outer edges whereby spaces for the passage of the hot gases are provided when the superheater is installed.

The straight sides of the gills lie at about the same distance from each other as the highest points of the ordinary circular gills, as indicated in Fig. 2.

A glance at the plan of an ordinary superheater of this type, as illustrated in Fig. 3, shows that there is considerable space unoccupied by heating surface, due to the circular form of the edges of the gills or rings, and the extent of such heating surface cannot be increased without increasing the center to center distance between the parallel elements. If, however, these gills be made rectangular, much of this empty space will be filled up and a very pronounced increase in the effective heat absorbing surface is secured. This increase is approximately forty per cent.

It has been definitely proved that the rate of transference of heat from a gas through the surface of a metal increases with the velocity of the gas sweeping over that surface, but it will be seen that the velocity of

the gases in such a case as shown in Fig. 3 must vary very considerably in passing different portions of the circular heating surfaces, being highest at the points of closest approximation of these surfaces. But by my new construction a great advantage is secured in the maintenance of a more uniform velocity of the gases sweeping the heat absorbing surfaces and avoiding the loss of velocity caused by the expansion of the gases within the areas between each row of tubes.

By my construction it is manifest that a much greater heat absorbing surface may be secured with the same center to center spacing of the superheater elements, and without adding anything approaching a proportional amount of metal.

I am aware that in the construction of heat radiating devices, tubes have been associated with plates or what may be considered as gills which have been substantially or entirely rectangular in configuration. But not only have the operative conditions in such cases been entirely dissimilar

to those which are met with in the case of steam superheaters, but the shape of the gills has been either fortuitous, or to meet certain conditions foreign to my purpose, and do not suggest the construction which I have devised.

What I claim as my invention is:

A superheater for steam boilers composed of parallel tubular elements of steel, surrounded and inclosed by an envelop made up of refractory metal gills of rectangular shape, with thickened centers forming a corrugated heat absorbing surface for such elements, the said elements being associated in such manner that the sides of the gills are parallel and closely spaced and so disposed with reference to each other as to secure passages through which the hot gases will pass with approximately uniform velocity over the heat absorbing surface.

In testimony whereof I hereunto affix my signature.

ERNEST H. FOSTER.