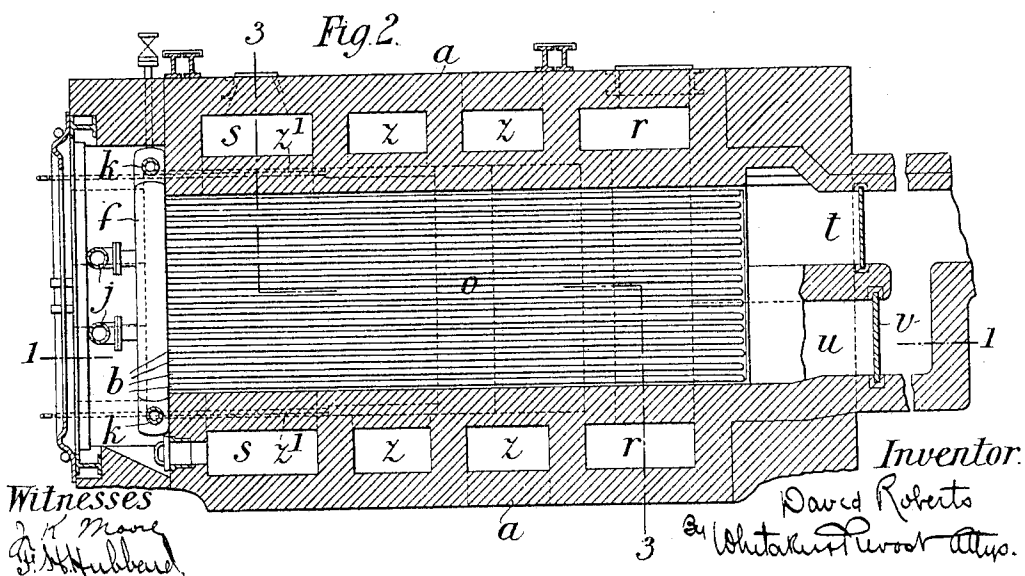
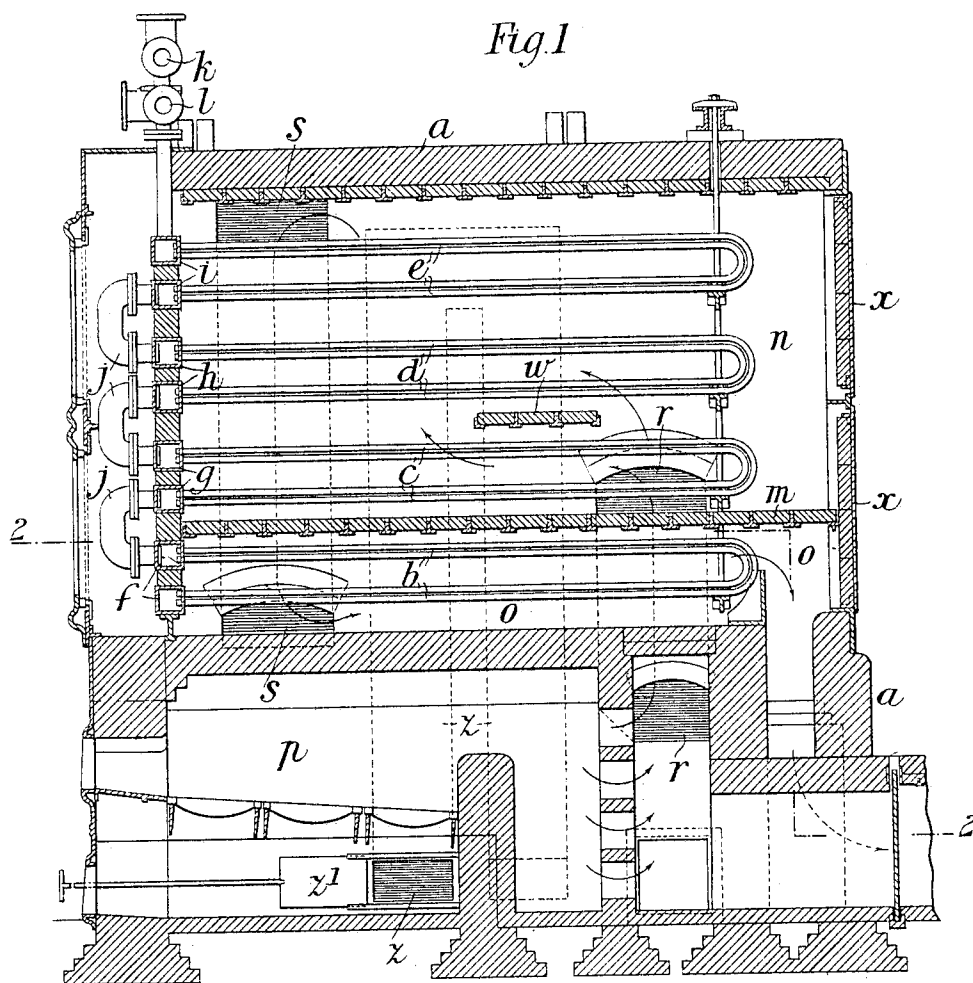


D. ROBERTS.
STEAM SUPERHEATER.
APPLICATION FILED SEPT. 6, 1904.

2 SHEETS—SHEET 1.



No. 798,705.

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2 SHEETS—SHEET 2.

Fig 3

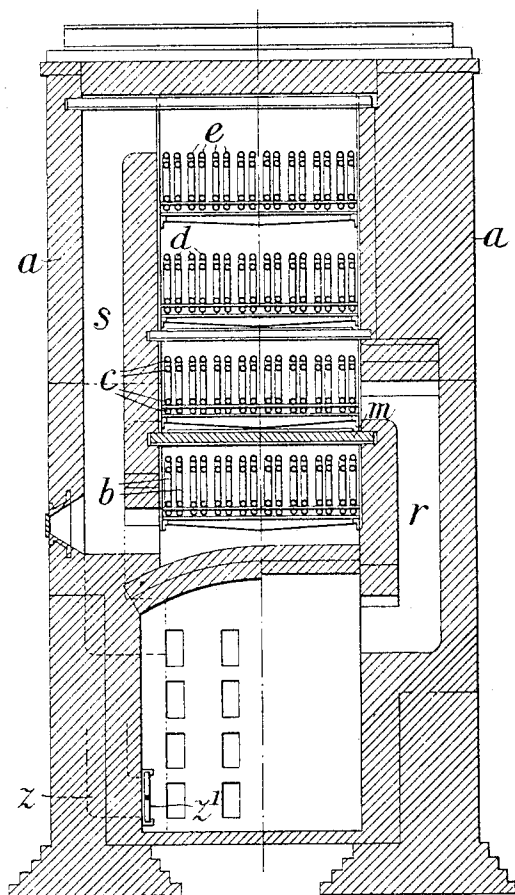
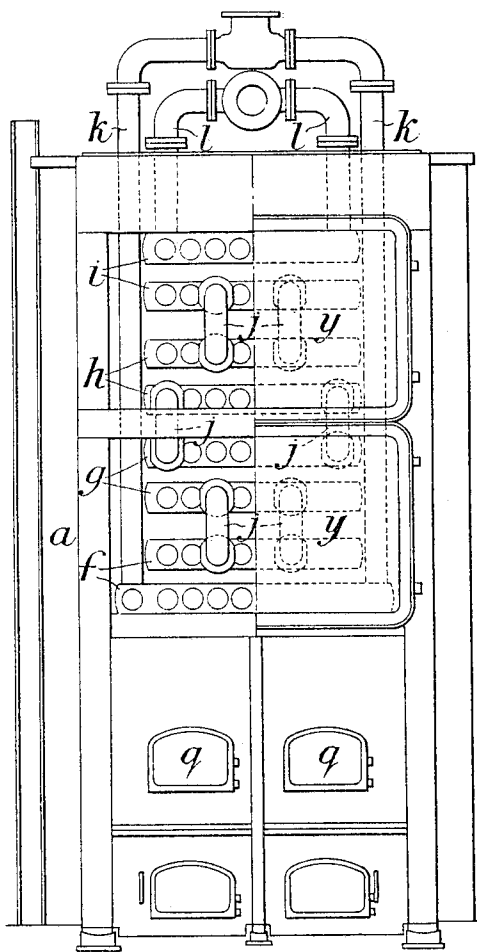


Fig 4



Witnesses

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DAVID ROBERTS, OF GRANTHAM, ENGLAND.

STEAM-SUPERHEATER.

No. 798,705.

Specification of Letters Patent.

Patented Sept. 5, 1905.

Application filed September 6, 1904. Serial No. 223,417.

To all whom it may concern:

Be it known that I, DAVID ROBERTS, a subject of the King of Great Britain, residing at Spittlegate Iron Works, Grantham, county of Lincoln, England, have invented new and useful Improvements in Steam-Superheaters, of which the following is a specification.

This invention relates to improvements in steam-superheaters, and has for its object to provide a superheater in which the expansion of the volume of the steam will distribute and regulate the flow of the steam and wherein, while the maximum economy of heat is obtained, the tubes containing the steam and transmitting the last stage of superheat are not subject to the action of the hottest gases.

In many existing superheaters the current of steam to be superheated is caused to flow, for the purpose of economizing heat, in a direction contrary to that of the flow of the hot gases, thereby subjecting parts of the tubes both internally and externally to the greatest heat and rendering them liable to corrode.

Now according to my invention the tubes in which the steam is superheated are so made—say curved or of a U shape—that both their ends are brought to the same side of the superheater-chamber, where they are fixed in suitable boxes to form a nest of tubes. Several nests of tubes may be superposed and suitably connected at the box ends to form the complete superheater. The steam is admitted to the bottom nest of tubes and being gradually heated and expanding in volume as it passes upwardly will flow and distribute itself through the tubes proportionately to the heat transmitted to it from the hot gases.

In the accompanying drawings, Figure 1 is a sectional elevation of a steam-superheater constructed according to the invention, the section being taken on the line 1 1, Fig. 2. Fig. 2 is a sectional plan view thereof, the section being taken on the line 2 2, Fig. 1. Fig. 3 is a sectional end elevation of the superheater, the section being taken along the line 3 3, Fig. 2; and Fig. 4 is a front end elevation of the superheater, the left-hand casing and doors being removed.

"a" represents the chamber of the superheater, and *b c d e* show nests of superheater-tubes, which are, as above described, of a U shape, both ends of each of the tubes being brought to the same side of the superheater-chamber and being fixed in the boxes *f g h i*, respectively. The tubes are connected together, so

as to form a continuous zigzag passage for the steam, by means of the connecting-pipes *j j*, which are secured to the boxes *f g h i*, as clearly shown in Fig. 1. The steam to be superheated enters the lowermost box *f* through the inlet-pipes *k*, and the superheated steam passes out from the topmost box *i* through the outlet-pipes *l*. The superheater-chamber *a* is divided by a horizontal partition *m* into an upper compartment *n* and a lower compartment *o*, the latter containing the lowermost nest *b* of superheater-tubes and the former the remaining nests.

p is the furnace for supplying the heat, the said furnace being located beneath the superheater, with the fire-doors *q q* at the same side as the inlet and outlet for the steam. The gases of combustion from the furnace *p* are conveyed through the flue *r* around the compartment *o* into the upper compartment *n* of the superheater, as indicated by the arrows, Fig. 1. The gases then flow upwardly through this compartment, bathing the superheater-tubes therein and communicating heat to the steam flowing through the same and escaping through the flue *s*, which opens at its lower end into the lower compartment *o*, through which the said gases flow and escape through the outlet-flue *t* to the chimney. It will thus be seen that the gases first impart heat to steam which has been partially superheated, then to steam receiving its final increment of superheat, and finally to the steam just entering the superheater.

A by-pass flue *u*, having a damper *v*, is provided for enabling the hot gases when desired to be passed directly to the chimney without flowing through the superheater.

w is a baffle in the upper compartment *n* of the superheater for distributing the flow of gases among the tubes, and any number of such baffles may be provided for obtaining the requisite distribution.

x x are doors for permitting access to be had to the superheater-tubes for purposes of cleaning and renewal, and *y y* are doors for enabling access to be obtained to the boxes *f g h i* and to the superheater-tubes.

In the drawings I have represented only one nest of tubes—namely, the nest *b*—as being located in the lower compartment *o*; but two or more nests may be arranged therein, the number being varied to suit the quantity of steam to be superheated and the temperature of superheat required. Furthermore, the air supplied to the furnace may be heated be-

fore its entry into the same, it being caused to pass through passages $z z$, Fig. 2, in the superheater-casing. These passages communicate with the under side of the fire-grate, and the flow of the air is regulated through the medium of the door z' .

The separate nests of tubes, instead of being fixed in boxes, may be fixed in a flat header and the flow of the steam regulated by internal baffle-plates.

It is to be noted that in my improved construction the steam enters at the lowest point of the superheater and continually moves horizontally or ascends as it passes from one set of tubes to another, so that the steam is never made to descend at any stage of its passage through the superheater. It will also be seen that when a greater degree of heat is transmitted to the steam contained in any tube on the same level with steam in other tubes which is receiving the average increment of heat the steam which receives the extra heat will begin to flow upward at a greater velocity, by virtue of the fact of its greater expansion and lower specific gravity. Conversely, steam receiving less than the average degree of heat will be retarded in its flow, the steam thus distributing itself proportionately through the pipes in accordance with the amount of heat transmitted to it.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a steam-superheater, the combination with a furnace, of a series of superposed nests of horizontally-disposed U-shaped tubes, boxes connected to the ends of said tubes, connecting-pipes for said boxes, a steam-inlet connected to the lowermost box, whereby the flow of the steam through the superheater is continually in horizontal and upward directions, substantially as described.

2. A steam-superheater comprising a furnace, a series of superposed nests of horizontally-disposed U-shaped tubes connected together, a steam-inlet connected with the lowermost nest of tubes and a steam-outlet con-

nected with the uppermost nest of tubes, whereby the flow of the steam through said tubes will be continually in horizontal and upward directions and means for directing the furnace-gases first into contact with intermediate nest of tubes containing steam which has already received an increment of heat, then into contact with the nests of tubes adjacent to the steam-outlet and then into contact with the tubes adjacent to the steam-inlet, substantially as described.

3. A steam-superheater comprising a furnace, a series of superposed nests of horizontally-disposed U-shaped tubes, boxes connected to the ends of said tubes, connecting-pipes for said boxes, a steam-inlet connected to the lowermost nest of tubes, a steam-outlet connected to the uppermost nest of tubes, a horizontal partition dividing the furnace into compartments, said partition being arranged between certain of said nests of tubes, a flue for conducting the gases from the furnace to the lower part of the upper compartment first, a flue connecting said compartments and a passage for conveying the gases from the lower compartment whereby heat is first applied to the steam which has received an increment of heat, then to the steam receiving its final increment of superheat and lastly to the steam as it enters the superheater, substantially as described.

4. In a steam-superheater the combination of a furnace, of a series of superposed nests of tubes of a curved or U shape, of boxes to which both ends of the tubes are connected, of connecting-pipes for the boxes, of a steam-inlet to the lowermost box, of a steam-outlet from the uppermost boxes and flues and baffles for causing the hot gases from the furnace to first flow around the upper nests of tubes in a direction from below upward and then the lowermost nest or nests of tubes, substantially as hereinbefore described.

DAVID ROBERTS.

Witnesses:

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A. ALBUTT.